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Remittance: Consumed or Invested? A Macro-Model of the Nigerian Economy

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Authors' contributions

All the authors collaborated to produce this work. Author ICO designed the study, wrote the protocol and wrote the first draft of the entire manuscript. Author NRU reviewed the draft manuscript and managed the literature searches. Author ACO carried out the analyses. All the authors read and approved the final manuscript.

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ABSTRACT

The increasing trend in remittance receipts, especially to developing countries has widened the opportunities for external sources of finance for investment and growth. However, while some literatures suggest that remittance matter for growth through investment, others contend that the relationship between remittance and growth depends on its end use. Given an import-dependent economy like Nigeria, it is necessary to examine the end-use of remittance – whether it is consumed or invested. Employing a quarterly time series data from 1986 to 2014 in a Keynesian dynamic macroeconomic framework, the results show that remittance significantly induces consumption and investment expenditure, as well as output growth in Nigeria. Specifically, when 1 unit remittance is received in Nigeria, it significantly induces consumption and investment spending by 3 units and 63 units respectively while output growth increases by 1012 units, ceteris paribus.

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1. INTRODUCTION

The Nigerian nation is facing the problem of increasing number of her skilled and unskilled labour migrating to other countries with the attendant brain drain. This negative trend is yielding positive fruits in form of remittance inflow. Remittance has become the second largest source of external finance next to oil, exceeding Official Development Assistance (ODA) since 1993 both in value and as percent of GDP, and surpassing FDI inflow since 1999 save for 2001, 2002 and 2003. Remittance was approximately 8 times the value of portfolio inflow for the same period and more than 30% of total export earnings in the most recent 12 year period. At regional level, remittance inflow into Nigeria represents about 50% of total remittance inflow to Sub-Saharan Africa (SSA) and approximately 77% of total inflow to West African countries.

Three factors – pull, push, and advancement in technology – may be advanced for this sudden upsurge in remittance inflow into developing countries including Nigeria [1]; Guiliano and Ruiz-Arranz, [2]. First, the developed and industrialized nations' demand for labour supported by the huge wage differences between developed and developing nations is the main pull factors that attract migrants to developed countries. Second, increasing rate of unemployment, falling economic prospects, volatile political environment, under-developed agriculture in both rural and urban areas, under-developed and inadequate infrastructure, and weak corporate governance are some of the factors that push migrants out to the outside world [1]. Third, according to Guiliano and Ruiz-Arranz [2], the technological advancement that has allowed for quicker, cheaper and easier international transfers between individuals and among countries and the attendant reduction in transaction costs have led to the current upsurge.

Remittance inflow is important because it affects growth in the recipient developing economies through savings and investment. Its potentials to scale up domestic consumption have short run effects on aggregate demand and output [3]. Finally, the balance of payment position of a country is determined by remittance inflow as it constitutes a major portion of a country's foreign exchange reserve. Available data support the upward trend in remittance inflow into Nigeria (Fig. 1). For instance, in absolute value and as proportion of GDP remittance inflow into Nigeria was $0.7 (₦0.5) million or 0.01% in 1970. It rose to $804 (₦65,365.2) million or 2.91% in 1995, $1.4 (₦142.4) billion or 3.87% in 2000, $14.6 (₦1,899.6) billion or 13.04% in 2005, and $23.0 (₦3,645.9) billion or 9.04% of GDP in 2012 World Development Indicator (WDI), [4].

Despite the upward trend, the nature and magnitude of the economic implications of remittances into Nigeria is not clear, especially given the import-dependent-consuming peculiarity of the country. A cursory look at the WDI [4] import content of foreign trade reveals that in 1970 total import was $1.4 billion (₦84.0 million), but rose to $6.9 (₦561.0) billion in 1995. By 2005, import figure had climbed to $21.4 billion (₦2.2 trillion), and rose further to $88.4 billion (₦13.9 trillion) in 2011. As a ratio of GDP it was 11.2%, 24.0%, 19.1%, and 36.0% in the years 1970, 1995, 2005, and 2011 respectively [4]. On its part, the outcome of gross fixed capital formation both as value and proportion of GDP during the period was rather mixed as depicted by WDI [4] data. For example, in 1990, 1995, 2005, and 2011 it was $4.4 (₦35.4) billion, $2.0 (₦162.6) billion, $6.1 (₦620.4) billion, and $25.3 billion (₦3,802.6 trillion) respectively. However, as ratio of GDP it was 14.3%, 7.1%, 5.5%, and 10.3% respectively.

Despite the results of some existing studies (see for instance, Balde, [5]; Faini, [6]; Abeng, [7]; Ukeje and Obiechina, [8]) which show evidence that remittance inflow promote investment and hence growth, the questions are whether this huge remittance inflow actually scale up investment and consumption levels and hence create economic opportunities in recipient economies. Do available data on gross fixed capital formation on Sub-Saharan Africa (SSA) and Nigeria in particular support these findings; or is it that remittance inflow has savings-inducing potentials that has not yet been harnessed? Aware that remittance is essentially unrestricted private financial flows capable of financing investment and consumption, the study attempts to answer the question about the use of remittance. This stems from the fact that the use of remittance determines its macroeconomic effect. Previous studies dwelt on impact analysis of remittance [8,5]. In this context, the study takes as a point of departure, the effect of the use of remittance on three macroeconomic variables – consumption, and investment, and growth – in Nigeria in the period 1986Q1 to 2014Q4. Structurally, the rest of the work is organised as follows: section 2 reviews relevant empirical literature and trends some important variables used for the study, section 3 discusses the methodology, section 4 presents and discusses the empirical results while section 5 presents the conclusion.

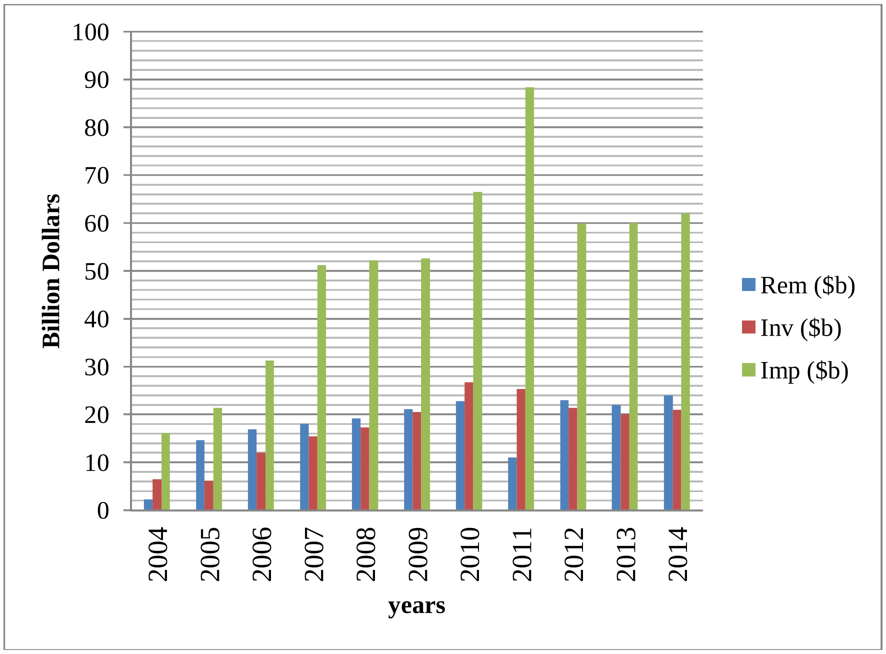

Fig. 1. Value of remittances, investment and imports in Nigeria in the most recent 12-year period (in billion dollars)

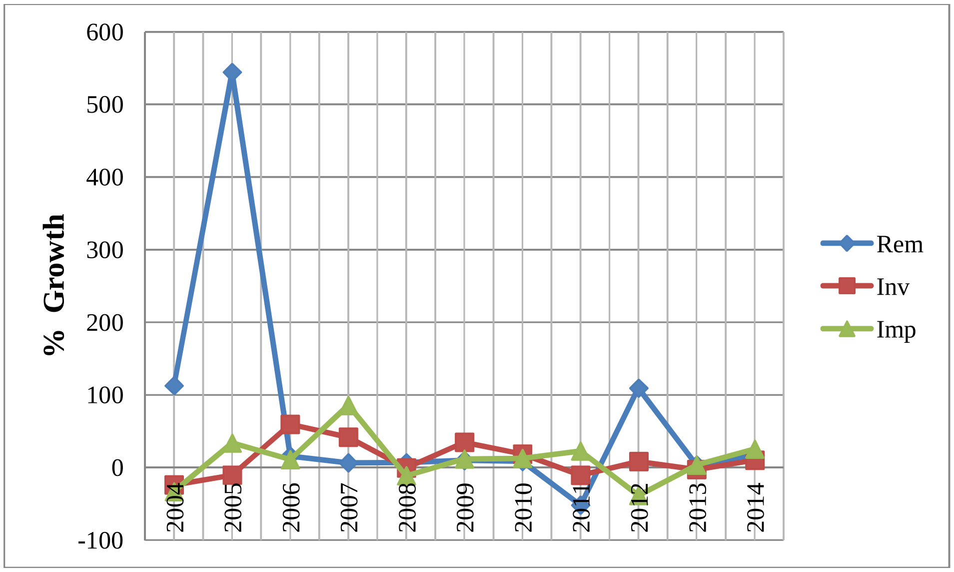

Fig. 2. Growth rates of remittances, investment and import in the most recent 12-year period

1.1 Related Theoretical and Empirical Literature

Studies in economic literature suggest conflicting relationship between remittance and growth. For instance, while Connell and Conway [9] contend that remittance has growth-inducing impact on investment, poverty alleviation, growth and development, studies such as Robert [10], Robert [11] argue that remittance does not contribute to economic growth and development. For Burnside and Dollar [12], Bjuggren, Dzansi, and Shukur [13], the impact of remittance on the growth of remitters' home economy can be either way, that is, it is conditional on its end use – whether it is consumed, saved, or invested. If it is invested, it is likely to have growth-promoting impact on the economy. Commenting in favour of its growth-inducing impact, Barajas, Chami, Fullenkamp, Gapen, and Montie [14] using growth accounting framework posit that remittance directly finance increase in capital accumulation in recipient economies compared to what would have been the case if such economies resort only to domestic sources of finance for investment. Mishra [15], Parajuli [16], World Bank (WB) [17], Lucas [18], Connell and Conway [9], and Ziesemer [19] all argue that remittances impact positively on investment. Specifically, Parajuli, Ziesemer, Connell and Conway add that remittance may promote investment in human and physical capital – education, housing and small business. WB argues that remittance raises investment and growth, especially in countries with highly skilled labour, strong institution and good policy environment.

