MACRO-ECONOMIC AND PUBLIC HEALTH EXPENDITURES IN KENYA

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Abstract
The demographic, people's working lives and habits currently experienced in Kenya dictates that future public health care expenditure will be increasing, both as percentage of GDP and of total government outlays. Furthermore, it is expected to continue growing to the next decade because of the growing ageing populations and growing public expectations on the accessibility and quality of care. In this paper we aimed to understand the trajectory of health expenditure and the factors associated with the growth of total health expenditure in the country. We estimated the determinants of aggregate health care expenditure function for Kenya by applying a co integration test on a time series data from 1980-2012. We linked per capita income, exchange rates and total health personnel in an econometric model, and it was apparent that the per capita income and exchange rates explained the growing health care expenditure in Kenya well.

Key words: Healthcare expenditure, macro-economic, co integration, Kenya

1. **Introduction**

The last 50 years of independence, Kenya has shown improvements in the health infrastructure and its broad health indicators, much as public financing remained unsatisfactory. However, increasingly Kenya is facing pressures on its budgetary allocations especially to social sectors like education and health. The Kenyan health care infrastructure has had also workforce shortages for decades and is not prepared to meet such a vast influx of patients effectively or efficiently. Training new physicians, nurses, and other health professionals take years, and even the few trained disappear through brain drain.

Health care system in Kenya is structured in levels, with complicated cases being referred to a higher level (referral hospitals). Gaps in the system are filled in by private and church run units. The levels are ranked from dispensaries and private clinics, health centres, sub-district hospitals and nursing homes, district hospital and private hospitals, provincial hospitals to National hospitals.

Funding healthcare expenditure in Kenya is from a variety of sources which include government, private sector, international donor agencies and NGOs. These monies are used on curative, preventive and primary and on secondary and tertiary inpatient care, while the remaining go for non-service costs. But the over reliance on donor grants and loans to finance health care has proved hard to sustain and it is inadequate. As such for Kenya to meet international health goals with current levels of health service provision, a massive injection of resources to provide the staff, medical inputs and health centre facilities is needed. At present the health sector is woefully under-staffed with staffing levels substantially below international minimum standards.

Conversely, Healthcare expenditure has serious implications for the welfare of Kenyans and goes a long way in addressing the longstanding challenges in the health sector which range from persisting social and regional inequalities in accessing health care, ageing populations, and rising burdens from chronic diseases. That aside the delivery systems, dominance of the private sector in healthcare, changes in lifestyles and the quick transition from central government to county governments dictates the shaping of healthcare financing in Kenya. That means therefore Healthcare expenditure it is the key to address the obstacles on the way to improving population health. However the Consumer-driven health care approach represented largely by the insurance-sector is the worst approach to health issues in Kenya for it looks more on value of care than saving life, retards health promotion, public health interventions, and the cost-effective use of medical care

on the other hand ,Healthcare expenditure in Kenya faces the challenges emanating from the influences of innovation, education, globalization and economic development which have transformed people's working lives and habits, increased the poverty gap ,increased health service costs, exposed the middle class workers to chronic and self caused diseases and lifestyles due to changing social and environmental conditions. That notwithstanding, high unemployment rate, poverty levels, soaring prices and difficult economic situation have threatened the majority of the poor Kenyans and have dealt severe consequences on their health status.

Subsequently, Public healthcare expenditure depends on how much government allocates to healthcare in a given year through public and private sources. The allocation should be in line with the constitution of Kenya which provides for the right to health care services on the Bill of rights Article 43(1a). Every person has the right to the highest attainable standard of health, and that a person shall not be denied emergency medical treatment. The Right to Equality encompasses within itself the right of a poor patient to quality health care, regardless of their ability to pay. In contrast, the vision of Kenya for health is to provide equitable and affordable health care at the highest possible standards for all citizens.

As such the government abolished and reduced in 2004 user fees at public dispensaries and health centers country-wide, to ksh 10 and ksh 20 respectively. This effort worsened the bad situation and resulted into the dilapidation of medical facilities, poor services and shortage of equipment, poor maintenance and upkeep. It also affected the ratio of qualified doctors to Para-medical and nursing personnel and very severe imbalances between public and private health care, between preventive and curative services, between primary and secondary and tertiary health care services, and between development and recurrent expenditures. As a consequence the society experienced big disparities between the poor and the better-off with respect to access to health care services, and denied poor Kenyans quality health care because health care costs increased instead.

