

## **DRIVERS OF LOTTERY REVENUE: EMPIRICAL EVIDENCE FROM LAGOS STATE**

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### **ABSTRACT**

The lotteries serve as an important source of government revenue in many states and economies. This triggers many public finance economists to conduct both theoretical and empirical works in examining the lottery revenue potential and desirability as a method of taxation. Therefore, this study applies an econometric analysis to investigate the drivers of lottery revenue using monthly data between January 2010 and June 2016 from Lagos State. The results reveal that Lagos Gross Domestic Products and inflation rate are critical factors that influence the long-term government revenue generated from lottery activities in Lagos State. However, seasonality –related events significantly affect short –run movements of lottery revenue in the State. The decomposition of the seasonality into football season, Christmas season, and Ramadan season, indicates that its short term lottery revenue is significantly influenced by the Christmas season. In addition, the lottery revenue exhibits a tendency to return to the long-run relationship in the presence of any shock, with the adjustment speed of about 51 percent in a month.

**Keywords:** Lottery revenue, Lagos state, Empirical evidence

### **1. INTRODUCTION**

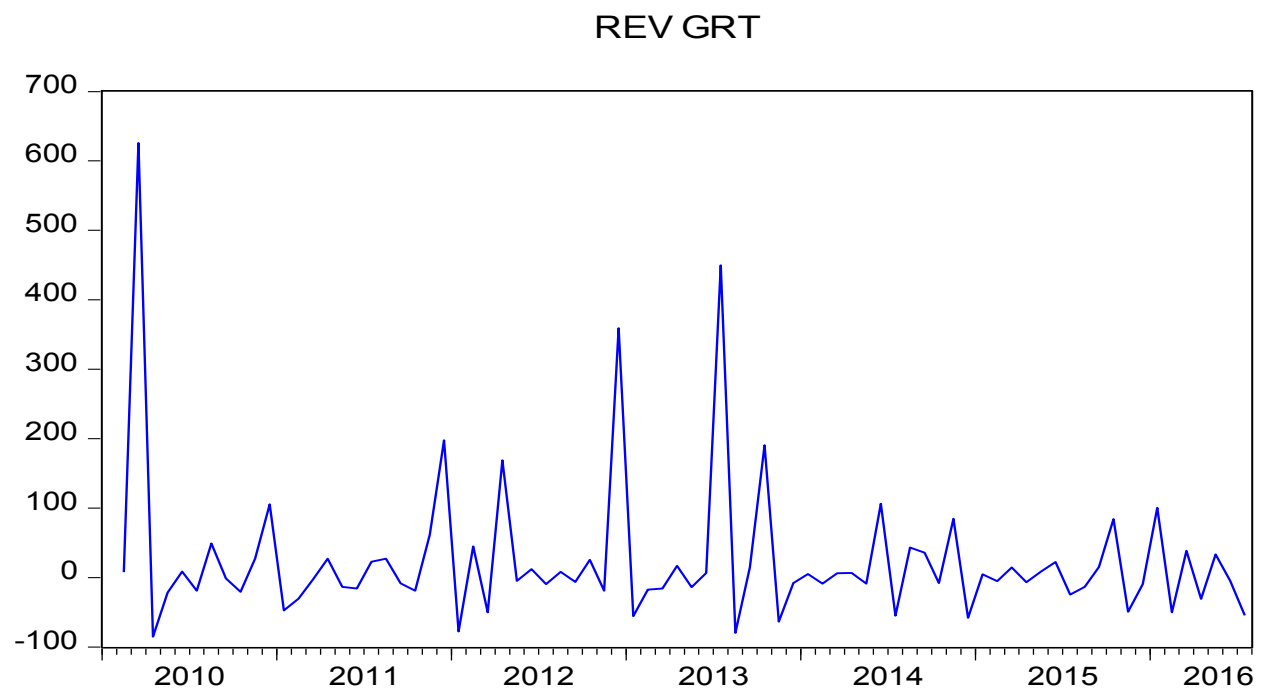
Among the fundamental reasons to examine the lotteries is that it serves as an important source of government revenue in many countries. This motivates many researchers to conduct both theoretical and empirical works with the purpose of identifying the revenue potential and desirability as a method of taxation. Lottery is an important alternative of generating revenue in Nigeria. However, inability to realize its full potentials has been attributed to ignorance and lack of transparency by operators. The proper education of the Nigeria about lottery, the country's revenue can be boosted by N100 billion on a yearly basis (Ekpe, 2016).

In 2004, Lagos State Lottery Board (LSLB) was established to regulate the games of chance in the State. Its regulation is carried out through the public online lottery, online sports betting, scratch cards & interactive game etc. Others include private lotteries, charitable lotteries, society

and promotional competitions. These deal with the payment or delivery of any money, goods, article, matter or thing, entailing any ticket, coupon or entry form for the right to compete in a draw. However, Lagos Ministry of Finance regulates pool betting, casino and slot machines.

The LSLB generates revenues from license fees and taxes on sales from the game of chance in the State. These revenues which are to pay in the Lagos State Distribution Trust Fund (DTF), are used to achieve the objectives of good causes in Lagos State. The good causes objectives are projects or grants for the development of infrastructure, education, environment, social and health.

**Figure 1: Growth rate of lottery revenue in Lagos State**



Source: Ministry of Economic Planning and Budget, Lagos State

As illustrated in Figure 1, the growth rate of lottery revenues in Lagos State exhibits high volatility from January 2010 to July 2016. In February 2010, the revenues generated from lottery grew at about 8 percent and skyrocketed to almost 630 percent in March 2010. The highest growth rate in March 2010 can be traced to an increase in the activities of lottery businesses through the entrance of many agents. It could also be linked to strategies put in place to attract investment in the business. However, there was a negative growth rate experienced in April, May, July, September, and October 2010. In addition, the highest negative growth rate of lottery

revenues in the State was -85 percent in 2010 whereas the highest positive was witnessed in March of the same year.

In 2011, lottery revenue experienced a negative growth rate from January to June with the exception of April. Whereas its growth rate was positive from July to December excluding September and October. Similarly, in 2012, boom pattern was witnessed in February, April, June, August, October and December with the highest growth rate of about 359 percent in December. In 2016, the rate of lottery revenue growth was positive only in January, March and May.

The figure depicts the extent of how revenues generated from lotteries in the State fluctuated. Therefore, this calls for an empirically based study that would examine factors that influence the lottery revenues in Lagos State. Based on this ground, this study intends to investigate determinants of lottery revenues in the commercial hub of Nigeria in order to provide policy directions how potential lottery revenues can be efficiently achieved.

### **1.1 Structure of Lagos State Revenue:**

Lagos State realized total revenue of N101.69bn in the first quarter of the year 2016. Out of its aggregate revenues, Lagos State Internal Revenue Service (LIRS) accounted for about 66.12 percent. The first quarter of the year 2016, the state realized total revenue of N101.695 billion against N97.279 in 2015 and 113.621 in 2014 of the same quarter.