However, Roberts [11] argue that by reducing the labour and saving efforts of recipient families, remittance impacts negatively on economic growth and development (moral hazard problem). Remittance may also hurt economic growth when the traded goods sector of recipient economy becomes the source of significant positive externalities that promote the productive capacity of other sectors. If this condition is satisfied, remittance may give rise to a Dutch disease effect to the extent that its inflow may cause the economy's real exchange rate to appreciate [20]. Finally, if remittance is disguised as capital flows (recipients investing on behalf of the migrant remitter) and the receiver is less skilled in investing, deficiency in investment is promoted to the extent that the unskilled investor may choose unprofitable investment and hence hurt future investment decisions from the remitter.

On the other hand, if consumed, remittance may hurt or have no impact on growth, especially in an import demand economy. For instance, if remittance is perceived to be permanent, they will tend to be consumed in their entirety and therefore will not affect aggregate investment. Similarly, the consumption impact of remittance on labour productivity depends on the living standard of remitters' family. If the standard of living of recipient family was sufficiently high to the extent that its basic needs are adequately met prior to the receipt of remittance, then the labour productivity effect of remittance disappears for that family as additional receipts from remittance may simply be consumed.

Arguing in favour of this theory, Durand, Parrado and Massey [21] contend that remittance receipts lead to an excessive consumption, especially on imported goods or unproductive residential investment such as house, jewellery and land. Paine [22] hypothesize that remittance increase the propensity to import since remitters families' taste and preferences for foreign goods and living standards have increased, especially after the return of migrant worker to their home. Azad [23] consider remittance as a major source of foreign exchange used to pay import liabilities in labour exporting economies. Arguing further, Lipton [24] writes that about 90% or more of remittance receipts are spent on daily-needs related consumption like food, clothing, house rent, etc. Massey et al. [25] report that between 68(%) to 86% of remittance sent to Mexico are spend on consumption. Rempel and Lobdell [26] posit that remittance is mainly devoted to daily consumption requirements.

Remittance, if saved has the potential to reduce the credit constraints to recipient households and promote entrepreneurship (Woodruff and Zenteno, [27]; Funkhouser, [28]). Stressing on the relationship between remittance and saving, Roberts [11] and Adams [29] add that remittance improves the propensity to save by households which ultimately increases the loanable funds of deposit money banks and hence its ability to expand credit to the private sector, increase investment potentials and this is expected to promote growth.

The end use of remittances may also be determined by the policy environment and institutional arrangements of the recipient country. By differentiating between countries with corruption level above median with those below median, Ratha [30] posit that corruption could have negative effect on the end use of remittance. Stark et al. [31] note that the income distribution policy of recipient country strongly determines the expected effects of remittances on her poverty and inequalities reduction.

Given the import content of consumption in Nigeria, and given that the country is a labour exporting economy, remittance receipt is expected to impact negatively on the country's balance of payment. If, however, a large chunk of remittance income was channeled to productive investment such that its effect neutralize or even outweigh the effect on the balance of payment, remittance may induce investment and growth. The end-use of remittance – whether consumed or invested has implications for a country's economic wellbeing.

1.1.1 Empirical studies for Nigeria

Many researchers have investigated the end use of remittance in Nigeria and gave varying conclusions. While majority of the studies examine the importance of remittance on economic growth, others acknowledge that remittance affect growth through its impact on savings and investment.

Omobitan [32] in analysing the determinants of international migrants' remittances flow into Nigeria for the period 1977-2010, and employing Engle Granger two stage long run relationship found that there exist significant co-integration relationship between remittances and gross domestic product. The author recommends that more remittance inflows can be improved through official channels with the maintenance of macroeconomic and financial stability.

Ukeje and Obiechinna [8] in their study on Workers' Remittances–Economic Growth nexus in Nigeria using an error correction model for the period 1970-2010 found significant and positive impacts of remittances on growth in the long run. The duo equally report that in the short run, the lagged value of workers' remittances is significant, appropriately signed and impacts positively on economic growth. The study recommend the provision of adequate infrastructure for attracting more remittance inflows into the economy through formal financial sector channel while adopting measures to encourage the recipients to channel such into productive sector or through domestic savings that would boost investment and economic growth.

Agu [33] in his study on the relationship between remittance and the macro economy in Nigeria using a four-sector medium scale macro model found a weak link between remittances and the real sector and components of aggregate demand. He posited that the existence of leakages of remittance proceeds through consumption of imported goods could be responsible for the weak nexus.

Oduh and Urama [34] investigated whether the end-use of remittances will be poverty-reducing as well as growth-financing in an import-dependent economy like Nigeria. Using macro-econometric model with six behavioural equations and six identities to estimate and simulate the effects of remittances inflow on aggregate demand in Nigeria, the simulation result shows that the much touted poverty-reducing effect of remittances is non-growth-financing for import-dependent country like Nigeria. The authors blamed the results on the negative impact of imports on the current account balance despite remittance positive effects on private consumption and investment.

Ogbonna, et al. [35] examined the linkages between remittance inflow and private domestic investment in Nigeria. Using a time series data from 1970-2012 and following Guiliano and Ruiz-Aranz [2] framework, OLS estimate was applied. The result indicates that remittance inflow is insignificantly negative in promoting domestic private investment, indicative that the quantum of remittance inflow into Nigeria has been hurting the country's domestic private investment in the long run. The authors recommend that Nigerian government should institute international and local initiatives and measures that would woo Nigerians in Diaspora to channel migrant transfers into investment at home to promote investment and hence economic growth.

Okodua [36] examines the private investment outcomes of workers' remittance flows to some selected Sub-Saharan African (SSA) countries using the system Generalized Method of Moments in a linear dynamic panel data model. A major finding is that remittance has a significant contemporaneous positive impact on private investment across the sampled countries over the study period. Okodua result suggests that remittance inflow to SSA occur as both financial and capital flows.

2. METHODOLOGY, MODEL AND DATA SOURCES

To evaluate the aggregate spending effects of remittance on domestic consumption, domestic investment, and the gross domestic product of the Nigerian economy, we reiterate the four uses of remittances as enunciated by Ratha, [29]. Ratha had posited that remittance receipts were spent for consumption, investment, health, and education. In this study, however, we collapse the four uses into two, mainly to suit the objectives of the study, and too, in line with NBS [37] data generating process which lumped 'health' and 'education' into non-food consumption. We consider simultaneous equation system as most appropriate to evaluate the impact of remittances on domestic investment, domestic consumption and aggregate expenditure in Nigeria economy in the period 1986-2013.

In line with the objective of the study which aims to explore whether remittance induces domestic investment, consumption and growth in Nigeria, the Keynesian dynamic macroeconomic framework is formulated to examine the aggregate spending effect of remittance on consumption, investment and national income. The three systems of behavioural equations are thus formulated:

Model 1

Theoretically, the positive determinants of consumption expenditure (CE) include, income (Y), and income in the previous year (Y_{t-1}), while savings deposit rate (SVG) is a negative determinant. Private Consumption expenditure is made up of food, and non food (including services) items. Literature is replete with studies which posit that remittance receipts are spent on daily-needs related consumption like food, clothing, house rent, etc. Based on this, it is important to explore the relationship between remittance and private consumption expenditure in Nigeria. For our purpose and considering country-specific peculiarities, remittance (REM), and exchange rate (EXR) are also included. Hence, we model:

$$CE = f(Y_t, Y_{t-1}, SVG_t, REM_t, EXR_t);\ f'(Y_t) > 0,\ f'(Y_{t-1}) > 0,\ f'(SVG_t) < 0,\ f'(REM_t) > 0,\ f'(EXR_t) < 0 \quad (1)$$

Model 2

In modeling the relationship between remittance and domestic investment, we recall that theoretically, domestic investment is positively determined by return on investment (profit) which itself is influenced by level of income and prime lending rate which is the cost of capital. Equivalently, current investment positively depends also on past investment which is also influenced by level of income. Hence, the relationship between remittance and gross domestic investment (INV_t) may be considered by establishing the relation among gross domestic product (Y_t), its one year lag (Y_{t-1}), remittance inflow (REM_t), and the prime lending rate of deposit money banks (INT_t). Symbolically:

$$INV_t = f(Y_t, Y_{t-1}, INT_t, REM_t, EXR_t);\ f'(Y_t) > 0,\ f'(Y_{t-1}) > 0,\ f'(INT_t) < 0,\ f'(REM_t) > 0,\ f'(EXR_t) < 0 \quad (2)$$

Model 3

We now try to assess the degree of relation among remittance and gross domestic product in Nigeria. The traditional Keynesian aggregate demand function of a given economy assumes that consumption expenditure (CE_t), domestic investment (INV_t), government consumption (GE_t), export (XPT_t), and import (MPT_t), are responsible for the level of gross domestic product (Y_t).

