Determinants of inflation in Namibia: A co-integration approach

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The paper aims to examine the determinants of inflation in Namibia for the period 1993–2013. It was necessitated by the recent increase in consumer prices as world economies remain volatile. Moreover, theoretical and empirical predictions are not without ambiguities on the determinants of inflation in any given economy. The paper employed a co-integration technique to assess the determinants of inflation in Namibia. Empirical results suggest that inflation was mainly driven by imports and government spending for the period under review. Policy implications emanating from the study suggest that the country is vulnerable to external price changes from the markets whence its imports come from, especially those from South Africa. Also, the significance of government expenditure postulates that the Namibian government should reconsider its excessive spending (budget deficit) on the economy.

Introduction

As Namibia is striving to become an industrialised nation by the year 2030 (Vision 2030), it is vital to ensure that solutions that could lead to stabilisation in the general price level of goods and services are brought to light so as to achieve a high economic growth whilst maintaining a low inflation (Odada & Eita 2010). Moreover, Odada and Eita argued that the high rate of economic growth and macroeconomic stability can only be achieved in the presence of steady prices. Inflation, as defined by Pahlvani and Rahimi (2009), is 'a constant sustained rise in the general price level, as measured by the consumer price index' and may become a threat to economic growth because it diminishes the purchasing power of money for goods and services of the Namibian population. This fall in purchasing power may in the process prevent the poorest from affording their basic necessities. Therefore, combating high inflation rate becomes a primary objective incumbent upon the monetary authority in every country in order to maintain a healthier economy, and as such, the causes and determinants of inflation must be identified and monitored. Inflation can be easily curbed when the causes are clearly known (Pahlvani & Rahimi 2009). Two studies (Odada & Eita 2010; Ogbokor & Sunde 2011) emphasised the fact that Namibia is a member of a *unified market*: the Southern Africa Custom Union (SACU), other members being South Africa, Botswana, Lesotho and Swaziland. Apart from this fact, it is also a member of a Common Monetary Area (CMA) with its currency pegged to the South African rand on a one-on-one basis and imports more than 80% of its goods (mainly food) from SACU.

Additionally, Odada and Eita (2010) noted that Namibia had not experienced very high levels of inflation since 1980. Their studies also revealed that for the period 1980–1989, average inflation was 12.97%, with the highest level being 15.2% in 1982 and the lowest being 9.1% in 1984. From 1990–2007, average inflation was 8.8%, with the highest level being 17.7 in 1992 (drought year) and the lowest level being 2.3% in 2005. In the same streak, average inflation for the period 1980–2007 was 10.29%, with the highest level being 17.7% in 1992 and the lowest level being 2.3% in 2005. From 1980–2007, the inflation rate trend has been downward in Namibia, meaning that both studies concurred that policy makers and planners have reasonably been successful in dealing with the problem of inflation over the 1990s period. Economists hold conflicting theories with regards to inflation; nonetheless, there are two main types of inflation, namely, the demand–pull inflation and the cost–push inflation. Demand–pull inflation is the inflation emanating from the demand side, for instance, a constant increase in the growth of money supply, increase in government expenditure within the domestic economy, increase in foreign debts and so on. When this happens, there is a mismatch in the equivalent quantity of supply, and producers respond by increasing the general price levels of goods and services, which will consequently result in what we call inflation (Khai 2011).

The cost–push inflation, also known as supply–push inflation, happens because of increases in the cost of production of raw materials, that is an increase of price of input units, rising wages because of trade union activities, and so on (Khai 2011; Olatunji *et al*. 2010). Economic theories postulate that

Economic Integration between member countries such as SACU as well as the CMA helps to decrease the prices of goods and services because the imports of goods within these member countries is duty free. Nevertheless, in reality, this has not been the case in Namibia, because recently the general price levels have been increasing and hence the necessity of the study on the determinants of inflation.

Moreover, because the Bank of Namibia (BoN) framework acts as a *Currency Board* (a monetary authority that issues notes and coins fully convertible into a pegged currency at a fixed rate and on demand), the supply of money by BoN is not expected to create inflation in Namibia. It is for this reason that the study is critical as it attempts to prove if indeed these assumptions in monetary economics can hold true. There is a positive relationship between the growth of money supply (a rise in the act of issuing of notes and coins) and inflation (prices) as postulated by the classical economists. It is upon the basis of this belief that controlling the growth of money is vital for a healthier economy that will attract investors in the country. Thus, it is the responsibility of the BoN to ensure that the annual growth rate of money supply is not so excessive that it causes inflation and erodes the value of money.