**Table 1: Components' contribution to Lagos State Revenue (%)**

	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Total internally generated Revenue</b>	<b>78.41487</b>	<b>66.09371</b>	74.78735
<b>Internally generated revenue</b>	<b>62.11023</b>	<b>65.1094</b>	<b>73.61817</b>
LIRS	54.95944	59.56733	66.12419
IGR (others)	4.144747	3.303014	3.77993
Dedicated Revenue	3.006047	2.730714	3.714047
<b>Capital receipts</b>	<b>16.30464</b>	<b>0.984316</b>	<b>1.169182</b>

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<b>Federal Allocation</b>	<b>33.31236</b>	<b>29.56389</b>	<b>25.21265</b>
Statutory allocation	13.69782	11.74099	7.355327
VAT	19.61453	17.8229	17.85732

Source: Ministry of Economic Planning and Budget, Lagos State

The recent available data indicate that the internally generated revenues accounted for about 62.1 percent in the first quarter of the year 2014, followed by the contribution of federal allocations with 33 percent while the revenues generated from capital receipts contributed about 16.3 percent to the total revenues in the State. By the first quarter of the year 2015, the share of internally generated revenues rose to about 65.1 percent while the contribution of capital receipt and federal allocation reduced to about 0.98 percent and 29.6 percent respectively.

Similarly, in the first quarter of the year 2016, about 73.6 percent of total revenues in the State was generated from the platform on internally generated revenue while the share of capital receipts to its total revenues recorded an improvement with about 1.17 percent. The contribution of federal allocation also declined to about 25.2 percent.

It can be inferred from the table 1 that share of internally generated revenue to the State's aggregate revenue maintains a continuous rise from about 62.1 percent in the first quarter of year 2014 to almost 74 percent in the first quarter of year 2016, whereas the share of federal allocation in relation to Lagos State total revenue recorded a continuous reduction from about 33.3 percent in the first quarter of the year 2014 to 25.2 percent in the first quarter of the year 2016.

Considering the annual revenue target of the State to attain N1 trillion by 2018, there is a need to examine the existing channels through which internally generated revenue can be optimally maximized. In the light of this, this study empirically investigates the drivers of lottery revenues in the State.

## **2. REVIEWS OF PREVIOUS RESEARCH**

### **2.1 Theoretical Reviews:**

Among the most relevant financial indicators that any government has to estimate is revenue because the revenue can be utilized as resources to provide public goods and services that best satisfy the people's needs. The interest of the government in identifying different sources of

revenues is two-fold. First, it is essential to examine the performance of the revenue sources in the pursuit of different policy objectives. Second, the budget design after investigating revenue source performance might not lead to fiscal problems.

Studies such as Humphreys and Matheson (2012), Mikesell and Zorn (1986, 1988) postulated that lotteries cannot generate than a few percent of the revenue required for a modern state or national government. Many tax collection agencies believe that the aim of lottery organizations is to maximize their revenue. This poses the great debate on how to generate efficient revenue from lotteries. Brinner and Clotfelter (1975) considered lotteries as an unusual form of taxation that involves voluntary participation whereby the government actually manufactures the consumption good that is then taxed.

Rodgers and Stuart (1995) and Farrell and Walker (1997) opined that the creation of new consumption product could boost welfare despite the dead-weight loss arising for taxing the product. In addition, Rodgers and Stuart (1995) pointed out that the creation of an untaxed lottery boosts welfare while tax levels associated with state lotteries reduces welfare.

Some studies identified volatility as an added puzzle associated with the level of lottery revenues (see Mikesell and Zorn, 1988; and Szakmary and Szakmary, 1995). Humphreys and Matheson (2012) stated that lottery and gaming revenues are subject to significant yearly variations. In addition, lotteries as a means of revenue collection exhibit a regressive pattern as identified by some economists.

#### 2.1.1 Overview of Lottery Industry in Nigeria:

The recent economic recession in the country has triggered different lottery schemes. This buttresses by the fact for one out of every five posters is linked to one form of lottery. The report has indicated that thinking of some Nigerians engage in the lottery games has gone beyond fun to be considered as a revenue stream with the current economic situation.

The lottery industry has been regulated by the National Lottery Regulatory Commission (NLRC) established in 2005 through the National Lottery Act of 2005. The NLRC is mandated to promote transparency, propriety and integrity in the lottery operations, and to protect the interests of all stakeholders including the general public in the lottery business.

The commission was able to remit more than N5 billion to the National Lottery Trust Fund (NLTF). However, the public perception about the lottery business is that lottery is a form of gambling that was not meant for decent members of the society. With the commission's effort, the public has viewed lottery as a tool for national development (Eke, 2016).

The commission regulates the following categories of lottery: promotional competitions, online lottery, sports lottery, SMS lottery, lottery concierge services, charitable lottery and traditional lottery. The licensed lottery businesses include Polls betting, Baba Ijebu, Nairabet, Naija bet, Winners Golden Bet, WGB, Betnaja, Superbet247, Alashe Baba Ijebu Lotto, E60 Lotto, Lagos State Lottery Board, Noipolls Limited, Sports Bet Nigeria Limited, Lotto House of Success, Golden Chance Lotto Agent, Hakym90 Lotto, Premier Lotto, Tys Lotto, Wesco Pools and Lotto, Happiness Lotto and Lottery Limited, , Naija Lottery, UBC365, Lotto Bigwinners, Premier Bet, 24Lottos, R And S Lotto Limited, Haykay Lotto, Effi Lotto World, Onstreet Lotto , Itouch Lotto.

## **2.2 Empirical Reviews:**

### 2.2.1 Government Revenue:

Mehrara & Rezaei (2014) investigated the relationship between government revenue and government expenditure in Iran for the period of 1978 to 2011 using Toda-Yamamoto Granger causality test. They found that there was a unidirectional causality from government revenue to government expenditure; the result supported the argument of that Freidman (1978) and Buchanan-Wagner hypothesis that stated that government revenues cause government expenditure.

Jegede (2014) revealed that major revenue in Nigeria between 1980 and 2008 was oil revenues, and this caused volatility in other revenues (non-oil and federal government independent revenue). The study established that government revenues promoting economic growth effectively in Nigeria. He advised Nigerian government to reexamine the non-oil revenues to increase tax rate in such a way that it does not distort the working of the economy.

Chowdhury (2011) used a bootstrap panel approach to investigate state government revenue and expenditure in the United States from 1970 to 2009. His analysis covered some years when States were facing fiscal crises an increased demand for public services while revenue is declining. He observed that there was no uniform relationship between government revenue and expenditure across different states.

Jinjarak (2013) studied the relationship between economic openness via financial and trade integration and government revenue from financial repression across countries over the 1980s and 2000s for the upper-income, the middle-income, and the low income in developing countries. He discovered a negative association between financial and trade openness with the financial repression revenue in the countries. He concluded that the effect of financial openness was stronger and the empirical correlations rely on the quality of government management and budgetary management.

### 2.2.2 Lottery Revenues:

Numerous studies have attempted to examine the factors that influence the level of lottery sales using time series, cross-sectional and panel data analysis. Fawell, Morgenroth, and Walker (1999) investigated the influence of lottery prices on sales using monthly UK time series data spanning from November 1994 to February 1997. They employed two stage least square and myopic addition model with variables for lottery revenue and consumption of the additive goods. Their result found that lotto play is less addictive than cigarette consumption, and changes in the expected value of holding a ticket influence the price elasticity.