On account of such confusion and high health care costs majority of Kenyans miss access to health care, the poor continue to bear high expenditure on medicines as a result of shortages and misuse of drugs in public health facilities, majority die on the process of raising funds to use on health, and their dead hastened because the consumption of essential items reduced. That notwithstanding, there have emerged chronic diseases ranging from high rates of cardiovascular disease, cancers, diabetes, persistent infectious diseases, like malaria, HIV/AIDS and tuberculosis. This has complicated the worse situation and because the poor can't bear huge burden and cost which are

associated with these diseases, hospital is not their first option to seek health care and as such they are weakened and even die unnoticed.

In Kenya a poor household, checks his account first or sell an asset before deciding which hospital to go. If one does not have any of these then can get assortments of painkillers from the kiosk/unlicensed shop or herbalists and even midwives or wait for natural healing from God. But if it is a case of inpatient and prolonged hospitalization or surgery then the patient would be held in the hospital till the bills are paid by politicians, well wishers, fund raiser, mortgaging or selling assets. On the contrary, the relatively better off Kenyans are benefiting more from public and private hospitals, or seek medical attention outside countries and mostly India.

Of recent public and private hospitals in Kenya are losing out to hospitals in India. Equally the country is losing health expenditure to India and brain drain to other countries. Local public hospitals do not receive many patients who need specialized treatment, because the government stopped to revamp and equip the public hospitals long time ago, their equipments stopped to work for many months and the private hospitals are costlier than going to a hospital in India, besides the services and chance survival. Distinctly like Radiotherapy is available in one public hospital (Kenyatta), and the equipment had not worked for many months. And yet, in spite the inadequate allocation to the sector, majority of Kenyans continue to rely on government facilities to access healthcare. Sadly there is only about 19 per cent of the population having health insurance mainly provided by employers and only about 6.6 million people are covered by 2014 in the formal sector as per the statistics from the National Health Insurance.

As a result, Kenya's total expenditure on health as a percentage of GDP increased from 4.49 % in 2011,to 4.7 % in 2012, and spent 36.25 US$ and 44.6 US$ per capita on health services respectively. On the other hand the health expenditure, public as percentage to GDP was 1.77 percent with the private sector contributing 2.71 percent in 2011 and 1.8% and 2.9% respectively in 2012. Similarly the health expenditure, public as a percentage of total health expenditure decreased from 39.4% in 2011 to 38.1% in 2012. Thus the rapid growth of public spending on health expenditures has become a great concern for both households and the government because it is unsatisfactory. Therefore in this study we focused on government funding by utilizing on the standard demand theory framework and the seminal work of Newhouse (1977) who estimated the relationship between health care expenditure and gross domestic product (GDP).

2. Literature

The literature supporting this study ranges from a seminal paper Newhouse (1977) which raised the question about what determines the quantity of resources any country devotes to medical care to latest works on this topic. Some of the studies that supported our paper include some which used household data and others used aggregated macroeconomic data. Thus we assembled GDP per capita, number of health personnel, share of total health care expenditure to GDP and exchange rates as our variable to test for Kenya.

Among the evidence recited in our study include Theo (1997), Cuyler (1990), Lau (1986) and Hitiris and Posnett (1992) in their studies. They found out that the dependence of health expenditure is on national income. Conversely Gerdtham et al. (1992) used a single cross section data from nineteen OECD countries and found per capita income, urbanization, and the share of public

financing to total health expenditure as positive and significant variables in explaining public expenditure.

On the other hand ,Gbesemete and Gerdtham (1992) used a cross sectional sample of thirty African countries and they concluded that per capita GNP was the most significant factor in explaining per capita health care expenditure. Hitris and Posnett (1992) used 560 pooled time series and cross section observations from 20 OECD countries over the period 1960-1987 and found a strong and positive correlation between per capita health spending and GDP. Similarly, Hansen and King (1996), McKoskey and Selden (1998), Gerdtham and Lothgren (2000), and Karatzas (2000) all agreed that health care expenditure is dependent on GDP of the country.

Kleiman (1974), Newhouse (1977), Leu (1986) and Getzen (2000), identified per capita GDP as a very important factor for explaining differences across countries in the level and growth of total health care expenditures. In the literature from OECD countries, cross-section regressions of aggregate health expenditure per capita on GDP per capita consistently showed income elasticity significantly above one (from about 1.20 to 1.50). Similarly, Musgrove, Zeramdini and Carrin (2002) used cross section data from 191 countries in 1997 and found that income elasticity of health expenditure was between 1.133 and 1.275 depending on the data included. Income elasticity for out of pocket ranged from 0.884 to 1.033 while it was from 1.069 to 1.194 for government health expenditure.