Another gap that the study attempts to tackle is the inclusion of government spending on the consumption of goods and services plus how it impacts price levels in the domestic economy. The main reason for the inclusion of this variable is because the Namibian government has been pursuing an expansionary budget deficit for sometimes now, except in 2006, which rises government expenditure. It is expected that as government expenditure increases, price levels of agricultural goods especially begin to rise too. This causes Namibian produce to become less competitive in the global market as compared to the other international produces. As a result, domestic industries which rely on trade with other economies will be at risk of collapsing (Ogbokor & Sunde 2011). Inflation could pose an adverse and profound impact upon the quality of lives, especially the most poor because of prevailing increases in the general price level of goods and services. It therefore becomes the responsibility of the government to ensure that any variables that could be interplaying in the process of diminishing the purchasing power are closely monitored. Therefore, the study will attempt to shade some insights on the causes/determinants of inflation in Namibia, especially during the period of worldwide financial instability.

The objective of the study

The general objective of the research study is to examine the effect of some macroeconomic variables, namely, money supply, imports and government expenditure on the level of inflation in Namibia. In quest of the study, the paper tries to achieve three main specific objectives as stated below:

1. To investigate the relationship between money supply and inflation
2. To examine the relationship between government spending and inflation
3. To evaluate the relationship between imports and inflation.

Literature review
Theoretical literature

Theoretical literature on the determinants of inflation is filled with contradictory views with regards to the causes of inflation. Below are the theoretical explanations as postulated by various economists:

The demand–pull inflation: Demand–pull inflation exists when the aggregate demand of goods and services from the consumers' side exceeds the aggregate supply (output) when the economy is at or close to full employment. The excess demand can be a resultant of either the rise in real GDP or the monetary sector of the economy, which is described as 'too much money chasing too few goods'. The main sources of demand–pull inflation are increases in government spending, increase in money supply and rise in household and firms consumption (Ogbokor & Sunde 2011).

The cost–push inflation: Cost–push inflation exists when wages or production costs start rising. The producers in turn pass these rising costs upon the consumers, leading to higher prices. Ogbokor and Sunde (2011) noted that this kind of inflation occurred mainly because of a rise in the cost of imported raw materials and an increase in the cost of labour.

The Monetarists' view: Monetarists' economists argue that there is a direct relationship between price and money supply. They believe that 'inflation is always and everywhere a monetary phenomenon'; hence, prices are likely to increase when the rate of inflation in money supply is greater than the rate of increase in real output of goods and services (Johnson 1973 cited in Olatunji *et al*. 2010). In addition, Goamab (1998) noted that such a situation (where any extra cash balances is spent on the acquisition of assets) will give rise to excess demand for assets, which will ultimately lead to increases in the general price level, thereby leading to a rise in inflation.

The Keynesians's views: The Keynesians tend to attribute inflation more to demand pressures within the economy. It is not necessarily a monetary phenomenon as opposed by the Monetarists' economy (Goamab 1998; Ogbokor & Sunde 2011). Furthermore, they believe that inflation is caused by movements in the rate of interest, which is in contrast to the Monetaristic view, which claims that inflation is caused by money supply.

The Structuralists' view: Structuralist economists stressed the significance of demand pressures, cost pressures and business cycles within an economy as the core causes of inflation. Structural inflation, as asserted by Conavese (1982) cited in Odada and Eita (2010), originates from three inter-related phenomena, namely, changes in economic structures which causes changes in relative prices, some money prices (especially wages) are inflationary (or rigid) downwards and an induced growth in money supply occurs to accommodate the resulting increases in the general price level.

Empirical literature

The section analyses the empirical works that have been conducted in the area of inflation in Namibia as well as other studies in various countries. The aim is to establish evidence of the existence of this phenomenon in these countries and to verify whether the theories analysed in the theoretical literature do hold true.