Similarly, Lee and Han (2010) conducted an economic analysis of the demand for lotto in Korea with the aid of monthly data from December 2002 to March 2010. They considered variables such as expected price of a lotto ticket, sales, size of lottery market, GDP per capita in the regression model. The data were obtained from Korean National Lottery Commission, Nanum Lotto and La Fleur's, and World Lottery Almanac. Their finding established that demand for lotto is unitary elastic in the short run but inelastic in the long run. They concluded that weak economic conditions such higher rates of unemployment and economic recessions stimulate lotto sales.

However, Pjesky (2013) empirically investigated the impact of the passage of a lottery on the education sector in the US in relation to educational funding using annual time series data between 1977 and 2006. He applied the OLS techniques and concluded that the passage of a lottery in states is a relevant channel through which states can increase education funding.

In the same vein, Stitzel and Pjesky (2011) examined the relationship between lottery revenue and cross-border shopping for 48 states in the US for the period 1977-2006 with the application of least square dummy variable model. Their estimated model which considers net lotteries revenue, bordering lottery, population and per capita income as variables, revealed that there is no significant impact of the passage of a lottery in a state on the lottery revenues of neighbouring states.

Kaizeler and Faustino (2008) tested the inverted U hypothesis between lottery sales and per capita GDP for 80 selected economies based on the world continents in 2004. In addition, they included control variables such as age, the gender distribution of a country's population, education level and percentage of Christians in country's population, obtained from La Fleur's 2005 World Lottery Almanac, World Bank Data, US Census Bureau International Data Base, UN Human development Report. They found that lottery sales rise as GDP increase up to a level when the sales start experiencing a reduction. In addition, their results revealed that Christians are the higher consumers of lottery products compared to the followers of other religions and that lottery products are highly purchased by the people aged between 15 and 29. It is also



established that the existence of a positive link between per capita sales and per-capita GDP for the low-income earners.

However, the study of Knight and Schiff (2009) extended the relationship between state lotteries and cross-border shopping in the US by adding the variable of spatial competition into the panel regression model for the sample period of 1995-2008. Their conclusion from the estimated model is that stronger link is established between lottery sales and prices in small populations and densely populated border region if cross-border shopping is significant. Also, change in tax rates in one state may influence tax revenues in neighbouring states.

Mikesell (1994) applied ordinary least square (OLS) and two-stage least square (TSLS) techniques to empirically establish the link between lottery sales and economic activity in the US using quarterly time series data from 1983 to 1991. Their findings show that higher income elasticity of state lottery sales compared to state-local revenue, and the response of lottery sales to unemployment is positive but relatively small. In addition, lottery sales decrease as the lottery ages mature, and high dependence on non-lotto game reduces the level of lottery sales.

Wan (2010) used a panel data of 1998 to 2003 with 37 districts across Beijing and Tianjin to examine the effect of lottery receipt experiment on tax revenues in China. He found that lottery receipt experiment increased significantly the sales tax, the growth of business and total tax revenues in experiment areas than those areas excluded in the sample.

### 2.2.3 Lottery Sales:

Ghent and Grant (2007) empirically analyzed the demand for three type of lottery game between 2002 and 2003 using seemingly unrelated regression (SURE) model. The result of the estimated model that entails per capita sales, fixed number of game, lotto tickets per country and economic characteristics as variables, revealed a distributional variation among different income earning groups as well as regions. People aged 65 or older has a positive influence on sales of instant games and online fixed the odd game, and cross-border shopping for all the games exhibits a significant influence. However, the upper-middle –income residents purchase more lottery tickets than lower-middle income residents.

Walker and Cummings (2014) examined the influence of casino proximity on lottery sales in Maryland from July 2009 to February 2014 with the application of two-way-fixed effects OLS model. They considered different types of traditional lottery products( instant, monitor, pick, multi-state and others) in the model, and found that amount of lottery sales reduces more in close proximity to casinos, with monitor and multi-state games most affected. In addition, Philander et al. (2015) examined the effect of casino tax rate levels on short-run labor decisions by casino firms. They used a panel data of all states with legal commercial casino gambling from



1998 to 2009, employing a 2SLS fixed-effect model and sin-based excise taxes as instruments. They found that the state tax revenue changes per employee from a 1percent increase in the gross gaming revenue tax, finding that states with comparatively low tax rates could increase public revenue with relatively small losses in employment.

Pantuosso et al. (2007) investigated the impact of lotteries on state education expenditures from 1984 to 2001, employing the SURE model among some selected states in the US. Their results show that the growth of lottery revenues exhibits a positive and significant influence on K-12 expenditure in four of the six-individual states. Also, the earmarked revenues for K-12 education do not influence an increase in actual state K-12 funding.

However, Freund and Morris (2005) estimated an OLS regression model to analyze the relationship between lottery and income inequality in the United States from 1975 to 1995. They found that State lotteries encourage income concentration. Their conclusion is that states with lotteries higher levels of income inequality than others. A significant impact also emanates from demographic and policy factors.

Kaizeler & Faustino (2008) applied a multivariate linear regression analysis on the United States macroeconomic data and qualitative variables to capture the variability of a country's per capita lottery sales. They used over 15 years of lottery total sales (dependent variable) from La Fleur's World Lottery Almanac for all continents; this sale was the aggregate sales of lotto, numbers, keno, Toto, draw, instant and others. However, GDP, population, Gini index and levels of education per country, religion, gender among others as independent variables. They concluded that the higher a country's level of education, the percentage of males and Christians, the higher are the lottery sales and the relationship between lottery sales and per-capita GDP is inverted U.

Chen et al. (2009) examined the income distribution on lottery expenses in Taiwan, they employed agent-based model developed earlier by Chen & Chie (2008). They looked into attributes of agents like the percentage of income spent on the lottery, the preferences among lottery numbers and the aversion to regret. They simulated data for different agents' incomes according to household income data in Taiwan from 1979 to 2003. They found that no significant impact of income distribution on lottery sales.

Faustino et al. (2009) investigated the lottery products sales of 99 countries for 13 years using a panel data approach. The data include the socio-economic and demographic data that aid them in analyzing gambling consumption. The analysis revealed that the richer countries spend more than the poorer countries and the income elasticity of the demand for lottery products is greater than one.

In the light of the above, three key gaps are identified in the existing literature. First is the absence of consideration of government revenue generated from lottery activities; the second is a general lack of empirical evidence in the Nigerian context, and third is the absence of recent data at the State level. The next section presents the data as well as a methodology to fill these gaps. The following research questions are offered in order to structure the discussion and analysis in providing policy directions:

- How does lottery revenue in Lagos State respond to economic activities? Does the performance of the lottery revenue react the same way to economic booms and recession, in the short run and the long run?
- What is the influence of economic and non-economic factor on the level of lottery revenue in the State?
- Which factors influence the level of lottery revenue more than others? What policy direction can be implemented by the Lagos State Government to achieve efficient lottery revenue?