For our purpose, we add remittances (REM_t) in the national income identity, so that:

$$Y_t = f(CE_t, INV_t, GE_t, XPT_t, MPT_t, REM_t);\ f'(CE_t) > 0,\ f'(INV_t) > 0,\ f'(GE_t) > 0,\ f'(REM_t) > 0,\ f'(XPT_t) > 0,\ f'MPT_t < 0 \quad (3)$$

For estimation purpose, the functional form and expected signs of the coefficients for equations 1-3 are expressed econometrically, hence:

$$CE_t = b_0 + b_1Y_t, + b_2Y_{t-1} + b_3SVG_t + b_4REM_t + b_5EXR_t + \varepsilon_t \quad (4)$$

$$INV_t = a_0 + a_1Y_t + a_2Y_{t-1} + {}_{a3}INT_t + a_4REM_t, + a_5EXR_t + \mu_t \quad (5)$$

$$Y_t = \beta_0 + \beta_1CE_t + \beta_2INV_t + \beta_3GE_t + \beta_4XPT_t, + \beta_5MPT_t, \beta_6REM_t + \gamma_t \quad (6)$$

b_t, a_t, β_t, are parameters to be estimated, while ε_t, μ_t, γ_t, are stochastic error term for the respective equations.

Equations (7), (8), and (9) are with dynamic version of the long-run relationship (an error correction form) to allow for inclusion of long-run information:

$$\Delta CE_t = b_0+b_1\Delta Y_t,+b_2\Delta Y_{t-1}+b_3\Delta SVG_t+ b_4\Delta REM_t+b_5\Delta EXR_t+\lambda ECM_{t-1}+\varepsilon_t \quad (7)$$

$$\Delta INV_t = a_0+a_1\Delta Y_t+a_2\Delta Y_{t-1}+ {}_{a3}\Delta INT_t+a_4\Delta REM_t,+a_5\Delta EXR_t+\Psi ECM_{t-1}+\mu_t \quad (8)$$

$$\Delta Y_t = \beta_0+\beta_1\Delta CE_t+\beta_2\Delta INV_t+\beta_3\Delta GE_t+\beta_4\Delta XPT_t, +\beta_5\Delta MPT_t,+\beta_6\Delta REM_t+\psi ECM_{t-1}+\gamma_t \quad (9)$$

Δ is the first difference operator, and λ, Ψ, ψ are the error correction coefficients, while the rest are as earlier defined.

2.1 Data Sources

Our data are from three main sources, namely World Development Indicators (WDI), National Bureau of Statistics (NBS), and the Central Bank of Nigeria (CBN).

Data used for estimation in the models spanned 1986Q1 – 2014Q4. All the data sets were used as reported by their respective institutions. However, because data from WDI are reported in US dollar, prevailing naira exchange rate for each year was used to multiply to get the naira equivalent. This is for data consistency and because of the importance attached to data attributes of the affected datasets.

The choice of quarterly series was predicated principally on two crucial reasons. First, sufficient degrees of freedom relating to number of observations was critical, especially when estimating over-parameterised models. Second, because we are interested in investigating the behaviour of these variables after deregulation, annual data series from 1986 which marked the deregulation period might have insufficient degrees of freedom. Generating high frequency (quarterly) datasets from low frequency (annual) series was performed on E-views strictly on the software's econometric strength. In the study, real data sets were used for estimation.

2.2 Estimation Techniques

The equations (4), (5) and (6) are not unrelated, estimating them separately using OLS means that the potential correlation among the equations is not taken into cognizance. Hence, it is assumed implicitly that the disturbance terms are not contemporaneously correlated. However, the consequence is that parameter estimates will be biased even in large samples [38]. One of major weakness of OLS in estimating the above equation is that it estimates the equation separately and by so doing ignores information provided by other equations. To correct for this and incorporate all the information in the three equations, the study adopted seemingly unrelated regression (SUR) technique developed by Zellener in 1962. Ellener [39] noted that SUR model produces estimator that are symptotically more efficient when applied to a system of equation compared to when OLS is applied, and that the efficiency increases when the correlation between the disturbance terms increases on one hand and when the correlation between the explanatory variables reduces on the other. Thus, to obtain efficient parameter estimates the study applied SUR techniques in estimating above equations.

To ascertain the quality of the variables in our model, we tested for the order of integration of each time series using the Augmented Dickey-Fuller (ADF). This approach is apt since the ADF model accounts for the autocorrelation of the first differences of the series in a parametric way by guessing the value of additional nuisance parameters [38]. Having achieved stationarity, cointegration tests were conducted to determine whether or not there exist long run relationships among the series. The error correction model (ECM) technique was carried out for the various stochastic equations in the model to incorporate long run information.

3. EMPIRICAL RESULTS AND DISCUSSION

3.1 Time Series Properties of the Variables

Unit root and co-integration tests were performed on all the variables using the Augmented.

Dickey-Fuller (ADF) and Johansen and Juselius co-integration technique respectively. For brevity, however, the results are not presented. For the unit root, all the variables are integrated (stationary) of order-one, that is I(1) except interest rate that is integrated at level form, that is I(0). In testing for co-integration employing both the Trace and Maximum Eigen-value statistics, the results indicate two co-integrating equations for trace and two for maximum eigen value for equations 4 and 5, and six co-integration for equation 6. Consequently, error correction models (ECM) are used for all the models. The ECM variables utilized in the equations are: ECM1 (consumption-remittance) referred to as equation 7, ECM2 (investment-remittance) referred to as equation 8, and ECM (national income-remittance) referred to as equation 9.

3.2 Empirical Results

Table 1 shows the determinants of consumption, investment, and national income.

3.2.1 Consumption expenditure-remittance model

The results reveal that the positive determinants of consumption include: GDP, lagged GDP, remittances and exchange rate; while savings deposit rate affects consumption negatively (Table 1a). Specifically, the results indicate that remittance significantly promote private consumption just as GDP, one quarter lagged GDP and exchange rate. Both GDP and its lagged coefficients met the a priori sign, that as national income (GDP) increases, private consumption expenditure rises ceteris paribus. This is in tandem with Keynesian theoretical formulation that income is a positive function of consumption. On its part, exchange rate coefficient is positive and significant indicative that for every 1 unit depreciation in exchange rate consumption increases by 1,299 units.

The results also indicate that as remittance increases by 1unit, private consumption expenditure which is made up of food and non food items significantly increases by approximately 3 units. The finding is indicative that in Nigeria, remittance raises the purchasing power of household recipients on food and non food items during the last two decades. Available data on trade statistics show that without oil revenue, Nigeria consistently had unfavourable balance of payment since the 1980s, and that more than 43% of total import into Nigeria is consumer goods [40]. If remittance coefficient is significantly positive in determining private domestic consumption and given that more than 43% of total import is on consumer goods, a large chunk of remittance funds may have been channelled on imported consumer goods rather than investment goods, especially if they are perceived to be permanent.

3.2.2 Investment expenditure-remittance model

The positive determinants of domestic investment in Nigeria include: GDP and its one quarter lagged value, exchange rate and remittance, while interest rate is a negative determinant (Table 1b). Theoretically, higher GDP and its lagged value increase per capita income and hence savings and investment expenditure. Our empirical results is in tandem with this theoretical postulation, that is, a 1unit increase each in GDP and its lagged value significantly promote investment expenditure by 0.06 units and 11 units respectively in a quarter, ceteris paribus. On its part, remittance coefficient is positive and significant, thus providing sufficient evidence to support the theoretical thesis that remittance directly finance increase in capital accumulation in recipient economies Mishra [15], Parajuli [16], Lucas [18]. Specifically, a 1unit increase in remittance receipt in a quarter promotes investment expenditure by 63 units in the long run. However, available data on investment indicate that despite tremendous increase in remittance inflow into Nigeria, investment rate and its GDP ratio have not exceeded 10% and 15% respectively since 1986 (Fig. 3).

The coefficient of prime lending rate (interest rate) is also in tandem with the theoretical thesis that the cost of capital is important in making a decision whether or not to invest. A higher cost of capital will ultimately scare investors and reduce investment decisions. Available data on prime lending rate shows that average rate since 1986 is above 22%. Hence, our result show that a percent increase in interest rate significantly hurt investment expenditure in Nigeria by 1508 units all things being equal.

3.2.3 National income-remittance model

The final estimated national income-remittance equation was specified as a function of consumption, investment, government expenditure, export and import proceeds, and remittance. The paper attempts to investigate the direct role of remittance on growth complimented by indirect contribution of other explanatory variables. Positive determinants of growth as reported in Table 1c include: Private and public consumption expenditures, investment, export, and remittance. Import is a negative determinant. All the coefficients met the a priori expectation.