Another study by Farag et al (2009), examining the fungibility of ODA for health and domestic government health expenditure based on panel data from 1995 to 2006 for 144 countries, found that a 1% increase in GDP was associated with 0.66% increase in domestic government health expenditure in low-income countries and 0.96% increase in middle-income countries. Several papers from OECD countries including the ones of Hansen & King (1996); Blomqvist & Carter (1997); Gerdtham & Löthgren (2000); Gerdtham & Löthgren (2002); Okunade & Karakus (2001); Dreger & Reimers (2005), studied the non-stationarity and co integration properties between health care spending and income and estimated the relationship between health expenditure and GDP controlling for non-income determinants and a proxy of technical progress. They concluded that the income elasticity was not greater than one.

However the empirical approaches of Culyer (1990), Hansen and King (1996) in their studies, indicated, that there is no long-run relationship between health care expenditure and GDP. Moreover, Gerdtham and Löthgren (2000) studied 20 OECD countries from 1960 to 1997 using Country-by- Country and panel data analysis in order to ascertain the factors affecting health care expenditure and suggested that health care expenditure and GDP are non-stationary time series and there is co integration between them. Some of the other studies also which examined the stationarity and co integration properties of HEGDP and supported our contention include (MacDonald and Hopkins (2002); McCaskey and Selden, (1998); Hitiris, (1997); Jewell et al., (2003) and Narayan, (2006).

Contrary, Baltagi and Moscone (2010) studied the long-run economic relationship between health expenditure and income in 20 OECD countries over the period 1971–2004, and indicated that health care expenditure and most of its determinants were non-stationary, and therefore co integrated. They showed that health care elasticity with respect to income was about 0.87 which was much smaller than that estimated in other OECD studies. However, Lu et al (2010) who looked at the

effects of official development (ODA) on health spending using data from 1995 to 2006 in low and low middle income countries found out that GDP per capita had no significant relationship with government health expenditure as a share of GDP.

Gerdtham & Jönsson (2000); Gerdtham et al. (1998) realized that the total supply of doctors may have a positive effect on health expenditure .However, Murthy and Okunade (2009) in their study of African countries found no relationship between the density of doctors and health expenditure . Conversely Delattre and Dormont (2005); Murthy and Okunade (2009) defined medical density, as the number of physicians per thousand population and used it to account for the supply of healthcare, and they considered it as cause of the increase in the health expenditures. Similarly, Bac (2004) linked the increase in the number of physicians with growing costs; while others like Gerdtham et al. (1992a), found that an increase in the number of physicians per capita would reduce total spending.

Thus based on these empirical work and theoretical justification we intended to investigate the macro economic and social variables forcing health care expenditure to increase year in year out and try to understand why the Kenyan health expenditure as a percentage of its GDP is so low.

3. Methodology

We examined the dynamics of the macro economic variables by the use of an econometric explanation and a vector that renders a linear combination of the level variables (co integrating vector) based on the standard demand theory framework. As such two tests were carried out: Unit root and Co integration tests. All variables were found to be stationary after first difference and the results confirmed the presence of one co integrating vector. This proved the existence of a long-run relationship between public health care expenditures and the other variables used in the model.

Health expenditure is the dependent variable while independent variables are GDP per capita, medical personnel and exchange rates. The functional model was specified as:

HEGDP = f (GDPP, EXCH, MEDI)

The structural estimation equation was expressed as follows:

$$HEGDP = \beta_0 + \beta_1 GDPP + \beta_2 MEDI + \beta_3 EXCH + \mu$$

HEGDP=Health care expenditure - expenditure incurred by government.
GDPP =Per capita income
EXCH=Exchange rates
MEDI = Medical personnel

Where: β_0 = Intercept
$B_1 - \beta_3$ = coefficients
μ = stochastic term or error term

The variables are in rates except medical personnel so that the regression coefficients directly reflect the elasticity. We therefore employed the multivariate co integration and error-correction

framework to investigate the relationship between health spending, incomes per capita, medical personnel and exchange rates in Kenya.