This study will deliver relevant insights that should help to provide a substantial amount of evidence that can be explored to review existing revenue policies in Lagos, and help to advise on future policy directions.

### **3.0 EMPIRICAL MODELS**

#### **3.1 Unit Root Tests:**

##### *Augmented Dickey Fuller Test*

The simple autoregressive model AR (1) can be written as:

$$Y_t = \alpha Y_{t-1} + \varepsilon_t \quad (1)$$

by subtracting the first lagged of the dependent variable of  $Y$  from both sides of equation (1),

$$Y_t - Y_{t-1} = \alpha Y_{t-1} - Y_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta Y_t = (\alpha - 1)Y_{t-1} + e_t, \quad t = 1, 2, 3, \dots, T \quad (3)$$

$\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$  , where  $\varepsilon_t$  is the error term.

The test statistics for on the lagged dependent variable in the equation (3) is referred to as Dickey-Fuller test. If  $\alpha > 1$  the coefficient of the lagged variable will be positive. If  $\alpha = 1$ , the coefficient of the lagged variable will be zero and if  $\alpha < 1$ , the coefficient of the lagged variable will be negative. For any value of  $\alpha > 1$  or  $\alpha = 1$ ,  $Y_t$  will be non-stationary, otherwise stationary, i.e. case where  $\alpha < 1$ .

Hypothesis Testing:

$$H_0: |\alpha| = 1 \quad (\text{Not stationary})$$

$$H_1: |\alpha| < 1 \quad (\text{Stationary})$$

Test Statistic:

$$t_{\alpha=1} = \frac{\hat{\alpha} - 1}{se(\hat{\alpha})}$$

### ***Phillips-Perron Test***

Phillips and Perron (1988) is used as an alternative to ADF test. It does not allow lags of the dependent variable to correct for heteroscedasticity and serial correlation in the error terms. The advantageous as it assumes no functional form for the error process but depends on asymptotic theory. Thus, it performs better in large sample data.

Consider the model

$$Y_t = \alpha Y_{t-1} + \varepsilon_t \tag{4}$$

$\varepsilon_t$  is serially correlated

$$\Delta Y_t = \delta Y_{t-1} + \varepsilon_t \tag{5}$$

where  $\delta = (\alpha - 1)$

Hypothesis:

$$H_0: |\delta| = 0 \quad \text{vs.} \quad H_1: |\delta| < 0$$

Test Statistic:

$$z_t = \sqrt{\frac{\hat{\sigma}^2}{\hat{\lambda}^2}} t_{\hat{\delta}} - \frac{1}{2} \left( \frac{\hat{\lambda}^2 - \hat{\sigma}^2}{\hat{\lambda}^2} \right) \left( \frac{n * se(\hat{\delta})}{\hat{\sigma}^2} \right) \quad (6)$$

$$z_{\delta} = n\hat{\delta} - \frac{1}{2}(\hat{\lambda}^2 - \hat{\sigma}^2) \left( \frac{n * se(\hat{\delta})}{\hat{\sigma}^2} \right) \quad (7)$$

where  $\hat{\sigma}^2 = \lim_{n \rightarrow \infty} n^{-1} \sum_{t=1}^n E(\varepsilon_t^2)$  and  $\hat{\lambda}^2 = \lim_{n \rightarrow \infty} \sum_{t=1}^n E \left( \frac{1}{n} \sum_{t=1}^n \varepsilon_t^2 \right)$

### 3.2 Vector Error Correction Model:

The vector error correction model (VECM) is employed after establishing the existence of cointegration among the variables. VECM is applied to evaluate both the short and long run properties of the cointegrated variables. The VECM adjusts for the change in variables at short run and deviations from the equilibrium.

The regression form of equation is given as:

$$\Delta Y_t = \alpha_0 + \alpha_1 \varepsilon_{t-1} + \sum_{i=1}^n \beta_i \Delta Y_{t-i} + \sum_{i=0}^n \gamma_i \Delta X_{t-i} + \sum_{i=0}^n \delta_i \Delta Z_{t-i} \quad (8)$$

$$\Delta X_t = \theta_0 + \theta_1 \varepsilon_{t-1} + \sum_{i=1}^n \beta_i \Delta X_{t-i} + \sum_{i=0}^n \gamma_i \Delta Y_{t-i} + \sum_{i=0}^n \delta_i \Delta Z_{t-i}$$

Specifically, we have

$$\begin{aligned} \Delta LNREV_t &= \alpha_0 + \alpha_1 \varepsilon_{t-1} + \sum_{i=1}^2 \beta_i \Delta LNREV_{t-i} + \sum_{i=0}^2 \gamma_i \Delta LNLAGGDP_{t-i} + \\ &\sum_{i=0}^2 \delta_i \Delta INFLATION_{t-i} + SEASONALITY \end{aligned} \quad (9)$$

$$\begin{aligned} \Delta LNLAGGDP_t &= \theta_0 + \theta_1 \varepsilon_{t-1} + \sum_{i=1}^n \beta_i \Delta LNLAGGDP_{t-i} + \sum_{i=0}^2 \gamma_i \Delta LNREV_{t-i} + \\ &+ \sum_{i=0}^2 \delta_i \Delta INFLATION_{t-i} + SEASONALITY \end{aligned}$$

$$\Delta INFLATION_t = \varphi_0 + \varphi_1 \varepsilon_{t-1} + \sum_{i=1}^2 \beta_i \Delta INFLATION_{t-i} + \sum_{i=0}^2 \gamma_i \Delta LNLAGGDP_{t-i} + \sum_{i=0}^2 \delta_i \Delta LNREV_{t-i} + SEASONALITY \tag{10}$$

**4. DATA AND RESULT**

**4.1 Data:**

This study investigates monthly data from January 2010 to July 2016. The commencement date of the sample is chosen subject to the availability of lottery revenue data. Data for lottery revenue is sourced from the Lagos State Lotter Board (LSLB) while data for Lagos gross domestic product (GDP) are obtained from a report published by Lagos Ministry of Economic Planning and Budget. Inflation rate data are sourced from the National Bureau of Statistics (NBS). The graphical illustration of these concerned variables is presented in Figure A.1.

The study conducts a preliminary investigation by applying the augmented Dickey-Fuller (ADF) and the Phillips- Perron (PP) test to examine the time series nature of lottery revenue, GDP (in logarithm) and inflation rate. The number of lags for ADF test are selected through the Akaike information criterion (AIC) and for PP test are selected on Newey-West Bandwidth criterion. In each test, the null hypothesis is that the series possesses a unit root. Test for the critical values for ADF and PP are -3.44(1%), -2.87(5%) and -2.57(10%). Test results in Table 2 generally suggest that all the variables considered in the study are stationary either at the level I (0) or first difference I (1).