The estimated results reveal that private and public consumption expenditures, investment, export, and remittance individually promote growth as relatively larger marginal propensities generated larger multiplier effect in the long run. Specifically, while remittance and export coefficients are significantly positive in the long run, the coefficients of private and public consumption expenditures and investment are insignificantly positive. Our findings reveal that as 1unit remittance receipt enters the Nigerian economy, output growth increases by 1012 units, thus corroborating the earlier results obtained in a related work by Ukeje and Obiechinna [8]. Equivalently, when export rises by one unit, additional 3 units of output will be produced, thus corroborating the Keynesian theoretical thesis that export increase production activities thus motivating more production, employment and income, ceteris paribus.

Though the a priori sign of the coefficients of private and public consumption expenditure are positive and in tandem with theoretical postulation, their insignificance can be explained following Oyejide and Raheem in Bogunjoko, [41] that most public expenditures (investment) in Nigeria were doubtful in utility and viability and constituted a dead-weight loss in terms of net benefits to Nigeria's economy. The country's 136th position out of 175 countries ranked in 2014 in corruption index (perceived level of public sector corruption) further corroborated and reinforced Oyejide and Raheem assertion. Equally, being an import dependent-consumer nation, the import content of public and private consumption expenditure may have given rise to these insignificant coefficients. Thus, the failure of private and public consumption expenditure coefficients to impact significantly to output growth is not surprising given the import-content

Table 1. Regression results

Dependent variable: CE – consumption-remittance model			**(A)**	
Variable	**Coefficient**	**STD. error**	**T-statistic**	**Prob.**
C	150443.2	6465.353	23.26914	0.0000
Y	0.006570	0.002326	2.824688	0.0050
Y(-1)	0.010579	0.002887	3.664734	0.0003
SVG	-5.32E-07	3.44E-07	-1.547329	0.1228
EXR	2.957193	0.865103	3.418314	0.0007
REM	1299.213	92.98543	13.97222	0.0000
ECM1(-1)	-0.353201	0.027246	-2.296363	0.0118
Adjusted R^2	**0.928459**	**Durbin-Watson Stat**	**0.221285**	
Dependent variable: INV – Investment-remittance model			**(B)**	
Variable	**Coefficient**	**STD. error**	**T-statistic**	**Prob.**
C	-39575.04	59600.22	-0.664008	0.5072
Y	0.060246	0.021335	-2.823752	0.0050
Y(-1)	0.107835	0.025742	4.189098	0.0000
INT	-1507.570	2580.198	-0.584285	0.5594
REM	62.62413	8.074852	7.755451	0.0000
EXR	919.1839	847.7900	1.084212	0.2791
ECM2(-1)	-0.061505	0.029937	-2.205604	0.0172
Adjusted R^2	**0.925253**	**Durbin-Watson Stat**	**0.220438**	
Dependent variable: Y – National income-remittance model			**(C)**	
Variable	**Coefficient**	**STD. error**	**T-statistic**	**Prob.**
C	-3666727.	2717660.	-1.349222	0.1782
CE	18.39931	13.02154	1.412990	0.1586
INV	3.753766	2.410177	1.557464	0.1204
GE	14.93478	37.53799	0.397858	0.6910
EXP	3.205043	1.018226	3.147675	0.0018
IMP	-7.500709	1.125966	-6.661579	0.0000
REM	1012.055	284.8425	3.553035	0.0004
ECM(-1)	-0.154638	0.058691	-2.634771	0.0088
Adjusted R^2	**0.590947**	**Durbin-Watson Stat**	**0.228843**	

Source: Researchers' regression results for macroeconomic model of Workers' remittances inflow to Nigeria using E-Views version 6

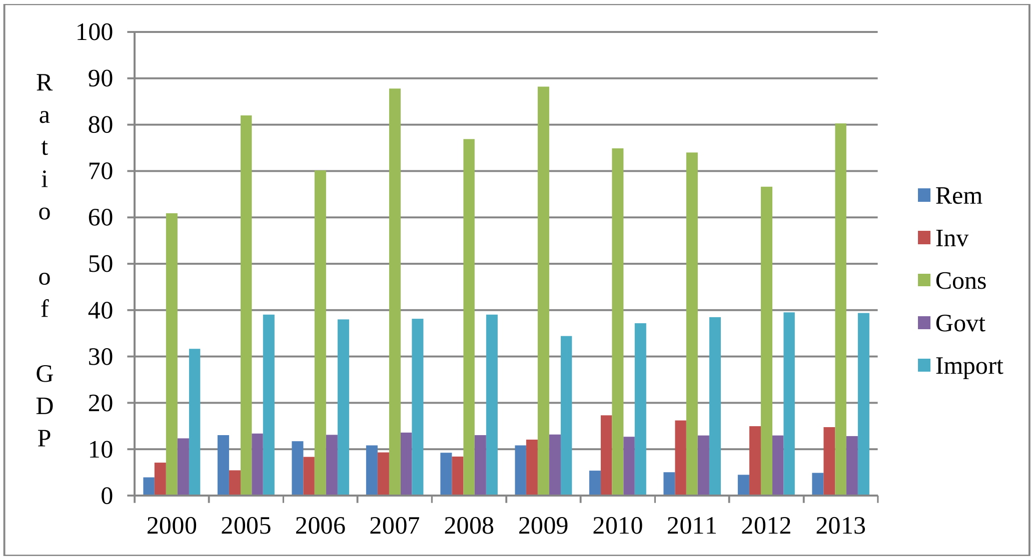

Fig. 3. Remittance (Rem), Investment (Inv), Consumption (Cons), Government Expenditure (Govt), and Import (Imp) as ratio of GDP in the period 2000-2013

of household and government consumption expenditures in Nigeria. As ratio of GDP, Fig. 3 displays the rising trends of private, public and import consumption expenditures.

That import coefficient is negative and significant is expected in an import-dependent economy like Nigeria. Thus, the theoretical explanation of the depressing impact of import on national economies (including Nigeria) is upheld in this study.

The error correction (ecm_{t-1}) coefficient in models 4, 5, and 6 (Table 1a,b, and c) are -35, -15, -15 and significant, indicative of a long run convergence speed of 35%, 15% and 15% respectively. Hence, any disequilibrium in the long run relationship among consumption expenditure and its determinants, investment expenditure and its determinants, and national income and its explanatory variables, automatically adjusted back to long-run equilibrium at the above respective rates (speed) per quarter.

To test the explanatory power of the explanatory variables on the dependent variable using adjusted R^2, the first and second models explain about 93 per cent each of the variations in private consumption and domestic investment, and the third explain about 59 per cent of variations in national income. Durbin-Watson (DW) autocorrelation coefficient at approximately 0.22, 0.22 and 0.23 signifies the presence of autocorrelation.

4. CONCLUSION

The question whether remittance is consumed or invested in Nigeria has been explored in this study. The use of seemingly unrelated regression (SUR) technique in an ECM framework has proved quite intuitive and useful. The empirical results reveal astoundingly that remittance income is significantly consumed and invested. Its deficit effect on the balance of payment derived from import content of consumption does not transmit depressing shock on domestic investment and economic growth in Nigeria. Hence, remittance, the much touted and acclaimed second largest source of external finance, is a positive function of consumption, investment and economic growth. Thus, the brain drain syndrome, heightened by the ever increasing number of migrants, but assumed to have been mitigated by remittance inflow is confirmed. Our result is therefore a proof that remittance receipts mitigate the assumed hurting effect of brain drain on investment and growth in Nigeria.

Our results also show that GDP, its one quarter lag, and exchange rate are positive determinants of consumption and investment, while deposit and prime lending rates are negative determinants respectively. The determinants of Nigeria's economic growth include investment, export, and private and public consumption, while import is a depressing factor.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX I: UNIT ROOT

Null Hypothesis: D(CE) has a unit root				
Exogenous: Constant				
Lag Length: 4 (Automatic based on SIC, MAXLAG=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.289361	0.0178
Test critical values:	1% level		-3.493129	
	5% level		-2.888932	
	10% level		-2.581453	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(CE,2)				
Method: Least Squares				
Date: 10/20/15 Time: 06:42				
Sample (adjusted): 1987Q3 2013Q4				
Included observations: 106 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CE(-1))	-0.329149	0.100065	-3.289361	0.0014
D(CE(-1),2)	0.163469	0.066758	2.448668	0.0161
D(CE(-2),2)	0.163272	0.066714	2.447341	0.0161
D(CE(-3),2)	0.163271	0.066714	2.447320	0.0161
D(CE(-4),2)	-0.719898	0.066697	-10.79348	0.0000
C	1138.927	629.1896	1.810149	0.0733
R-squared	0.801419	Mean dependent var		51.61321
Adjusted R-squared	0.791490	S.D. dependent var		12301.00
S.E. of regression	5616.985	Akaike info criterion		20.15992
Sum squared resid	3.16E+09	Schwarz criterion		20.31068
Log likelihood	-1062.476	Hannan-Quinn criter.		20.22102
F-statistic	80.71480	Durbin-Watson stat		1.881714
Prob(F-statistic)	0.000000			