Empirical studies on Namibia's inflation: Goamab (1998) conducted a study on inflation in Namibia using data covering the period 1974–1996. The study applied a combination of econometric techniques, namely, co-integration (CI), error correction modelling (ECM) and structural stability testing. The CI method was used to capture potential information about the long-term equilibrium relationship of the model, whereas the ECM was used to evaluate the short-term adjustments in the model and structural stability testing was used to analyse the behaviour of inflation function in Namibia. The study shows that Namibia's inflation is highly affected both in the short-run as well as in the long-run by external factors. A study was conducted by Odada and Eita (2010) to establish the possible causes of inflation in Namibia. They used annual time series data covering the period 1972–2008. The Augmented Dickey–Fuller (ADF) unit root and CI tests were carried out. The results revealed that money supply and imports have a positive impact on inflation. Also, Ogbokor and Sunde (2011) utilised ordinary least squares (OLS) estimation techniques to analyse and test the hypothesis as to whether inflation is mainly driven by imports using annual macroeconomic data from 1980–2007. They found out that amongst other variables, imports and money supply played a significant role in explaining inflation in Namibia.

Empirical studies on other countries' inflation: Olatunji *et al.* (2010) did a study for AAAE and AEASA in Nigeria. Time series data were employed using descriptive statistics and CI analysis tools. They concluded that total imports, government expenditure and money supply exert a positive effect on inflation, especially on food prices. In the same view, Arif and Ali (2012) utilised Johanse–Juselius CI method and the ECM to test for both long-run property of the model and short-run determination in Bangladesh. The study employed data from 1978–2010. They concluded that there was a positive relationship between money supply, government expenditure and imports on inflation in the long-run. On the other hand, there are other studies that have been carried out that found an inverse relationship between the independent variables (imports, government expenditure and money supply) and inflation. Ali and Mim (2011) did a study on the drivers of inflation in eight MENA countries by using annual data from 1980–2009. The study applied estimation techniques, namely, system of Generalised Method of Moments. They concluded that there was a negative relationship between money supply growths and government spending against inflation.

In the study by Sola and Peter (2013), the Nigeria Autoregressive model was used covering secondary data ranging from 1970–2008. The results revealed money supply to be positively related to inflation, but government expenditure had an inverse relationship. Also, Adusei (2013) carried out a study on South Africa using time series data starting from 1965–2006 to investigate whether inflation in South Africa is a structural or a monetary phenomenon. Unit root testing, CI analysis, fully modified ordinary least squares, two-stage least squares regression, ECM and pairwise Granger Causality test techniques were conducted. The study disclosed that, amongst other, there was an inverse relationship amongst broad money supply, openness of the South African economy and government expenditure with inflation. Based on the aforementioned literatures, one can firmly say the following: there are mixed findings with regards to the causes of inflation ranging from those refuting and agreeing (or no relationship at all). There are also significant methodological approaches, be it a cross–country study or an individual country study. There is variation in terms of data frequency utilised ranging from monthly, quarterly and annually. There seems to be no study in Namibia that has attempted to study the cause of inflation using government expenditure as a determinant of inflation. It is against this background that the study intends to fill up the gap and add up to the empirical literature for Namibia.

Methodology

The study will adopt a CI functional approach as used by Olatunji *et al.* (2010). This is in line with the main objective of the study, which is to discover the links between inflation and its possible determinants in Namibia by employing a CI approach. The study considers Namibia's Money Supply (M2 = currency, demand deposit, overnight and quasi money), Imports (spending by firms, individuals and government for goods and services produced in foreign nations) and Government Expenditure (spending by the Namibian government for goods and services it consumes in providing public services) as the major determinants of inflation in Namibia. The specific model is expressed as:

$$\ln Y_t = \vartheta_0 + \vartheta_1 \ln X_{1t} + \vartheta_2 \ln X_{2t} + \vartheta_3 \ln X_{3t} + \vartheta_4 \ln X_{4t} + \xi \qquad (1)$$

Where Y_t = annual inflation rate, X_1 = annual money supply, X_2 = annual imports, X_3 = annual government expenditure, X_4 = annual gross domestic product and ξ is the stochastic error term with the usual properties. The subscript t denotes the time period and the rest are parameters. In light of the objectives of the study, as well as in line with the conceptual framework of the topic and the methodological issues, the estimation technique is carried out in steps. The first step before conducting a CI test will be to carry out a unit root test in order to check whether the variables are stationary, so that spurious regression results are avoided.