Total Health expenditure comprises out-of-pocket payments and prepayments. This is the sum of private health expenditures and public as a ratio of total population respectively. It is the major components of national health spending. It covers the preventive and curative, family planning activities, nutrition activities and emergency aid designated for health but excludes water and sanitation. That is to say, it consists of recurrent and capital spending from government budgets, external borrowings and grants both from NGOs, international agencies and social insurance funds. A huge sum consists of Out-Of-Pocket (OOP) payments which refer to the payments made by the patients at the point of receiving services, Prepayments which are contributions made through general taxation, and compulsory and voluntary insurance.
Medical personnel represents the total number of practicing physicians per capita multiplied by population of 100000 and other medical plus laboratory technicians registered in the country.

3.1 Data
Our analysis used annual data on Kenya from 1980 to 2012. We collected information on per-capita total health care expenditure and per-capita income estimated in GDP purchasing power parity, and expressed in US Dollars from World Bank. Data on, number of physicians and real exchange rates were taken from the Kenya bureau of statistics, World Bank Development Indicators (WDI), and African Development Bank's databases.

3.2 Testing stationarity.
Since we were using time series data, the non-stationarity of the series could pose problems. Therefore, we first checked whether our variables were non-stationary; if so then estimate the elasticities controlling for a set of regressors and for unobserved common factors and finally, we tested whether our variables formed a co integrating set and if so then they were linked in the long-run.
Granger and Newbold (1974) and Phillips (1986), stated that regression results may be spurious if the variables are non-stationary. Therefore to avoid this, we determined the order of integration for each series by applying the Augmented Dickey-Fuller (ADF) and Phillips- Perron (PP) unit root tests. The PP test suggested that all the variables are integrated of order 1 (1) process. Hallam and Zaloni (1993) and Obben (1998) noted that if the ADF and PP results are inconsistent, the results of PP test is preferred because it is more powerful than the ADF test in particular when the estimates sample is small.
Thus the Augmented Dickey-Fuller (ADF) test was done using this reduced form model using ordinary least squares.

$$Y_t = \mu + Á_1 Y_{t-1} + Á_2 Y_{t-2} + ----Á_p Y_{t-p} + \varepsilon t$$

Table 1 present the results of the ADF tests. The order of integration was tested at 1% significance level and the critical values obtained from Mackinnon (1991) Tables.

Table 1

Exogenous variables	ADF test statistics	t-statistics at 1%	5%	R2	Prob F-statistics	
D(HEPGDP)	-9.005186	-3.661616	-2.960411	0.736589	0.000000	
D(EXCH)	-6.127502	-3.661661	-2.960411	0.564221	0.000000	
D(GDPP)	-4.648959	-4.309824	-3.574244	0.534082	0.000007	
D(MEDI)	-5.113786	-4.296729	-3.568379	0.545034	0.000014	
U(-1)	-5.667551 At levels	-3.679332	-2.967767	0.565243	0.000003	

These results were consistent to the assertion that most of the macroeconomics time series are non-stationary at level, but stationary after first differencing (Nelson and Plosser, 1982). Then, we proceeded to examine the presence of long-run equilibrium relationship through the multivariate Johansen-Juselius co integration test between health spending and its determinants. The Johansen-Juselius co integration approach can be applied within the vector error-correction model (VECM) but first we checked to establish the lag length. We had to determine the lag structure in the VECM system because too few lags may lead to serial correlation problem, whereas too many lags will consume more degree of freedoms and may lead to small sample problem (Hall, 1991).

3.3 Lag structure

In order to find the optimal length of the variables, several lag selection criteria, such as the Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), Hannan–Quinn Criterion (HQ), SBC, LR and FPE were used. A part from FPE and LR all those other criteria reported a maximum of 4 lags for the multivariate Johansen-Juselius co integration test as shown in Table 2.

Table 2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-647.3787	NA	3.80e+14	44.92267	45.11126	44.98174
1	-537.4982	181.8712	5.94e+11	38.44815	39.39112*	38.74348
2	-517.3787	27.75103*	4.80e+11	38.16405	39.86138	38.69563
3	-494.4981	25.24764	3.61e+11	37.68952	40.14122	38.45736
4	-463.7782	25.42329	1.97e+11*	36.67436*	39.88043	37.67846*

Now that the variables contemplated in the model followed the 1(1) process, we proceeded to estimate the long run equilibrium equation using OLS. But first an ADF test was done on the residual of the long run equation to determine if the variables in question were co integrated (whether the error term follows a stationary process). We then combined the error term with the first differenced variables to estimate the final model (ECM)-short run. It helped to show the deviations from equilibrium position and how an adjustment towards the equilibrium is made by combining both long run and short run version of the model in one regression. The coefficient of the error correction model was significant and negative. That the speed of adjustment towards long run recorded 28.3%. This long-run equilibrium relationship among the dependent and the independent variables implied that the residuals from the co integrating regression can be used by an error correction term, to explain the system's short-run dynamics.