Null Hypothesis: D(EXR) has a unit root				
Exogenous: Constant				
Lag Length: 4 (Automatic based on SIC, MAXLAG=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.297980	0.0174
Test critical values:	1% level		-3.493129	
	5% level		-2.888932	
	10% level		-2.581453	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(EXR,2)				
Method: Least Squares				
Date: 10/20/15 Time: 06:44				
Sample (adjusted): 1987Q3 2013Q4				
Included observations: 106 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.303638	0.092068	-3.297980	0.0013
D(EXR(-1),2)	0.151710	0.091674	1.654890	0.1011
D(EXR(-2),2)	0.151519	0.091637	1.653467	0.1014
D(EXR(-3),2)	0.151512	0.091637	1.653392	0.1014
D(EXR(-4),2)	-0.398585	0.091708	-4.346253	0.0000
C	0.454464	0.232729	1.952760	0.0536
R-squared	0.371210	Mean dependent var		0.002453
Adjusted R-squared	0.339770	S.D. dependent var		2.382961
S.E. of regression	1.936263	Akaike info criterion		4.214335
Sum squared resid	374.9115	Schwarz criterion		4.365096
Log likelihood	-217.3598	Hannan-Quinn criter.		4.275440
F-statistic	11.80712	Durbin-Watson stat		1.913626
Prob(F-statistic)	0.000000			

Null Hypothesis: D(REM) has a unit root				
Exogenous: Constant				
Lag Length: 4 (Automatic based on SIC, MAXLAG=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.994308	0.0386
Test critical values:	1% level		-3.493129	
	5% level		-2.888932	
	10% level		-2.581453	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(REM,2)				
Method: Least Squares				
Date: 10/20/15 Time: 06:45				
Sample (adjusted): 1987Q3 2013Q4				
Included observations: 106 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(REM(-1))	-0.303333	0.101303	-2.994308	0.0035
D(REM(-1),2)	0.152078	0.086978	1.748462	0.0835
D(REM(-2),2)	0.152079	0.086978	1.748472	0.0835
D(REM(-3),2)	0.152077	0.086978	1.748449	0.0835
D(REM(-4),2)	-0.560977	0.095440	-5.877807	0.0000
C	78.23158	61.75711	1.266762	0.2082
R-squared	0.501215	Mean dependent var		-2.407736
Adjusted R-squared	0.476276	S.D. dependent var		830.6456
S.E. of regression	601.1283	Akaike info criterion		15.69043
Sum squared resid	36135521	Schwarz criterion		15.84119
Log likelihood	-825.5929	Hannan-Quinn criter.		15.75154
F-statistic	20.09743	Durbin-Watson stat		1.882901
Prob(F-statistic)	0.000000			

Null Hypothesis: D(XPT) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 4 (Automatic based on SIC, MAXLAG=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.594515	0.0350
Test critical values:	1% level		-4.046925	
	5% level		-3.452764	
	10% level		-3.151911	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(XPT,2)				
Method: Least Squares				
Date: 10/20/15 Time: 11:24				
Sample (adjusted): 1987Q3 2013Q4				
Included observations: 106 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(XPT(-1))	-0.371004	0.103214	-3.594515	0.0005
D(XPT(-1),2)	0.189462	0.100063	1.893429	0.0612
D(XPT(-2),2)	0.189479	0.100069	1.893476	0.0612
D(XPT(-3),2)	0.189490	0.100072	1.893543	0.0612
D(XPT(-4),2)	-0.242986	0.102177	-2.378076	0.0193
C	-6760.499	37506.29	-0.180250	0.8573
@TREND(1986Q1)	865.1614	646.5581	1.338103	0.1839
R-squared	0.287364	Mean dependent var		-614.3962
Adjusted R-squared	0.244173	S.D. dependent var		202904.3
S.E. of regression	176401.6	Akaike info criterion		27.06267
Sum squared resid	3.08E+12	Schwarz criterion		27.23856
Log likelihood	-1427.321	Hannan-Quinn criter.		27.13396
F-statistic	6.653460	Durbin-Watson stat		1.912142
Prob(F-statistic)	0.000006			

Null Hypothesis: D(INV) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 4 (Automatic based on SIC, MAXLAG=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.783671	0.0212
Test critical values:	1% level		-4.046925	
	5% level		-3.452764	
	10% level		-3.151911	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(INV,2)				
Method: Least Squares				
Date: 10/20/15 Time: 11:26				
Sample (adjusted): 1987Q3 2013Q4				
Included observations: 106 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INV(-1))	-0.428308	0.113199	-3.783671	0.0003
D(INV(-1),2)	0.220192	0.092313	2.385273	0.0190
D(INV(-2),2)	0.220229	0.092320	2.385485	0.0190
D(INV(-3),2)	0.220261	0.092327	2.385671	0.0190
D(INV(-4),2)	-0.463588	0.095300	-4.864493	0.0000
C	-5342.874	14586.57	-0.366287	0.7149
@TREND(1986Q1)	316.7165	236.9251	1.336779	0.1844
R-squared	0.492440	Mean dependent var		-889.5107
Adjusted R-squared	0.461679	S.D. dependent var		93996.02
S.E. of regression	68965.22	Akaike info criterion		25.18435
Sum squared resid	4.71E+11	Schwarz criterion		25.36024
Log likelihood	-1327.770	Hannan-Quinn criter.		25.25564
F-statistic	16.00849	Durbin-Watson stat		1.873226
Prob(F-statistic)	0.000000			

Null Hypothesis: D(SVG) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 4 (Automatic based on SIC, MAXLAG=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.231158	0.0571
Test critical values:	1% level		-4.046925	
	5% level		-3.452764	
	10% level		-3.151911	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(SVG,2)				
Method: Least Squares				
Date: 10/20/15 Time: 11:20				
Sample (adjusted): 1987Q3 2013Q4				
Included observations: 106 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SVG(-1))	-0.304007	0.103716	-2.931158	0.0042
D(SVG(-1),2)	0.169282	0.074760	2.264349	0.0257
D(SVG(-2),2)	0.148082	0.075234	1.968293	0.0518
D(SVG(-3),2)	0.159575	0.074927	2.129726	0.0357
D(SVG(-4),2)	-0.763226	0.079918	-9.550100	0.0000
C	-3.86E+08	3.70E+08	-1.041749	0.3001
@TREND(1986Q1)	12081851	6409801.	1.884903	0.0624
R-squared	0.729578	Mean dependent var		-36226415
Adjusted R-squared	0.713189	S.D. dependent var		3.12E+09
S.E. of regression	1.67E+09	Akaike info criterion		45.37289
Sum squared resid	2.76E+20	Schwarz criterion		45.54878
Log likelihood	-2397.763	Hannan-Quinn criter.		45.44418
F-statistic	44.51570	Durbin-Watson stat		1.871582
Prob(F-statistic)	0.000000			

Null Hypothesis: D(MPT) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic based on SIC, MAXLAG=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.234618	0.0206
Test critical values:	1% level		-3.490772	
	5% level		-2.887909	
	10% level		-2.580908	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(MPT,2)				
Method: Least Squares				
Date: 10/20/15 Time: 11:16				
Sample (adjusted): 1986Q3 2013Q4				
Included observations: 110 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MPT(-1))	-0.182685	0.056478	-3.234618	0.0016
C	14065.80	11343.65	1.239972	0.2177
R-squared	0.088321	Mean dependent var		-1325.430
Adjusted R-squared	0.079880	S.D. dependent var		112590.8
S.E. of regression	108000.4	Akaike info criterion		26.03567
Sum squared resid	1.26E+12	Schwarz criterion		26.08477
Log likelihood	-1429.962	Hannan-Quinn criter.		26.05559
F-statistic	10.46275	Durbin-Watson stat		1.829851
Prob(F-statistic)	0.001617			

Null Hypothesis: INT has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic based on SIC, MAXLAG=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.599642	0.0002
Test critical values:	1% level		-3.490772	
	5% level		-2.887909	
	10% level		-2.580908	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(INT)				
Method: Least Squares				
Date: 10/20/15 Time: 11:12				
Sample (adjusted): 1986Q3 2013Q4				
Included observations: 110 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INT(-1)	-0.105778	0.022997	-4.599642	0.0000
D(INT(-1))	0.728689	0.066002	11.04032	0.0000
C	-0.094039	0.278048	-0.338213	0.7359
R-squared	0.547280	Mean dependent var		-0.023182
Adjusted R-squared	0.538818	S.D. dependent var		4.286379
S.E. of regression	2.910897	Akaike info criterion		5.001694
Sum squared resid	906.6457	Schwarz criterion		5.075343
Log likelihood	-272.0932	Hannan-Quinn criter.		5.031566
F-statistic	64.67453	Durbin-Watson stat		1.951986
Prob(F-statistic)	0.000000			

Null Hypothesis: D(GE) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic based on SIC, MAXLAG=12)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.815724	0.0001
Test critical values:	1% level		-3.490772	
	5% level		-2.887909	
	10% level		-2.580908	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(GE,2)				
Method: Least Squares				
Date: 10/20/15 Time: 11:14				
Sample (adjusted): 1986Q3 2013Q4				
Included observations: 110 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GE(-1))	-0.355224	0.073763	-4.815724	0.0000
C	929.8676	434.7430	2.138891	0.0347
R-squared	0.176774	Mean dependent var		58.84064
Adjusted R-squared	0.169152	S.D. dependent var		4548.800
S.E. of regression	4146.271	Akaike info criterion		19.51582
Sum squared resid	1.86E+09	Schwarz criterion		19.56492
Log likelihood	-1071.370	Hannan-Quinn criter.		19.53574
F-statistic	23.19120	Durbin-Watson stat		2.195325
Prob(F-statistic)	0.000005			