**Table 2: Unit Root Tests**

Variable	Augmented Dickey- Fuller		Phillips-Perron	
	Level	1st Difference	Level	1st Difference
Constant Only				
LNREV	-1.4998	11.9494	- 4.0455***	-

INFLATION	-1.0430	-4.2529***	-0.9003	-9.9579***
LNGDP	0.1657	-6.8608***	0.1385	-6.8484***
Constant and Trend				
LNREV	- 6.8084***	-	-7.0458***	-
INFLATION	0.3398	-11.1431***	0.8237	-10.9196***
LNGDP	-2.8697	-6.7880***	-3.3750*	-6.7715***

Source: Computed by the author

**4.2 Estimation of Co-integrating Relationship:**

Based on the outcomes of the unit root test, the study tests for co-integration between lottery revenue and macroeconomic variables using the Autoregressive Distributed lag (ARDL) approach. The results of the bound tests after the estimation of the ARDL model are shown in Table 3. The bound test confirms the existence of a long-run relationship between lottery revenue, real GDP and inflation rate with the F-statistic of about 9.27 against upper critical bounds of 4.66 at 1 percent level of significance.

**Table 3: Result of Bound Tests**

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	9.265187	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound

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10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

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**4.3. Short-run Dynamic Adjustments:**

The study estimates a dynamic adjustment of lottery revenue to deviation from the long-run relationship by allowing for shocks using the Vector Autoregressive Model (VECM). The estimated vector error correction (VEC) model are reported in Table 4. The dynamic adjustment process is captured by the error correction model  $\hat{\epsilon}_{t-1}$ . If  $\hat{\epsilon}_{t-1} = 0$ , so the established relationship between lottery revenue and all other variables remain constant, then the lottery revenue will change only based on the normal seasonal influences. If  $\hat{\epsilon}_{t-1} \neq 0$  and  $\alpha_1 < 0$ , then the lottery revenue in the absence of further shock tends back to the long run relationship. The magnitude of  $\alpha_1$  determines the speed of adjustment. However without other shocks, the dynamics of adjustment also rely on the coefficients of the lag of the lottery revenue.

**Table 4: Vector Error Correction Model (VECM) Estimates (Seasonality)**

Variable	Coefficients
<b>Long run equation</b>	
Constant	92.2003
LNREV(-1)	1.0000
LNLGGDP(-1)	-4.018512***
INFLATION(-1)	0.1344**
<b>Short run equation</b>	
EC	-0.5154***



D(LNREV(-1))	-0.3118**
D(LNREV(-2))	-0.2345**
D(LNLAGGDP(-1))	776.2218
D(LNLAGGDP(-2))	10679.3500*
D(INFLATION(-1))	0.0202
D(INFLATION(-2))	0.0098
Constant	-60.1643
SEASONALITY	0.3256**
Adjusted R <sup>2</sup>	= 0.53
F-statistic	= 10.44525

Note: \*\*\* indicates significant at 1%, \*\* indicates significant at 5% and \* indicates significant at 10%.

Table 4 presents the OLS estimates of the coefficients in the VEC model. Estimated coefficients have the expected signs as identified in the theoretical literature, except for the coefficient on inflation, which is positive but statistically insignificant. As the estimated coefficient on the deviation from the long-run relationship is negative, it is observed that the cointegrating relationship is normalized. Put differently, the lottery revenue exhibits a tendency to return to the long-run relationship in the absence of other shocks.

In the VEC model, the long run result reveals that Lagos real GDP has a positive and statistically significant influence on the amount of lottery revenue realized in the State, implying that a 1 percent increase in its real GDP would lead to about 4.02 rise in the amount of lottery revenue on average, ceteris paribus. On the other hand, a 1percent rise in the inflation rate would significantly lead to a reduction of about 0.13 percent in the amount of revenues generated from lottery activities in the State, holding other factors constant.

In the short run, one year lag and two-year lag of the lottery revenue, as well as seasonality significantly, determine the amount of lottery revenue in the State. For instance, a 1 percent rise in its one-year lag and two-year lag result into a decline of about 0.31 percent and 0.23 percent in the State’s lottery revenue on average respectively. The seasonality also has a positive and significant effect on the amount of the lottery revenue in Lagos.

The estimated coefficients also show that real GDP and inflation rate plays a very critical role in long run lottery revenue movement. However, in the short run, seasonality tends to have a significant positive effect on the lottery revenue. The estimated coefficient of the seasonality implies that for each festival period, the lottery revenue generated by Lagos Government increase by approximately N1.38/game ( $=e^{0.325628}$ ).

The significance of the monthly lagged lottery revenue and the monthly dummy variable indicate the seasonal effect in the lottery revenues that are not captured by the other explanatory variables. The monthly effects show that lottery revenue is likely to increase the most in December and to reduce the most in fasting months. The R<sup>2</sup> and F statistics in the table suggest that the estimated VEC model is consistent.

**Table 5: Vector Error Correction Model (VECM) Estimates (Disaggregated Seasonality)**

<b>Variable</b>	<b>Coefficients</b>
<b>Long run equation</b>	
Constant	103.0431
LNREV(-1)	1.0000
LNLAGGDP(-1)	-4.45154***
INFLATION(-1)	1.11507*
<b>Short run equation</b>	
EC	-0.58321***
D(LNREV(-1))	-0.26505*
D(LNREV(-2))	-0.2152*
D(LNLAGGDP(-1))	841.5028
D(LNLAGGDP(-2))	10779.93*
D(LNINF(-1))	-0.0767
D(LNINF(-2))	0.0278
Constant	-61.0325
XMAS	0.449384**
RAMANDAN	0.28697
UEFA	-0.0734
PREMIERE	0.0218
Adjusted R <sup>2</sup>	= 0.53
F-statistic	= 7.90

Note: \*\*\*, \*\*, and \* represents 1%, 5% and 10% significant level respectively

As reported in Table 5, the income elasticity of lottery revenue is significantly positive and elastic of about 4.45. This implies that lottery revenue in Lagos State responds substantially to any change in its GDP. For instance, one percent rise in the level of the State’s GDP will lead to a rise in its lottery revenue by about 4.45 % on average in the long run. Therefore, the recent

upgrade of infrastructure facilities in the State would directly boost the economic activities by attracting more local and foreign investors in the State, and thus lead to increase the revenue generated from the lottery business.

However, the long-term elasticity of lottery revenue with respect to the inflation rate is significant at 10 percent level of significance and inelastic. Its inelastic nature indicates that a 1percent increase in the inflation rate would reduce the lottery revenue in Lagos State by about 1.12 percent on average. This might occur because the high inflation rate reduces the purchasing power of disposable income, and invariably implies that lesser amount of money will be available to engage in the lottery business. On the other hand, the level of addiction of some youth to sport betting could be responsible for the small magnitude of the impact of inflation on the lottery revenue (Table 5).

With decomposition of the seasonality dummy variables into UEFA season, Christmas season, Ramadan season and Premier season, the short-run result of model estimation indicates that only the Christmas season significantly and positively influences the level of revenue generated from the lottery in the State. Other season variables are not significant. This result confirms that lottery activities increase exponentially during the December period. It is the Christmas season that different forms of the lottery game are sponsored by companies in order to increase the sales and clear the stock in order to prepare for the subsequent year. This leads to increase the amount of revenue realized from the lottery industry within the State (Table 5).