3.4 Co integration test

To determine the number of co integrating equations we did the maximum Eigen - value tests and trace tests to ascertain the number of co integrating vectors. Trace tests indicated one co integrating equations while maximum Eigen - value tests recorded also one co integration at 0.05 levels. Therefore our coin grating equation was derived from this equation.

$$y_t = \beta_0 + \beta_1 y_{t-1} + ...+ \beta_k y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + ... + \alpha_q x_{t-q} + \varepsilon_t$$

4. Findings:

Results from this study were consistent with previous studies, which showed that when GDPP increased, health expenditure in general increases. We also found that per capita as a share of GDP had a positive association with health expenditure. The co integrating equation was found to be as:

HEGDP=0.164609 +0.007764(GDPP) +0.058235(EXCH) - 7.20005(MEDI)
(2.634664) (3.348404) (-2.15963)

The GDPP variable exerts statistically significant and positive effects on health care. The empirical results are robust and satisfactory as shown in appendix table 13. The regression had a coefficient of determination of about 54% adjusted for the degrees of freedom and an F-statics of less than 5%. This means that about 54% of the variations in public health spending in Kenya could be attributed to the explanatory variables presented and therefore presents a good fit of the regression model. This reinforces the existence of a long-run linear relationship among public health spending, real GDP, exchange rates and number of personnel. The income elasticity of public health care expenditures is estimated at 0.78 percent.

The GDPP variable exerts statistically significant and positive effects on health care at 0.78 percent. As this value is less than unity it suggests that, contrary to most of the Organization for Economic Co-operation and Development (OECD) countries, health care in Kenya qualifies as a necessity. The analysis also suggests that elasticity of health expenditure when GDP changes by one unit is only 0.78 percent, which suggest that for every one percent increase in GDP, 0.78 of that, go to public healthcare expenditure. The empirical results indicated that per-capita GDP resources are central part and significantly correlated with HEGDP. Our empirical results suggest that health care in Kenya is technically, a necessity rather than a luxury good and GDP is considered to be one of the main factors behind evolution in health care spending. The increase in wealth in the country allows people to demand more health care in order to live longer and maintain themselves as well as their standards. This leads to increase in public health expenditure and that is why GDPP is positive.

The finding of a positive effect of real exchange rates on HEGDP could suggest that it affects the external resource inflows causing impacts on HEGDP to go up. An appreciated exchange rate increases the prices of pharmaceuticals, professionals, laboratory and scientific instruments. This is one of the reasons as to why medicine is costlier in Kenya. It can also have strong effects on current account balances. This effect occurs through a reduction of savings and even Real export growth may slow down, while imports remain by and large unaffected .The positive exchange rates can as well have powerful effects on the macro-economy affecting variables such as the demand for exports and imports; real GDP growth, inflation, businesses and jobs.

Based on our findings, the sign of the coefficient on the medical density is negative but significant. Our results showed a negative sign reflecting the low supply of services which in turn will contribute to higher health costs deaths. The per capita health care spending is expected to fall as the number of people per physician falls. A reduction in 1% of medical personnel leads to a decrease of health expenditure by US$ 7200 annually. This concurs with Gerdtham et al. (1992a), who found that an increase in the number of physicians per capita would reduce total spending. Medical density is an indicator of Health Care supply and a decreased physician density increases the average rate of personal profit as well as private hospitals. In Kenya it is defined by physicians as per hundred thousand populations and is used to account for the supply of healthcare. It can be considered a cause of the increase in the health expenditures (Delattre and Dormont, 2005; Murthy and Okunade 2009). We also noticed that, except for the medical density, all the variables were statistically significant and positive to determine total health expenditures.

The per capita health care spending is expected to fall as the number of people per physician falls. Thus this paper provides suggestions that per capita GDP of the country is not the single most important factor affecting health expenditures also medical density and exchange rates which affect the prices of pharmaceuticals imported. However the distribution of income in Kenya indicated to be a serious independent determinant of population health signifying that inequality in the distribution of income matters a lot and is more likely to have greater numbers of people pushed into poverty. This also confirms the findings that increases in real GDP tend to raise public expenditure in the long run. Thus as Kenya's real GDP rises, it has the potential to spend extra more on the health sector of the economy. However, the very low elasticity suggests that Kenya tends to spend a small portion of her income on healthcare.