APPENDIX II: CO-INTEGRATION TEST

Date: 10/20/15 Time: 14:41					
Sample (adjusted): 1987Q2 2013Q4					
Included observations: 107 after adjustments					
Trend assumption: Linear deterministic trend					
Series: CE Y SVG REM EXR					
Lags interval (in first differences): 1 to 4					
Unrestricted Cointegration Rank Test (Trace)					
Hypothesized		Trace	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None *	0.695397	220.9319	69.81889	0.0000	
At most 1 *	0.513587	93.73602	47.85613	0.0000	
At most 2	0.090269	16.62146	29.79707	0.6678	
At most 3	0.035524	6.498524	15.49471	0.6366	
At most 4	0.024264	2.628299	3.841466	0.1050	
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level					
* denotes rejection of the hypothesis at the 0.05 level					
**MacKinnon-Haug-Michelis (1999) p-values					
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					
Hypothesized		Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None *	0.695397	127.1959	33.87687	0.0000	
At most 1 *	0.513587	77.11456	27.58434	0.0000	
At most 2	0.090269	10.12293	21.13162	0.7330	
At most 3	0.035524	3.870225	14.26460	0.8728	
At most 4	0.024264	2.628299	3.841466	0.1050	
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level					
* denotes rejection of the hypothesis at the 0.05 level					
**MacKinnon-Haug-Michelis (1999) p-values					
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):					
CE	Y	SVG	REM	EXR	
9.83E-06	-5.57E-07	9.39E-12	0.000412	0.001664	
3.69E-05	-5.20E-07	1.30E-10	0.000163	-0.008462	
-1.56E-05	-5.95E-07	3.65E-10	4.87E-05	0.048359	
-1.06E-05	2.62E-07	-2.52E-11	-0.000344	0.031851	
2.71E-05	-3.94E-07	1.73E-10	-0.000149	-0.031124	

Unrestricted Adjustment Coefficients (alpha):					
D(CE)	4411.361	2686.408	512.0840	-332.8093	-383.4964
D(Y)	-508334.8	164889.6	13558.58	-68836.28	-17033.29
D(SVG)	-8.37E+08	-7.65E+08	4654185.	2.08E+08	-2336697.
D(REM)	-68.50409	260.2652	-1.761778	93.93294	24.71833
D(EXR)	0.335490	0.207424	-0.470193	-0.017089	-0.166859
1 Cointegrating Equation(s):		Log likelihood	-6058.727		
Normalized cointegrating coefficients (standard error in parentheses)					
CE	Y	SVG	REM	EXR	
1.000000	-0.056634	9.56E-07	41.96598	169.3302	
	(0.00667)	(3.1E-06)	(4.05954)	(360.964)	
Adjustment coefficients (standard error in parentheses)					
D(CE)	0.043350				
	(0.00628)				
D(Y)	-4.995352				
	(0.59680)				
D(SVG)	-8228.412				
	(1741.64)				
D(REM)	-0.000673				
	(0.00068)				
D(EXR)	3.30E-06				
	(2.1E-06)				
2 Cointegrating Equation(s):		Log likelihood	-6020.169		
Normalized cointegrating coefficients (standard error in parentheses)					
CE	Y	SVG	REM	EXR	
1.000000	0.000000	4.39E-06	-8.035628	-361.6062	
		(1.0E-06)	(2.11177)	(166.948)	
0.000000	1.000000	6.06E-05	-882.8909	-9374.877	
		(4.2E-05)	(86.2772)	(6820.74)	
Adjustment coefficients (standard error in parentheses)					
D(CE)	0.142465	-0.003853			
	(0.02169)	(0.00043)			
D(Y)	1.088264	0.197082			
	(2.21598)	(0.04423)			
D(SVG)	-36469.16	864.4155			
	(5978.56)	(119.317)			
D(REM)	0.008929	-9.73E-05			
	(0.00241)	(4.8E-05)			
D(EXR)	1.09E-05	-2.95E-07			

	(8.0E-06)	(1.6E-07)			
3 Cointegrating Equation(s):		Log likelihood	-6015.108		
Normalized cointegrating coefficients (standard error in parentheses)					
CE	Y	SVG	REM	EXR	
1.000000	0.000000	0.000000	-2.409377	-708.3222	
			(1.02168)	(157.095)	
0.000000	1.000000	0.000000	-805.1853	-14163.46	
			(38.7277)	(5954.86)	
0.000000	0.000000	1.000000	-1282210.	79015796	
			(187733.)	(2.9E+07)	
Adjustment coefficients (standard error in parentheses)					
D(CE)	0.134454	-0.004158	5.79E-07		
	(0.02333)	(0.00055)	(2.2E-07)		
D(Y)	0.876141	0.189013	2.17E-05		
	(2.39403)	(0.05610)	(2.2E-05)		
D(SVG)	-36541.97	861.6459	-0.105939		
	(6460.96)	(151.389)	(0.06072)		
D(REM)	0.008957	-9.63E-05	3.26E-08		
	(0.00261)	(6.1E-05)	(2.5E-08)		
D(EXR)	1.83E-05	-1.49E-08	-1.41E-10		
	(8.3E-06)	(2.0E-07)	(7.8E-11)		
4 Cointegrating Equation(s):		Log likelihood	-6013.173		
Normalized cointegrating coefficients (standard error in parentheses)					
CE	Y	SVG	REM	EXR	
1.000000	0.000000	0.000000	0.000000	-1087.115	
				(283.146)	
0.000000	1.000000	0.000000	0.000000	-140751.4	
				(81285.4)	
0.000000	0.000000	1.000000	0.000000	-1.23E+08	
				(1.3E+08)	
0.000000	0.000000	0.000000	1.000000	-157.2159	
				(100.560)	
Adjustment coefficients (standard error in parentheses)					
D(CE)	0.137967	-0.004245	5.87E-07	2.396820	
	(0.02404)	(0.00057)	(2.2E-07)	(0.31803)	
D(Y)	1.602775	0.170997	2.34E-05	-158.3854	
	(2.45058)	(0.05763)	(2.2E-05)	(32.4247)	
D(SVG)	-38740.95	916.1683	-0.111180	-541630.0	
	(6599.23)	(155.197)	(0.06021)	(87317.3)	
D(REM)	0.007965	-7.17E-05	3.03E-08	-0.018237	
	(0.00266)	(6.3E-05)	(2.4E-08)	(0.03517)	
D(EXR)	1.85E-05	-1.93E-08	-1.41E-10	0.000155	
	(8.6E-06)	(2.0E-07)	(7.9E-11)	(0.00011)	

Date: 10/20/15 Time: 14:44					
Sample (adjusted): 1987Q2 2013Q4					
Included observations: 107 after adjustments					
Trend assumption: Linear deterministic trend					
Series: INV Y INT REM EXR					
Lags interval (in first differences): 1 to 4					
Unrestricted Cointegration Rank Test (Trace)					
Hypothesized		Trace	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None *	0.899494	334.3316	69.81889	0.0001	
At most 1 *	0.471635	88.49513	47.85613	0.0000	
At most 2	0.133260	20.23263	29.79707	0.4072	
At most 3	0.038860	4.929851	15.49471	0.8162	
At most 4	0.006418	0.688901	3.841466	0.4065	
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level					
* denotes rejection of the hypothesis at the 0.05 level					
**MacKinnon-Haug-Michelis (1999) p-values					
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					
Hypothesized		Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None *	0.899494	245.8365	33.87687	0.0001	
At most 1 *	0.471635	68.26250	27.58434	0.0000	
At most 2	0.133260	15.30278	21.13162	0.2682	
At most 3	0.038860	4.240950	14.26460	0.8331	
At most 4	0.006418	0.688901	3.841466	0.4065	
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level					
* denotes rejection of the hypothesis at the 0.05 level					
**MacKinnon-Haug-Michelis (1999) p-values					
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):					
INV	Y	INT	REM	EXR	
1.29E-06	-4.25E-07	0.002432	0.000212	0.005796	
-5.03E-07	2.61E-07	0.006501	-0.000391	-0.022988	
-7.64E-07	9.14E-08	-0.130935	-2.88E-05	0.018703	
-2.41E-06	1.65E-07	-0.033351	0.000239	-0.024489	
6.23E-06	-4.72E-07	-0.037886	-7.80E-05	0.001904	

Unrestricted Adjustment Coefficients (alpha):					
D(INV)	-7923.140	-48732.59	274.6592	1002.645	443.6070
D(Y)	-883957.7	171321.4	33968.82	-16616.34	3196.916
D(INT)	0.352720	-0.001077	0.857150	0.231895	-0.041556
D(REM)	-17.68404	-285.4046	48.66230	-70.86634	-11.40419
D(EXR)	0.188241	0.041758	0.089328	-0.068509	0.157622
1 Cointegrating Equation(s):		Log likelihood	-4137.384		
Normalized cointegrating coefficients (standard error in parentheses)					
INV	Y	INT	REM	EXR	
1.000000	-0.329425	1882.788	164.4397	4487.864	
	(0.01097)	(3937.77)	(14.1692)	(1048.22)	
Adjustment coefficients (standard error in parentheses)					
D(INV)	-0.010232				
	(0.01000)				
D(Y)	-1.141583				
	(0.05723)				
D(INT)	4.56E-07				
	(3.8E-07)				
D(REM)	-2.28E-05				
	(8.2E-05)				
D(EXR)	2.43E-07				
	(2.8E-07)				
2 Cointegrating Equation(s):		Log likelihood	-4103.252		
Normalized cointegrating coefficients (standard error in parentheses)					
INV	Y	INT	REM	EXR	
1.000000	0.000000	27757.70	-904.5752	-67520.69	
		(56839.0)	(107.478)	(14198.1)	
0.000000	1.000000	78545.63	-3245.091	-218588.5	
		(170677.)	(322.735)	(42634.1)	
Adjustment coefficients (standard error in parentheses)					
D(INV)	0.014299	-0.009332			
	(0.00785)	(0.00282)			
D(Y)	-1.227825	0.420723			
	(0.05576)	(0.02007)			
D(INT)	4.56E-07	-1.50E-07			
	(4.0E-07)	(1.5E-07)			
D(REM)	0.000121	-6.69E-05			
	(7.6E-05)	(2.8E-05)			
D(EXR)	2.22E-07	-6.92E-08			
	(3.0E-07)	(1.1E-07)			