The dynamic elasticity of lottery revenue is captured by based on the coefficients of its one-year lagged and two-year lagged. Both one-year lagged and two-year lagged lottery revenue have negative and significant impact on the current lottery revenue at 10 percent level of significance. The implication of this is that the one-year lagged and two-year lagged reduce by one percent, the current lottery revenue would increase by about 0.27 percent and about 0.22 percent on average.

As reported in the estimated model, any disturbance or shock that leads to disequilibrium in the established long term relationship would be normalized by the end of two month after the shock. The speed of adjustment of 58.3% in absolute term, is statistically significant and negative, which confirms to a prior expectation. For instance, any positive or negative shock to either independent variables or exogenous variables that results into imbalance will be adjusted back by about 58.3 percent in every month. This implies that before the end of two months after the shock, everything is normalized to the long term equilibrium (See Table 5).

#### **4.4 Policy Implications and Discussion:**

This study seeks out to understand the drivers of lottery revenue in Lagos State as well as the responsiveness of this revenue to economic and non-economic factors both in the short run and the long run. To summarize, the main findings are as follows: lottery revenue is mainly influenced by real GDP and inflation rate and seasonality in the long term; in the short run, only the lag year of lottery revenue, as well as seasonality, determine the amount of revenue generated from lottery activities in the State.

The study is one of very few to examine the drivers of lottery revenue in Nigeria, most previous works are carried out in relation to other countries of the world. Also, their focus is mainly based on what determines the demand for the lottery.

It has provided some relevant points regarding the drivers of lottery revenue in Lagos State. First, its analysis is consistent with the existing literature that real GDP plays a critical role in determining the lottery revenue. Second, the analysis buttresses that the changes in inflation rate can explain some longer movement in the lottery revenue in the State. No other study in the literature has examined the drivers of lottery revenue as a form of government revenue especially in Nigeria. Providing evidence on the factors that influence government revenue generated from lottery activities is important for highlighting a role that government revenue agency can play in determining lottery revenue.

Third, the study finds that seasonality –related events significantly affect short –run movements of lottery revenue in the State. Also, the result explains that high volatility of lottery revenue as well as why disequilibrium can persist for up to 2 months.

This study contributes to two aspects of policy. The first is linked to the drivers of lottery revenue by providing information of direct interest to public finance and government agency. The second aspect is general economic policy especially the regulation of lottery activities throughout the Lagos State. The result reveals clear implications for public policy through supplying information to public finance analyst as well as government revenue agency that aid better understand factors that influence lottery revenues both in the short run and the long run.

#### **5. CONCLUDING REMARKS**

Lagos is the economic hub of the country that accommodates more than 22 million people equivalent to the entire population of Ghana. The high level of economic and social activities in the State since its creation, has place it among international economic hubs. In addition, the most

people of its neighbouring states get the means of their livelihoods in the State. The infrastructure facilities enjoyable in the State is incomparable to other states of the country.

According to the Lagos State Lottery Board (LSLB), about N1 million was generated from nearly 11 sport betting companies in 2013. In addition, there is more revenue potential that could be generated from the lottery, if more resources are invested in developing the industry. Only 40 percent of the industry are able to tap into the enabling environment provided by the state government. Therefore, there is a prime need for a more enabling environment in terms of improved electricity and internet provision to boost the revenue generation of the industry and provide jobs for youths. The study provides the Lagos State Government an in-depth evidence-based guide on what kinds of measures to put in place in achieving its lottery revenue potentials.

The recent economic recession in the country has triggered different lottery schemes. This buttresses by the fact for one out of every five posters is linked to one form of lottery. The report has indicated that thinking of some Nigerians engage in the lottery games has gone beyond fun to be considered as a revenue stream with the current economic situation. Lottery business is a business of raising money by selling numbered tickets and giving out prizes to the holders of particular numbers that are chosen randomly. Prior to the recent economic recession, lottery business has been in existence. The philosophy of the thing about lottery is that there are always winners is the backbone that makes people engage in the lottery business (Rashmong, 2016).

Several studies have addressed the factors that influence the lottery sales. Against the previous studies, the study distinguishes itself mainly from two ways. First, the study examines the drivers of government revenue generated from lottery activities. Second, by utilizing monthly recent data the research issue in the context of the commercial centre of the most populous country in Africa. The result reveals empirically how lottery revenues in Lagos State can be influenced by both economic and social activities.

Its findings while confirming some previous findings in the literature, also indicate some points not identified in exiting studies. First, the study is able to indicate that drivers of lottery revenue in the State, in the long run, are not the same in the short-run. Second, the huge magnitude effect on lottery revenue in the State comes from her GDP in the long run. Third, in the short run, the significant effect of the Christmas season on lottery revenue is established against other season dummies.

In summary, the Lagos lottery revenue accounts for the lion share of national revenue generated from the lottery activities. Therefore, the study provides an evidence-based analysis of factors that influence the lottery revenue in the State in order to serve as a policy guide to what has been

done and what needs to be done to actualize the unlocking lottery revenue potential in Lagos State.

For the short-term policy, more attentions are needed to ensure that increasing revenue from Christmas seasons outweigh the declining experienced in other seasons. For the medium and long term strategy, the revenue acquired for the short term lottery revenue has been used to enhance more infrastructural facilities that can boost economic activities in the State as empirically shown that there is a positive relationship between economic growth and lottery revenue. Additionally, providing an inclusive access to lottery game centres as well as international standard facilities could serve as a pull factor that could contribute the growth rate of the State lottery revenue.

In designing these measures to achieve the lottery revenue potential in the State, the following issues needed to be given a deep thought: Sport betting in Lagos is viewed as another way of addressing huge youth and graduate unemployment in the country. Many young Nigerians now consider the sport betting as a means of earning for living. Considering the upward trends of the lottery activities in the State, would this source of income encourage the youth to participate in the productive sectors like agriculture and agro-allied activities? If not, policy directions are required to address this dilemma.

In addition, why it is difficult for the companies in the lottery industry to enjoy the enabling environment provided by the State? Which companies enjoy the environment? What makes them enjoy while others are not? What has to be done to ensure an inclusive improved enabling environment in the industry? Does the number of existing companies translate to the revenue generated from the lottery activities? If yes, improvement is an issue; and if no, what measures must be in place to address this? These are research questions that have to be answered by the future research.

## **REFERENCES**

Chen, S., Chie, B., Fan, H., & Yu, T. 2009. Income Distribution and Lottery Expenditures in Taiwan : An Analysis Based on Agent-Based Simulation. *Natural Computing in Computational Finance*, 2, 207–223.

Chowdhury, A. 2011. State government revenue and expenditures: A bootstrap panel analysis. *Working Paper 2011-03*.

Farrell, L., Morgenroth, E., & Walker, I. 1999. A time series analysis of UK lottery sales: Long and short-run price elasticities. *Oxford Bulletin of Economics and Statistics*, 61, 513–+. <http://doi.org/Doi 10.1111/1468-0084.00141>

Farrell, L., and Walker, I. 1997. It could be you! But what's it worth? The welfare gain from Lotto. In *Institute for Fiscal Studies Working Papers*.