5. Conclusion

The results also showed that health care is a necessity rather than a luxury in Kenya, with an elasticity of 0.78 percent. This then should suggest the government to start to avoid overdependence on private sector growth and instead reduce private health expenditures, revamp the existing facilities in the health sector, improve quality, ensure regular attendance by medical staff, equip and maintain the existing institution. These reforms also should focus not only on public health sector only but also in private sector to eliminate untrained and unqualified private medical practitioners mushrooming in rural areas causing unnecessary deaths.

At the same time, the government should work on the ratio of qualified doctors to Para-medical and nursing personnel which is lop-sided. It should also strive to reduce wasteful and inappropriate care in the hospital, dispensaries, health ministry offices and exorbitant charges in private hospitals and clinics.

Pharmaceuticals and medicinal are major imports to Kenya. That is why our results indicated a correlation between health expenditure and exchange rates. Most of these products are of dubious value, fake or counterfeit. These drugs are purchased by insurance companies, health maintenance organizations, government agencies, and other players and the prices charged are often much lower than they sell making them inaccessible to majority poor. As such they have caused many unnecessary deaths, disabilities and injuries to patients, but also greatly contribute to the high cost of public healthcare.

Goodness, healthcare now in Kenya is a County subject and County government policies would have important bearing on the public health expenditures in the country. This is so because the County governments are run by different political parties and competition among them could make the performances of individual counties a matter of high political and electoral interest.
However in the long run, the overall economic health of the country is going to be the most important constraint on fiscal policy, but as well an immensely complicated problem. Equally private spending is going to worsen and as such poverty will continue stuck to the sick.

Thus health care now in Kenya remains a political decision and an election gimmick as health care expenditures continue to impede private-sector growth as well. At the same time, Health insurance in the country has made most people less concerned and ignorant about the cost of care because of the medical covers. This has complicated health care for the poor and aging in the country. Those with the most serious health problems have been driven poor and those who are too ill or too overwhelmed are left to shop around for a better deal, go to India, check herbalists or wait to die.

Therefore the study established that, there is strong evidence that national income, exchange rate and number of medical personnel are the key determinants of public health spending, and that healthcare is a necessity but not a luxury commodity. As a necessity, much effort should be made by government to make it available to all irrespective of location, age, gender, religion or tribe, social or economic status of the individual.

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APPENDIX 1

Dependent Variable: H_EXP_GDP
Method: Least Squares

Sample: 1980 2012
Included observations: 33

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPP	0.007764	0.002947	2.634664	0.0134
EXCHANGE	0.058235	0.017392	3.348404	0.0023
MEDI_PSN	-7.20E-05	3.41E-05	-2.113365	0.0433
C	0.504003	0.593156	0.849696	0.4025

R-squared	0.537973	Mean dependent var	3.356364
Adjusted R-squared	0.490177	S.D. dependent var	1.505083
S.E. of regression	1.074657	Akaike info criterion	3.095093
Sum squared resid	33.49176	Schwarz criterion	3.276488
Log likelihood	-47.06904	Hannan-Quinn criter.	3.156127
F-statistic	11.25563	Durbin-Watson stat	2.034337
Prob(F-statistic)	0.000046		

APPENDIX 2

Sample (adjusted): 1983 2012
Included observations: 30 after adjustments
Trend assumption: Linear deterministic trend
Series: H_EXP_GDP GDPP EXCHANGE MEDI_PSN
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.736368	66.43079	47.85613	0.0004
At most 1	0.481567	26.43470	29.79707	0.1162
At most 2	0.198836	6.726365	15.49471	0.6097
At most 3	0.002519	0.075660	3.841466	0.7833

Trace test indicates 1 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 No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.736368	39.99608	27.58434	0.0008
At most 1	0.481567	19.70834	21.13162	0.0781
At most 2	0.198836	6.650705	14.26460	0.5312
At most 3	0.002519	0.075660	3.841466	0.7833

Max-eigenvalue test indicates 1 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):

H_EXP_GDP	GDPP	EXCHANGE	MEDI_PSN
-1.172339	0.023904	0.093368	-0.000164
-1.582879	-0.011997	0.054053	8.60E-05
1.102707	-0.012929	-0.102026	0.000222
0.252030	-0.013051	-0.144650	0.000242

Unrestricted Adjustment Coefficients (alpha):

D(H_EXP_GDP)	0.152332	0.408395	-0.155846	-0.029089
D(GDPP)	7.363225	16.48086	7.692678	-0.998876
D(EXCHANGE)	-0.278989	0.020432	-1.159088	0.269871
D(MEDI_PSN)	1822.632	-884.6218	56.74905	15.12400