Stationarity or non-stationarity: To test whether variables are stationary or non- stationary, the study carries out the ADF statistic. However, ADF statistic has limitations in the sense that it has lower power, such that it is likely to under-reject the null hypothesis of unit roots. Because of this constraint, an additional test statistic, the Phillips–Perron (PP) statistic, will be used in the study. This is one gap filled by the study

because there has been no study in Namibia that has used the PP approach to test for unit root. According to Arif and Ali (2012), a stationary time series is one whose basic properties do not change overtime, whilst a non-stationary variable has some sort of upward or downward trends.

CI test: An Engle–Granger (E-G) CI method will be applied because the study intends to merely use a single equation, after establishing non-stationarity, in order to determine long-term equilibrium relationships amongst the variables. The study will utilise annual time series data covering the period 1993–2013. The reason for choosing this time interval is that there was no suitable data available prior to independence gained in 1990, and this lack of data for a considerably sufficient period poses a serious estimation challenge. The data in the study were obtained from the Namibian Statistical Agency and the World Bank.

Empirical results and analysis

Unit root test

The ADF test is used to test whether variables exhibit unit root, and it is further confirmed by verifying with the PP test. The reason why such verification is deemed necessary is because ADF test has the tendency of having lower power, such that it is likely to under-reject the null hypothesis of unit roots. Table 1 presents the results of unit root test.

Table 1 presents the outcome of the unit root test from the ADF test and the PP test. At all levels, all the variables in both the tests exhibited unit root, that is they are non-stationary. However, after differencing the variables, they all became stationary at 5% for both tests, which indicates that all variables are integrated of degree one, I(1). Differencing is deemed necessary in order to avoid having spurious regression. Seeing that the variables became stationary after the first difference, it was imperative that a CI test be conducted in order to determine whether there was long-run relationship between the series.

Testing for CI

Two or more variables are said to be co-integrated if they have a long-run, or equilibrium, relationship between them. In economics, this implies that the co-integrated variables

will move closely together over time. In the study, the E-G CI test was used mainly because the study used a single equation. This was simply conducted by first obtaining the residuals from the OLS regression, and the ADF test was used to determine CI. The E-G CI test results are presented in Table 2.

From Table 2, we can observe that the residual term (ECT) is stationary at all levels, that is I(0). This suggests our variables are co-integrated. In fact, the residual also appeared to be stationary when plotted (see Appendices A1 and A2). This re-affirms that the variables in the model are indeed co-integrated. With these outcomes, it implies that ECM can be estimated. The model in Eqn (1) is re-specified as:

$$\Delta \ln Y_t = \vartheta_0 + \vartheta_1 \Delta \ln X_{1t} + \vartheta_2 \Delta \ln X_{2t} + \vartheta_3 \Delta \ln X_{3t}$$
$$+ \vartheta_4 \Delta \ln X_{4t} + \varphi \text{ECT}_{t-1} + \xi \qquad (2)$$

Where all variables are as defined before and ECT_{t-1} is the lagged error correction term, which is given by the residual from Eqn (1).

Estimating the ECM

The ECM integrates short-run dynamics with the long-run equilibrium without losing any long-run information. The ECM is helpful in the derivation of the short-run impacts on the inflation rate in Namibia. Table 3 presents the ECM results.

Table 3 reports that both government spending and imports have a positive and significant impact on inflation in Namibia, whilst money supply and gross domestic product have an inverse relationship, but it was however insignificant. The finding strongly proves that government expenditure, followed by imports is the reason for inflation in the Namibian economy. Hence, it is safe to say that Namibia's inflation rates are import driven. This is because of the spillover

TABLE 2: Engle-Granger CI result.

ADF –Test	Significance level	t-statistics	P-value
Null Hypothesis: ECT has a unit root	-	-	-
ADF test statistic	-	-4.5176	0.0103
Test critical values:	1% level	-4.5325	-
-	5% level	-3.6736**	-
-	10% level	-3.2773	-

Source: Author's compilation and the values were obtained from Eviews.
**, The rejection of the null hypothesis is at 5%.

TABLE 3: Results from the ECM.

Variable	Coefficient	Standard error	t-Statistic	Probability
DLNX$_4$	-1.900757	3.089811	-0.615169	0.5491
DLNX$_3$	5.178453	1.877023	2.758865	0.0163
DLNX$_2$	2.330495	0.812770	2.867348	0.0132
DLNX$_1$	-0.998563	0.590220	-1.691850	0.1145
ECT	-8.754834	2.176754	-4.021967	0.0015
C	-0.250351	0.152133	-1.645609	0.1238
R-squared	0.733485	Mean dependent variable		-0.012676
F-statistic	7.155531	Durbin-Watson statistic		1.941842
Probability (F-statistic)	0.002024	-		

TABLE 1: Unit root stationarity test: ADF and PP in levels and first difference.