Faustino, H., Kaiseler, M. J., & Marques, R. 2009. Why Do People Buy Lottery Products? *Working Paper 01/2009/DE/SOCIUS*.

Freund, E. A., & Morris, I. L. 2006. Gambling and income inequality in the states. *Policy Studies Journal*, 34(2), 265–276. <http://doi.org/10.1111/j.1541-0072.2006.00169.x>

Ghent, L. & Grant, A.P. 2007. The demand for lottery products and their distributional consequences.

Grote, K. R., & Matheson, V. A. 2011. *The Economics of Lotteries: A Survey of the Literature* (Vol. 01610). Retrieved from [http://college.holycross.edu/RePEc/hcx/Grote-Matheson\\_LiteratureReview.pdf](http://college.holycross.edu/RePEc/hcx/Grote-Matheson_LiteratureReview.pdf)

Humphreys, B. R., and Matheson, V.A. 2012. Booms, Busts, and Gambling: Can Gaming Revenues Reduce Budget Volatility? In *Boom and Bust Again*, edited by R. Ascah and D. Ryan. Alberta, Canada: University of Alberta Press.

Jegade, C. A. 2014. Econometric analysis of the effectiveness of public revenue in economic growth in developing countries: An examination of Nigerian economy. *International Journal of Economics and Finance*, 6, (8), 187-169.

Jinjarak, Y., 2013. Economic integration and government revenue from financial repression. *Economic Systems*, 37, 271-283.

Kaiseler, M. J., & Faustino, H. C. 2008. Lottery Sales and Per-capita GDP: An Inverted U Relationship, 20.

Kaiseler, M. J., & Faustino, H. C. 2008. Demand for lottery products: A cross-country analysis. *Working Paper 33/2008/DE/SOCIUS*.

Knight, B., & Schiff, N. 2012. Spatial competition and cross-border shopping: Evidence from state lotteries. *American Economic Journal: Economic Policy*, 4(4), 199–229. <http://doi.org/10.1257/pol.4.4.199>

Mehrara, M., & Rezaei, A. 2014. The relationship between government revenue and government expenditure in Iran. *International Journal of Academic Research in Business and Social Science*, 4 (3), 172-182. Ministry of Economic Planning and Budget, Lagos State

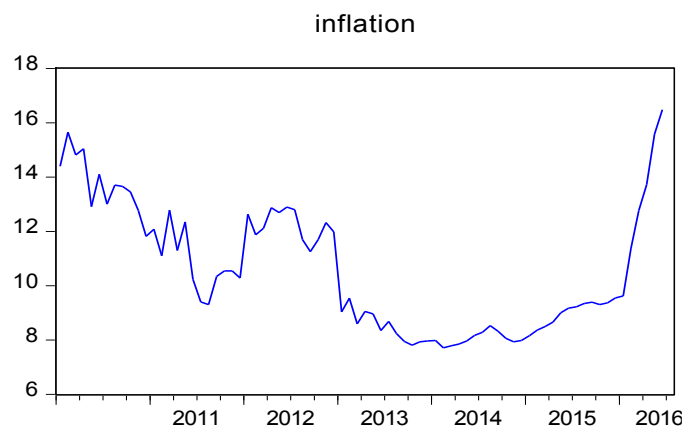
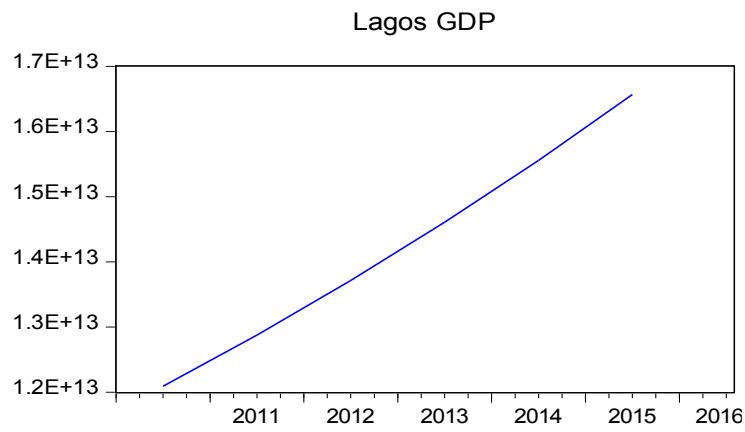
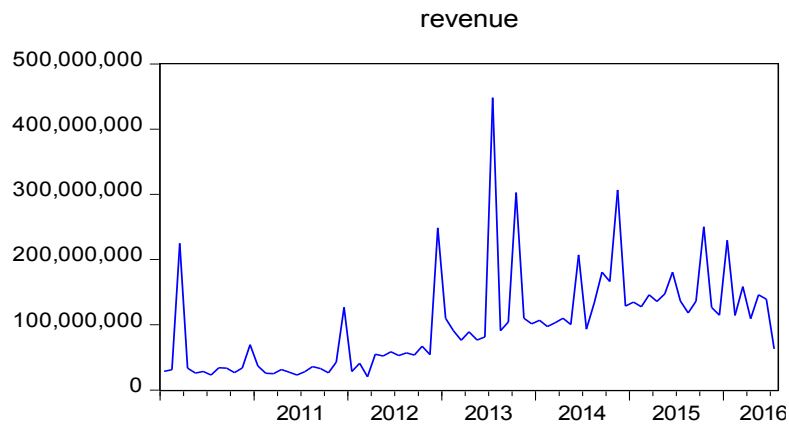
Mikesell, J. L. 1994. State Lottery and Economic Activity. *National Tax Journal*, 47(1).



- Mikesell, J. L., and Zorn, C.K. 1986. State Lotteries as Fiscal Savior or Fiscal Fraud: A Look at the Evidence. *Public Administration Review* 46:311-320
- Pantuosco, L., Seyfried, W., & Stonebraker, R. 2007. The Impact of Lotteries on State Education Expenditures: Does Earmarking Matter? *The Review of Regional Studies*, 37(2), 169–185.
- Perez, L. 2009. The state of empirical research on the Demand for Lottery. *Economic Discussion Papers, EDP 01/2009*. [www.uniovi.es/economia/edp.htm](http://www.uniovi.es/economia/edp.htm).
- Perez, L., & Humphreys, B. 2011. Lottery Participants and Revenues : An International Survey of Economic Research on Lotteries.
- Philander, K. S., Bernhard, B. J., Wimmer, B. S., Singh, A. K., & Eadington, W. R. 2015. U.S. casino revenue taxes and short-run labor outcomes. *Journal of Policy Modeling*, 37(1), 35–46. <http://doi.org/10.1016/j.jpolmod.2015.01.008>
- Pjesky, R. J. 2013. Convergence in state and local spending on education: Are lotteries earmarked for education the key? *Journal of Business & Economics Research*. 11(3), 137–146.
- Rashmong, 2016. Is recession a boon for lottery business?- The Nation Nigeria
- Rodgers, W. M., and Stuart, C. 1995. The Efficiency of a Lottery as a Source of Public Revenue. *Public Finance Quarterly* 23 (2):242-254.
- Sims. 1980. Vector Autoregression and Vector Error-Correction Models. *Chapter 5*, 70–99.
- Stitzel, L., & Pjesky, R.J. 2011. Lottery revenue and cross-border shopping: A nationwide analysis.
- Walker, D. M., & Cunmmings W.E. 2014. The effect of casino proximity on lottery sales : Zip code-level evidence from Maryland.
- Wan, J. 2010. The incentive to declare taxes and tax revenue: the lottery receipt experiment in China. *Review of Development Economics*, 14(3), 611–624.