1 Cointegrating Equation(s): Log likelihood -524.6706

Normalized cointegrating coefficients (standard error in parentheses)

H_EXP_GDP	GDPP	EXCHANGE	MEDI_PSN
1.000000	-0.020390	-0.079642	0.000140
	(0.00345)	(0.01616)	(3.9E-05)

Adjustment coefficients (standard error in parentheses)

D(H_EXP_GDP)	-0.178584		
	(0.23633)		
D(GDPP)	-8.632193		
	(9.36836)		
D(EXCHANGE)	0.327070		
	(1.56629)		
D(MEDI_PSN)	-2136.742		
	(448.054)		

2 Cointegrating Equation(s): Log likelihood -514.8164

Normalized cointegrating coefficients (standard error in parentheses)

H_EXP_GDP	GDPP	EXCHANGE	MEDI_PSN
1.000000	0.000000	-0.046477	-1.78E-06
		(0.01118)	(1.8E-05)
0.000000	1.000000	1.626586	-0.006935
		(0.66724)	(0.00107)

Adjustment coefficients (standard error in parentheses)

D(H_EXP_GDP)	-0.825025	-0.001258	
	(0.35399)	(0.00481)	
D(GDPP)	-34.71940	-0.021716	
	(13.9668)	(0.18964)	
D(EXCHANGE)	0.294728	-0.006914	
	(2.63163)	(0.03573)	
D(MEDI_PSN)	-736.4930	54.18024	
	(644.138)	(8.74614)	

3 Cointegrating Equation(s): Log likelihood -511.4911

Normalized cointegrating coefficients (standard error in parentheses)

H_EXP_GDP	GDPP	EXCHANGE	MEDI_PSN
1.000000	0.000000	0.000000	-0.000211
			(5.9E-05)
0.000000	1.000000	0.000000	0.000397
			(0.00206)
0.000000	0.000000	1.000000	-0.004508
			(0.00122)

Adjustment coefficients (standard error in parentheses)

D(H_EXP_GDP)	-0.996877	0.000757	0.052198	
	(0.39799)	(0.00524)	(0.02618)	
D(GDPP)	-26.23663	-0.121177	0.793473	
	(15.5284)	(0.20435)	(1.02143)	
D(EXCHANGE)	-0.983407	0.008072	0.093313	
	(2.95865)	(0.03893)	(0.19461)	
D(MEDI_PSN)	-673.9154	53.44651	116.5688	
	(737.650)	(9.70719)	(48.5212)	

APPENDIX 4

Dependent Variable: D(H_EXP_GDP)
Method: Least Squares

Sample (adjusted): 1983 2012
Included observations: 30 after adjustments
D(H_EXP_GDP) = C(1)*(H_EXP_GDP(-1) - 0.0203895998494*GDPP(-1) - 0.0796422435611*EXCHANGE(-1) + 0.000139629852489 *MEDI_PSN(-1) + 2.90232907787) + C(2)*D(H_EXP_GDP(-1)) + C(3) *D(H_EXP_GDP(-2)) + C(4)*D(GDPP(-1)) + C(5)*D(GDPP(-2)) + C(6) *D(EXCHANGE(-1)) + C(7)*D(EXCHANGE(-2)) + C(8)*D(MEDI_PSN(-1)) + C(9)*D(MEDI_PSN(-2)) + C(10)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.178584	0.236328	-0.755663	0.4587
C(2)	-0.565328	0.306145	-1.846603	0.0797
C(3)	0.111522	0.218162	0.511190	0.6148
C(4)	0.009326	0.008966	1.040224	0.3106
C(5)	-0.009480	0.007902	-1.199747	0.2443
C(6)	0.070982	0.047073	1.507907	0.1472
C(7)	0.087979	0.056176	1.566135	0.1330
C(8)	8.38E-05	7.70E-05	1.088478	0.2893
C(9)	-0.000122	6.85E-05	-1.787067	0.0891
C(10)	-0.159496	0.406920	-0.391959	0.6992

R-squared	0.560859	Mean dependent var	0.113333
Adjusted R-squared	0.363246	S.D. dependent var	1.383684
S.E. of regression	1.104137	Akaike info criterion	3.297206
Sum squared resid	24.38236	Schwarz criterion	3.764272
Log likelihood	-39.45809	Hannan-Quinn criter.	3.446625
F-statistic	2.838163	Durbin-Watson stat	2.414036
Prob(F-statistic)	0.024938		