3 Cointegrating Equation(s):		Log likelihood	-4095.601		
Normalized cointegrating coefficients (standard error in parentheses)					
INV	Y	INT	REM	EXR	
1.000000	0.000000	0.000000	-1005.025	-70581.26	
			(118.303)	(14789.7)	
0.000000	1.000000	0.000000	-3529.332	-227248.9	
			(352.586)	(44078.7)	
0.000000	0.000000	1.000000	0.003619	0.110260	
			(0.00075)	(0.09411)	
Adjustment coefficients (standard error in parentheses)					
D(INV)	0.014090	-0.009307	-372.0318		
	(0.00896)	(0.00287)	(742.342)		
D(Y)	-1.253769	0.423827	-5483.330		
	(0.06339)	(0.02032)	(5252.32)		
D(INT)	-1.99E-07	-7.20E-08	-0.111380		
	(4.4E-07)	(1.4E-07)	(0.03611)		
D(REM)	8.37E-05	-6.24E-05	-8.269976		
	(8.7E-05)	(2.8E-05)	(7.19842)		
D(EXR)	1.54E-07	-6.10E-08	-0.010967		
	(3.5E-07)	(1.1E-07)	(0.02862)		
4 Cointegrating Equation(s):		Log likelihood	-4093.481		
Normalized cointegrating coefficients (standard error in parentheses)					
INV	Y	INT	REM	EXR	
1.000000	0.000000	0.000000	0.000000	33631.44	
				(12007.6)	
0.000000	1.000000	0.000000	0.000000	138713.4	
				(44792.6)	
0.000000	0.000000	1.000000	0.000000	-0.264979	
				(0.08257)	
0.000000	0.000000	0.000000	1.000000	103.6917	
				(20.7991)	
Adjustment coefficients (standard error in parentheses)					
D(INV)	0.011675	-0.009141	-405.4714	17.57989	
	(0.01631)	(0.00302)	(765.839)	(2.86120)	
D(Y)	-1.213762	0.421087	-4929.152	-259.5713	
	(0.11530)	(0.02134)	(5414.08)	(20.2272)	
D(INT)	-7.57E-07	-3.38E-08	-0.119114	0.000106	
	(7.9E-07)	(1.5E-07)	(0.03710)	(0.00014)	
D(REM)	0.000254	-7.41E-05	-5.906486	0.089372	
	(0.00016)	(2.9E-05)	(7.35447)	(0.02748)	
D(EXR)	3.19E-07	-7.23E-08	-0.008682	4.73E-06	
	(6.3E-07)	(1.2E-07)	(0.02951)	(0.00011)	

Date: 10/20/15 Time: 14:46				
Sample (adjusted): 1987Q2 2013Q4				
Included observations: 107 after adjustments				
Trend assumption: Linear deterministic trend				
Series: Y CE INV GE XPT MPT REM				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.946451	801.9371	125.6154	0.0001
At most 1 *	0.890588	488.7320	95.75366	0.0001
At most 2 *	0.685656	251.9798	69.81889	0.0000
At most 3 *	0.510543	128.1521	47.85613	0.0000
At most 4 *	0.249042	51.70511	29.79707	0.0000
At most 5 *	0.175635	21.05978	15.49471	0.0065
At most 6	0.003672	0.393639	3.841466	0.5304
Trace test indicates 6 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.946451	313.2050	46.23142	0.0000
At most 1 *	0.890588	236.7523	40.07757	0.0001
At most 2 *	0.685656	123.8276	33.87687	0.0000
At most 3 *	0.510543	76.44701	27.58434	0.0000
At most 4 *	0.249042	30.64533	21.13162	0.0017
At most 5 *	0.175635	20.66614	14.26460	0.0043
At most 6	0.003672	0.393639	3.841466	0.5304
Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
Y	CE	INV	GE	XPT
5.86E-08	6.22E-06	-1.09E-06	3.41E-05	1.33E-06
8.47E-07	9.01E-06	-7.97E-07	-2.67E-06	6.50E-07
3.50E-06	-6.10E-06	-3.53E-06	-5.48E-05	-6.90E-06
-1.35E-06	1.54E-05	8.26E-06	-1.47E-05	-2.56E-06

-9.57E-08	-4.55E-05	1.44E-05	-0.000170	2.94E-06
9.74E-07	1.25E-05	1.02E-05	-0.000145	-3.23E-06
-3.02E-06	8.49E-06	5.41E-06	-0.000116	-6.85E-07
Unrestricted Adjustment Coefficients (alpha):				
D(Y)	466888.8	-542558.4	101651.7	-163185.0
D(CE)	-657.0484	465.5000	-3929.224	-2471.872
D(INV)	35083.34	37846.88	-10824.13	1020.347
D(GE)	-230.1140	2653.476	633.3786	-482.2182
D(XPT)	-2644.377	-1559.445	17756.28	32077.59
D(MPT)	-10337.53	10201.31	4814.425	35604.31
D(REM)	244.6921	99.90900	-133.6810	17.26820
1 Cointegrating Equation(s):		Log likelihood	-8220.016	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	CE	INV	GE	XPT
1.000000	106.2638	-18.63193	582.3397	22.72806
	(23.6620)	(9.06633)	(120.250)	(3.50773)
Adjustment coefficients (standard error in parentheses)				
D(Y)	0.027346			
	(0.00428)			
D(CE)	-3.85E-05			
	(4.5E-05)			
D(INV)	0.002055			
	(0.00031)			
D(GE)	-1.35E-05			
	(2.2E-05)			
D(XPT)	-0.000155			
	(0.00076)			
D(MPT)	-0.000605			
	(0.00044)			
D(REM)	1.43E-05			
	(1.9E-06)			
2 Cointegrating Equation(s):		Log likelihood	-8101.640	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	CE	INV	GE	XPT
1.000000	0.000000	1.026049	-68.26822	-1.674791
		(1.31790)	(17.4875)	(0.47673)
0.000000	1.000000	-0.184992	6.122573	0.229644
		(0.08727)	(1.15800)	(0.03157)

Adjustment coefficients (standard error in parentheses)				
D(Y)	-0.432059	-1.980049		
	(0.03316)	(0.42772)		
D(CE)	0.000356	0.000103		
	(0.00065)	(0.00842)		
D(INV)	0.034101	0.559176		
	(0.00258)	(0.03332)		
D(GE)	0.002233	0.022463		
	(0.00018)	(0.00230)		
D(XPT)	-0.001475	-0.030502		
	(0.01099)	(0.14179)		
D(MPT)	0.008032	0.027526		
	(0.00625)	(0.08059)		
D(REM)	9.89E-05	0.002423		
	(2.6E-05)	(0.00034)		
3 Cointegrating Equation(s):		Log likelihood	-8039.726	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	CE	INV	GE	XPT
1.000000	0.000000	0.000000	-40.73204	-1.630558
			(4.97943)	(0.23217)
0.000000	1.000000	0.000000	1.157918	0.221669
			(0.50878)	(0.02372)
0.000000	0.000000	1.000000	-26.83710	-0.043110
			(4.40273)	(0.20528)
Adjustment coefficients (standard error in parentheses)				
D(Y)	-0.076596	-2.599921	-0.435606	
	(0.13428)	(0.46759)	(0.14096)	
D(CE)	-0.013384	0.024063	0.014207	
	(0.00225)	(0.00784)	(0.00236)	
D(INV)	-0.003749	0.625182	-0.030271	
	(0.01001)	(0.03486)	(0.01051)	
D(GE)	0.004448	0.018601	-0.004098	
	(0.00071)	(0.00247)	(0.00074)	
D(XPT)	0.060616	-0.138779	-0.058508	
	(0.04604)	(0.16031)	(0.04833)	
D(MPT)	0.024868	-0.001832	-0.013834	
	(0.02642)	(0.09200)	(0.02773)	
D(REM)	-0.000369	0.003238	0.000125	
	(9.6E-05)	(0.00033)	(0.00010)	
4 Cointegrating Equation(s):		Log likelihood	-8001.502	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	CE	INV	GE	XPT
1.000000	0.000000	0.000000	0.000000	-3.998637
				(0.35102)