## **APPENDIX**

### **Figure A.1**



**Table A.1**

Vector Error Correction Estimates

Date: 08/08/16 Time: 15:55

Sample (adjusted): 2010M04 2015M12

Included observations: 69 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1		
LNREV(-1)	1.000000		
LNLAGGDP(-1)	-4.018512		
	(1.19689)		
	[-3.35747]		
INFLATION(-1)	0.134355		
	(0.06005)		
	[ 2.23722]		
C	92.20032		
		D(LNLAGG	D(INFLATI
Error Correction:	D(LNREV)	DP)	ON)
CointEq1	-0.515447	-7.68E-06	-0.683994

	(0.16347)	(3.6E-06)	(0.28940)
	[-3.15310]	[-2.10706]	[-2.36350]
D(LNREV(-1))	-0.311832	1.12E-06	0.470894
	(0.14757)	(3.3E-06)	(0.26124)
	[-2.11315]	[ 0.34054]	[ 1.80253]
D(LNREV(-2))	-0.234516	2.19E-06	0.117342
	(0.11380)	(2.5E-06)	(0.20147)
	[-2.06072]	[ 0.86184]	[ 0.58244]
D(LNLAGGDP(-1))	776.2218	0.130380	-5514.490
	(5803.45)	(0.12946)	(10273.9)
	[ 0.13375]	[ 1.00711]	[-0.53675]
D(LNLAGGDP(-2))	10679.35	0.022277	406.5793
	(5776.32)	(0.12885)	(10225.9)
	[ 1.84882]	[ 0.17289]	[ 0.03976]
D(INFLATION(-1))	0.020244	-5.89E-07	-0.302194
	(0.06864)	(1.5E-06)	(0.12152)

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	[ 0.29492]	[-0.38444]	[-2.48680]
D(INFLATION(-2))	0.009811	-1.31E-06	0.131643
	(0.06738)	(1.5E-06)	(0.11928)
	[ 0.14561]	[-0.87021]	[ 1.10366]
C	-60.16426	0.004445	26.70509
	(40.1468)	(0.00090)	(71.0725)
	[-1.49861]	[ 4.96382]	[ 0.37574]
SEASONALITY	0.325628	8.86E-07	-0.059221
	(0.12621)	(2.8E-06)	(0.22343)
	[ 2.58002]	[ 0.31476]	[-0.26505]
<hr/>			
R-squared	0.582062	0.183150	0.232665
Adj. R-squared	0.526337	0.074236	0.130354
Sum sq. resid	10.47689	5.21E-09	32.83472
S.E. equation	0.417869	9.32E-06	0.739760
F-statistic	10.44525	1.681608	2.274094
Log likelihood	-32.87650	706.1545	-72.28637
Akaike AIC	1.213812	-20.20738	2.356127
Schwarz SC	1.505217	-19.91597	2.647532

Mean dependent	-0.009752	0.005247	-0.076232
S.D. dependent	0.607164	9.69E-06	0.793268
<hr/>			
Determinant resid covariance (dof			
adj.)		7.88E-12	
Determinant resid covariance		5.18E-12	
Log likelihood		602.8134	
Akaike information criterion		-16.60329	
Schwarz criterion		-15.63193	
<hr/>			

**Table A.2**

Vector Error Correction Estimates  
 Date: 12/21/16 Time: 14:28  
 Sample (adjusted): 2010M04 2015M12  
 Included observations: 69 after adjustments  
 Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNREV(-1)	1.000000
LNLGGDP(-1)	-4.451539 (1.12174) [-3.96844]
LNINF(-1)	1.115072 (0.59318) [ 1.87981]
C	103.0431
Error Correction:	D(LNREV) D(LNLGG) D(LNINF)

	DP)		
CointEq1	-0.583209 (0.17451) [-3.34197]	-8.03E-06 (4.0E-06) [-2.01712]	-0.056269 (0.02888) [-1.94807]
D(LNREV(-1))	-0.265048 (0.15313) [-1.73083]	1.28E-06 (3.5E-06) [ 0.36742]	0.036367 (0.02535) [ 1.43479]
D(LNREV(-2))	-0.215175 (0.11483) [-1.87388]	2.18E-06 (2.6E-06) [ 0.83011]	0.010379 (0.01901) [ 0.54609]
D(LNLAGGDP(-1))	841.5028 (5796.17) [ 0.14518]	0.131523 (0.13228) [ 0.99425]	-475.6309 (959.372) [-0.49577]
D(LNLAGGDP(-2))	10779.93 (5737.44) [ 1.87888]	0.029926 (0.13094) [ 0.22854]	46.97702 (949.651) [ 0.04947]
D(LNINF(-1))	-0.076705 (0.77285) [-0.09925]	-9.39E-06 (1.8E-05) [-0.53256]	-0.272464 (0.12792) [-2.12995]
D(LNINF(-2))	0.027763 (0.76161) [ 0.03645]	-1.91E-05 (1.7E-05) [-1.10053]	0.123415 (0.12606) [ 0.97902]
C	-61.03249 (39.7403) [-1.53578]	0.004399 (0.00091) [ 4.85037]	2.239202 (6.57774) [ 0.34042]
XMAS	0.449384 (0.18184) [ 2.47130]	3.07E-07 (4.2E-06) [ 0.07398]	-0.004572 (0.03010) [-0.15190]
RAMADAN	0.286969 (0.19293) [ 1.48739]	1.25E-06 (4.4E-06) [ 0.28489]	0.014811 (0.03193) [ 0.46381]
UEFA	-0.073449	2.56E-07	-0.012355



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	(0.32562)	(7.4E-06)	(0.05390)
	[-0.22556]	[ 0.03440]	[-0.22923]
PREMIERE	0.021809	1.41E-06	0.015981
	(0.32570)	(7.4E-06)	(0.05391)
	[ 0.06696]	[ 0.18942]	[ 0.29645]

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R-squared	0.603791	0.189430	0.189073
Adj. R-squared	0.527329	0.033004	0.032578
Sum sq. resid	9.932196	5.17E-09	0.272105
S.E. equation	0.417431	9.53E-06	0.069093
F-statistic	7.896663	1.210990	1.208171
Log likelihood	-31.03455	706.4208	93.07394
Akaike AIC	1.247378	-20.12814	-2.349969
Schwarz SC	1.635918	-19.73960	-1.961429
Mean dependent	-0.009752	0.005247	-0.006359
S.D. dependent	0.607164	9.69E-06	0.070246

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Determinant resid covariance (dof adj.)	7.11E-14
Determinant resid covariance	4.01E-14
Log likelihood	770.5196
Akaike information criterion	-21.20347
Schwarz criterion	-19.94071

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