APPENDIX 5

Null Hypothesis: U has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.667551	0.0001
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

APPENDIX 6

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(U)
Method: Least Squares

Sample (adjusted): 1984 2012
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U(-1)	-1.084878	0.191419	-5.667551	0.0000
C	0.011123	0.118755	0.093666	0.9261

R-squared	0.543311	Mean dependent var	0.002418
Adjusted R-squared	0.526396	S.D. dependent var	0.929196
S.E. of regression	0.639463	Akaike info criterion	2.010095
Sum squared resid	11.04063	Schwarz criterion	2.104391
Log likelihood	-27.14637	Hannan-Quinn criter.	2.039627
F-statistic	32.12114	Durbin-Watson stat	2.010664
Prob(F-statistic)	0.000005		

APPENDIX 7

Null Hypothesis: D(EXCHANGE) has a unit root

Exogenous: Constant

		t-Statistic
Augmented Dickey-Fuller test statistic		-6.127540
Test critical values:	1% level	-3.661661
	5% level	-2.960411
	10% level	-2.619160

*MacKinnon (1996) one-sided p-values.

APPENDIX 8

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXCHANGE,2)
Method: Least Squares

Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic
D(EXCHANGE(-1))	-1.180094	0.192589	-6.127540
C	2.945554	1.338781	2.200176

R-squared	0.564216	Mean dependent var	
Adjusted R-squared	0.549189	S.D. dependent var	
S.E. of regression	6.827918	Akaike info criterion	
Sum squared resid	1351.994	Schwarz criterion	
Log likelihood	-102.5050	Hannan-Quinn criter.	
F-statistic	37.54675	Durbin-Watson stat	
Prob(F-statistic)	0.000001		

APPENDIX 9

Null Hypothesis: D(H_EXP_GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.005186	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

APPENDIX 10

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(H_EXP_GDP,2)
Method: Least Squares

Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(H_EXP_GDP(-1))	-1.451021	0.161132	-9.005186	0.0000
C	0.060829	0.226082	0.269057	0.7898

R-squared	0.736587	Mean dependent var	0.051935
Adjusted R-squared	0.727504	S.D. dependent var	2.411358
S.E. of regression	1.258757	Akaike info criterion	3.360467
Sum squared resid	45.94959	Schwarz criterion	3.452982
Log likelihood	-50.08724	Hannan-Quinn criter.	3.390625
F-statistic	81.09338	Durbin-Watson stat	2.121829
Prob(F-statistic)	0.000000		

APPENDIX 11

Null Hypothesis: D(MEDI_PSN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.113786	0.0014
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

APPENDIX 12

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MEDI_PSN,2)
Method: Least Squares

Sample (adjusted): 1983 2012
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MEDI_PSN(-1))	-1.346813	0.263369	-5.113786	0.0000
D(MEDI_PSN(-1),2)	0.443696	0.218260	2.032877	0.0524
C	-37.54019	1463.063	-0.025659	0.9797
@TREND(1980)	215.8437	84.60793	2.551105	0.0170

R-squared	0.545034	Mean dependent var	267.6333
Adjusted R-squared	0.492538	S.D. dependent var	4968.615
S.E. of regression	3539.459	Akaike info criterion	19.30490
Sum squared resid	3.26E+08	Schwarz criterion	19.49173
Log likelihood	-285.5735	Hannan-Quinn criter.	19.36467
F-statistic	10.38240	Durbin-Watson stat	1.823914
Prob(F-statistic)	0.000114		

APPENDIX 13

Dependent Variable: H_EXP_GDP
Method: Least Squares

Sample (adjusted): 1984 2012
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.839030	0.616195	1.361630	0.1860
GDPP	0.006463	0.003700	1.746616	0.0935
EXCHANGE	0.050979	0.018045	2.825122	0.0094
MEDI_PSN	-5.87E-05	4.11E-05	-1.427325	0.1664
U(-1)	-0.283337	0.327123	-0.866149	0.3950

R-squared	0.535126	Mean dependent var	3.508966
Adjusted R-squared	0.457647	S.D. dependent var	1.456111
S.E. of regression	1.072347	Akaike info criterion	3.133162
Sum squared resid	27.59827	Schwarz criterion	3.368903
Log likelihood	-40.43085	Hannan-Quinn criter.	3.206993
F-statistic	6.906735	Durbin-Watson stat	1.975090
Prob(F-statistic)	0.000756		