Variables	Model specification	ADF		PP		Order of integration
		Level	First difference	Level	First difference	
LY	Intercept and	-3.2757	-3.8718**	-2.6956	-3.8624**	I(1)
	trend	-2.8704	-3.9786**	-2.3694	-3.9907**	
LX$_1$	Intercept and	-1.8150	-3.7090**	-1.8150	-3.6194**	I(1)
	trend	-1.1444	-3.8452**	-1.1444	-3.8125**	
LX$_2$	Intercept and	-2.6995	-4.1322**	-1.8868	-3.1952**	I(1)
	trend	0.0505	-3.9881**	-0.0036	-3.2664**	
LX$_3$	Intercept and	-1.1366	-4.1712**	-1.1366	-4.1644**	I(1)
	trend	1.1622	-3.8467**	1.3282	-3.8467**	
LX$_4$	Intercept and	-2.2952	-4.8089**	-2.2870	-4.8089**	I(1)
	trend	0.9190	-4.7072**	0.9190	-4.7081**	

Source: Author's compilation and the values were obtained from Eviews.
**, The rejection of the null hypothesis is at 5%.

effect of the rise in the prices from industrial countries with which Namibia has trade relations. The strong significance of government expenditure could be because of the excessive involvement of the government (through its expansionary fiscal policy) in combating unemployment and building the country's infrastructure, which meet the objectives of vision 2030 so as to attract potential investors and in the end achieve industrialisation. We can further observe that the error term is negative and statistically significant. This suggests that the adjustment process to equilibrium is about 875%. Moreover, the model's DW-statistics of 1.9, which is approximately closer to 2, shows that there is no first-order autocorrelation in the error term.

Conclusion and policy implications

The study looks at the possible determinants of inflation in Namibia. This is because of the fact that maintaining a low and a stable inflation rate is vital for the sound economic growth of Namibia and for any country desiring to attain macroeconomic stability. The empirical results show that inflation in Namibia is mainly an argument for imports and government expenditure in the short-run. The significance of imports in our analysis suggests that Namibia is heavily an open and import-dependent economy. As a result, the country is vulnerable to external price changes from the markets whence its imports come from, especially those from South Africa. Also, the significance of government expenditure postulates that the Namibian government should reconsider its excessive spending (budget deficit) on the economy. Conversely, the study reveals that GDP and broad money supply exerted a negative impact on inflation, which is contrary to the outcome obtained by Odada and Eita (2010).

The policy recommendations that are necessary in order to lessen the momentum of inflation in Namibia are the following:

1. Imports must be minimised in Namibia. This can be achieved by encouraging the domestic manufacturing base of primary products to start adding value to the natural resources they extract. Also, policies (such as lower taxes, tax holiday and land tenure) which would attract investment in the agricultural sector ought to be encouraged in order to enhance the agricultural output and in the process achieve food security as well as to reduce the effects caused by the drastic change in the prices of these imports.

2. It is worth mentioning that the role of government spending is very important for economic growth; however, because of the significance of government expenditure on inflation, the Namibian government should minimise its involvement in the economy. That is, it should stop doing what the private sector can do. This can be achieved by pursuing a contractionary fiscal (or monetary) policy so as to minimise the dangers of deficit spending.

3. The government of Namibia should consider the immediate implementation of import substitution. These inward-looking policies such as higher tariffs, low quotas and infant industry protection should be highly considered if we are to achieve industrialisation by the year 2030.

4. On the basis of the study, we can conclude that inflation in Namibia is triggered by both the demand side factor alongside with the supply side factor, but government expenditure together with imports were found to be critical. It is imperative that future studies should be carried out using a different data set and a different methodological approach in order to determine whether similar findings can be obtained.

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Authors' contributions

V.J.U. (University of Namibia) and T.K. (University of Namibia) contributed equally to the writing of this paper.