0.000000	1.000000	0.000000	0.000000	0.288988
				(0.03142)
0.000000	0.000000	1.000000	0.000000	-1.603365
				(0.16561)
0.000000	0.000000	0.000000	1.000000	-0.058138
				(0.01158)
Adjustment coefficients (standard error in parentheses)				
D(Y)	0.143333	-5.108897	-1.783879	14.20647
	(0.12431)	(0.64168)	(0.29391)	(2.14446)
D(CE)	-0.010053	-0.013942	-0.006217	0.228222
	(0.00215)	(0.01108)	(0.00507)	(0.03702)
D(INV)	-0.005125	0.640870	-0.021840	1.673957
	(0.01068)	(0.05514)	(0.02526)	(0.18427)
D(GE)	0.005098	0.011187	-0.008083	-0.042546
	(0.00073)	(0.00375)	(0.00172)	(0.01254)
D(XPT)	0.017384	0.354415	0.206524	-1.532597
	(0.04711)	(0.24317)	(0.11138)	(0.81266)
D(MPT)	-0.023117	0.545586	0.280337	-1.168862
	(0.02351)	(0.12136)	(0.05559)	(0.40558)
D(REM)	-0.000392	0.003503	0.000268	0.015154
	(0.00010)	(0.00053)	(0.00024)	(0.00176)
5 Cointegrating Equation(s):		Log likelihood	-7986.180	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	CE	INV	GE	XPT
1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.000000
Adjustment coefficients (standard error in parentheses)				
D(Y)	0.142804	-5.360386	-1.704063	13.26554
	(0.12433)	(1.60418)	(0.55145)	(5.90409)
D(CE)	-0.010008	0.007482	-0.013016	0.308379
	(0.00214)	(0.02757)	(0.00948)	(0.10146)
D(INV)	-0.004396	0.986733	-0.131608	2.967974
	(0.01015)	(0.13099)	(0.04503)	(0.48211)
D(GE)	0.005054	-0.009693	-0.001456	-0.120667
	(0.00070)	(0.00902)	(0.00310)	(0.03319)
D(XPT)	0.015115	-0.723479	0.548619	-5.565445
	(0.04596)	(0.59308)	(0.20388)	(2.18279)
D(MPT)	-0.024424	-0.075351	0.477406	-3.492045
	(0.02274)	(0.29347)	(0.10088)	(1.08009)
D(REM)	-0.000397	0.000985	0.001067	0.005732

	(9.9E-05)	(0.00128)	(0.00044)	(0.00472)
6 Cointegrating Equation(s):		Log likelihood	-7975.847	
Normalized cointegrating coefficients (standard error in parentheses)				
Y	CE	INV	GE	XPT
1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.000000
0.000000	0.000000	0.000000	0.000000	0.000000
Adjustment coefficients (standard error in parentheses)				
D(Y)	0.156869	-5.179487	-1.556219	11.17954
	(0.12809)	(1.65246)	(0.64248)	(7.52064)
D(CE)	-0.011185	-0.007661	-0.025392	0.482999
	(0.00214)	(0.02755)	(0.01071)	(0.12537)
D(INV)	-0.004449	0.986051	-0.132166	2.975842
	(0.01047)	(0.13511)	(0.05253)	(0.61490)
D(GE)	0.005369	-0.005648	0.001850	-0.167313
	(0.00071)	(0.00911)	(0.00354)	(0.04146)
D(XPT)	0.043231	-0.361883	0.844141	-9.735111
	(0.04559)	(0.58814)	(0.22867)	(2.67672)
D(MPT)	-0.025142	-0.084585	0.469859	-3.385566
	(0.02346)	(0.30266)	(0.11767)	(1.37746)
D(REM)	-0.000327	0.001881	0.001799	-0.004594
	(9.7E-05)	(0.00125)	(0.00049)	(0.00571)

APPENDIX III: REGRESSION RESULTS

Table 1a. Regression results

System: LONG_RUN				
Estimation Method: Seemingly Unrelated Regression				
Date: 03/25/16 Time: 03:01				
Sample: 1986Q1 2013Q4				
Included observations: 112				
Total system (unbalanced) observations 334				
Linear estimation after one-step weighting matrix				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	150443.2	6465.353	23.26914	0.0000
C(2)	0.006570	0.002326	2.824688	0.0050
C(3)	0.010579	0.002887	3.664734	0.0003
C(4)	-5.32E-07	3.44E-07	-1.547329	0.1228
C(5)	1299.213	92.98543	13.97222	0.0000
C(6)	2.957193	0.865103	3.418314	0.0007
C(7)	-39575.04	59600.22	-0.664008	0.5072
C(8)	0.060246	0.021335	2.823752	0.0050
C(9)	0.107835	0.025742	4.189098	0.0000
C(10)	-1507.570	2580.198	-0.584285	0.5594
C(11)	62.62413	8.074852	7.755451	0.0000
C(12)	919.1839	847.7900	1.084212	0.2791
C(13)	-3666727.	2717660.	-1.349222	0.1782
C(14)	18.39931	13.02154	1.412990	0.1586
C(15)	3.753766	2.410177	1.557464	0.1204
C(16)	14.93478	37.53799	0.397858	0.6910
C(17)	3.205043	1.018226	3.147675	0.0018
C(18)	-7.500709	1.125966	-6.661579	0.0000
C(19)	1012.055	284.8425	3.553035	0.0004
Determinant residual covariance		2.18E+33		
Equation: CE=C(1)+C(2)*Y+C(3)*Y_1+C(4)*SVG+C(5)*EXR+C(6)*REM				
Observations: 111				
R-squared	0.931711	Mean dependent var		305527.6
Adjusted R-squared	0.928459	S.D. dependent var		130270.1
S.E. of regression	34843.44	Sum squared resid		1.27E+11
Durbin-Watson stat	0.221285			
Equation: INV=C(7)+C(8)*Y+C(9)*Y_1+C(10)*INT+C(11)*REM+C(12)*EXR				
Observations: 111				
R-squared	0.928650	Mean dependent var		897858.9
Adjusted R-squared	0.925253	S.D. dependent var		1188704.
S.E. of regression	324991.3	Sum squared resid		1.11E+13
Durbin-Watson stat	0.220438			

Equation: Y=C(13)+C(14)*CE+C(15)*INV+C(16)*GE+C(17)*XPT+C(18)				
*MPT+C(19)*REM				
Observations: 112				
R-squared	0.894677	Mean dependent var		11401101
Adjusted R-squared	0.888659	S.D. dependent var		16021612
S.E. of regression	5346068.	Sum squared resid		3.00E+15
Durbin-Watson stat	0.228843			

System: SHORT_RUN				
Estimation Method: Seemingly Unrelated Regression				
Sample: 1986Q2 2013Q4 Included observations: 111				
Total system (unbalanced) observations 331				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	5562.488	1096.105	5.074778	0.0000
C(2)	-0.002677	0.000792	-3.381412	0.0008
C(3)	0.000925	0.000902	1.026365	0.3055
C(4)	-2.41E-06	2.54E-07	-9.490110	0.0000
C(5)	379.3819	291.3704	1.302061	0.1939
C(6)	0.630434	0.920087	0.685190	0.4937
C(7)	-0.035321	0.027246	-1.296363	0.1958
C(8)	15678.36	10019.39	1.564802	0.1187
C(9)	-0.008941	0.007513	-1.190016	0.2350
C(10)	-0.000867	0.008565	-0.101242	0.9194
C(11)	748.4660	1959.282	0.382010	0.7027
C(12)	69.49551	8.773727	7.920865	0.0000
C(13)	3669.706	2718.043	1.350128	0.1780
C(14)	-0.061505	0.029937	-0.205604	0.8372
C(15)	1184056.	231890.5	5.106098	0.0000
C(16)	-46.36539	14.82731	-3.127027	0.0019
C(17)	-3.489639	2.546760	-1.370227	0.1716
C(18)	-20.95859	41.98064	-0.499244	0.6180
C(19)	0.419064	1.537500	0.272562	0.7854
C(20)	-1.687421	2.333973	-0.722982	0.4702
C(21)	-26.28547	284.9942	-0.092232	0.9266
C(22)	-0.154638	0.058691	2.634771	0.0088
Determinant residual covariance		1.84E+30		
Equation: D(CE)=C(1)+C(2)*D(Y)+C(3)*D(Y_1)+C(4)*D(SVG)+C(5)*D(EXR)				
+C(6)*D(REM)+C(7)*ECM01_1				
Observations: 110				
R-squared	0.507944	Mean dependent var		2837.245
Adjusted R-squared	0.479280	S.D. dependent var		13312.94
S.E. of regression	9606.743	Sum squared resid		9.51E+09

Durbin-Watson stat	0.382936			
Equation: D(INV)=C(8)+C(9)*D(Y)+C(10)*D(Y_1)+C(11)*D(INT)+C(12)				
*D(REM)+C(13)*D(EXR)+C(14)*ECM02_1				
Observations: 110				
R-squared	0.404398	Mean dependent var		27429.81
Adjusted R-squared	0.369703	S.D. dependent var		113043.8
S.E. of regression	89746.87	Sum squared resid		8.30E+11
Durbin-Watson stat	0.526249			
Equation: D(Y)=C(15)+C(16)*D(CE)+C(17)*D(INV)+C(18)*D(GE)+C(19)				
*D(XPT)+C(20)*D(MPT)+C(21)*D(REM)+C(22)*ECM03_1				
Observations: 111				
R-squared	0.081025	Mean dependent var		764873.9
Adjusted R-squared	0.018570	S.D. dependent var		2140564.
S.E. of regression	2120595.	Sum squared resid		4.63E+14
Durbin-Watson stat	0.275470			

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