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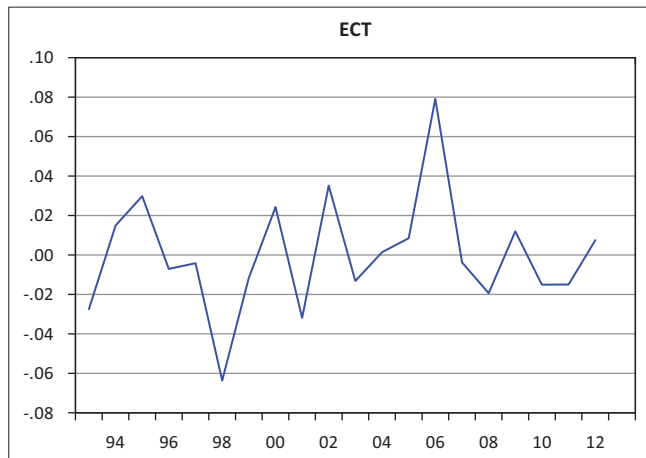
APPENDICES

Appendix 1

FIGURE 1-A1: Plot of residual, ECT.

Appendix 3

TABLE 1-A3: Data used in the study period 1993–2013 (X_4 and Y_t were obtained from NSI and the rest of the variables were from the World Bank).

Year	Y_t	X_2	X_3	X_1	X_4
1993	8.55	1.71E + 09	1.13E + 09	32.03505	41 476
1994	10.74	1.78E + 09	1.15E + 09	34.16115	42 194
1995	10.06	1.94E + 09	1.18E + 09	37.81658	43 839
1996	8.00	2.25E + 09	1.21E + 09	39.55621	45 238
1997	8.85	2.32E + 09	1.26E + 09	38.36206	47 147
1998	6.20	2.5E + 09	1.3E + 09	37.90007	48 699
1999	8.59	2.53E + 09	1.35E + 09	41.06174	50 340
2000	9.38	2.4E + 09	1.37E + 09	39.98176	52 098
2001	9.18	2.75E + 09	1.41E + 09	37.70814	52 712
2002	10.96	2.91E + 09	1.37E + 09	35.09389	55 236
2003	7.33	3.22E + 09	1.42E + 09	36.52884	57 578
2004	4.14	2.9E + 09	1.49E + 09	37.07182	64 642
2005	2.28	2.93E + 09	1.4E + 09	37.61627	66 277
2006	4.95	3.4E + 09	1.55E + 09	41.67903	70 965
2007	6.55	4.49E + 09	1.75E + 09	39.85046	74 779
2008	9.06	5.28E + 09	1.9E + 09	41.6751	77 655
2009	9.49	6.26E + 09	1.99E + 09	64.56716	76 522
2010	4.92	5.56E + 09	2.02E + 09	63.21905	81 569
2011	5.00	5.42E + 09	2.17E + 09	63.82857	86 473
2012	6.72	6.26E + 09	2.22E + 09	55.75014	92 258
2013	5.61	7.23E + 09	2.42E + 09	-	96 323

Appendix 2

TABLE 1-A2: Table of residual, ECT.

ADF test	Level	1st difference	t-statistic	P-value
Null hypothesis: ECT has a unit root	-	-	-	-
Exogenous: Constant, linear trend	-	-	-	-
Lag length: 0 (Automatic –based on SIC, maxlag = 4)	-	-	-	-
ADF test statistic	-	-	-4.517634	0.0103
Test critical values:	1% level		-4.532598	-
	5% level	-	-3.673616	-
	10% level	-	-3.277364	-
ADF test equation	-	-	-	-
Dependent variable: D(ECT)	-	-	-	-
Method: Least squares	-	-	-	-
Included observations: 19 after adjustments	-			-

Variable	Coefficient	Standard error	t-Statistic	Probability
ECT(-1)	-1.102251	0.243988	-4.517634	0.0004
C	-0.000486	0.014964	-0.032489	0.9745
@TREND(1993)	0.000189	0.001313	0.143804	0.8875
R-squared	0.561415	Mean dependent variable	-	0.001832
Adjusted R-squared	0.506591	Standard deviation dependent variable	-	0.044441
Standard error of regression	0.031217	Akaike information criterion	-	-3.951767
Sum squared residual	0.015592	Schwarz criterion	-	-3.802645
Log likelihood	40.54178	Hannan–Quinn criterion	-	-3.926529
F-statistic	10.24046	Durbin–Watson statistics		1.976101
Probability (F-statistic)	0.001369	-	-	-