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Eradicating Tax Evasion in Indonesia Through Financial Sector Development

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Eradicating Tax Evasion in Indonesia Through Financial Sector Development

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Abstract

Motivation and aim: Most economists recognized that macroeconomic variables are characterized by nonlinearity rather than growing linearly or monotonically over time. We conjecture that if gross domestic product (GDP) grows in a nonlinear fashion, any economic variables derive and depend on it will also be nonlinear. One particular macroeconomic variable is the size of the shadow economy. Nevertheless, the nonlinear relationship between shadow economy and economic development is also likely. This paper investigates the nonlinear relationship between the size of the shadow economy and the level of economic development in Malaysia. Our results suggest that the size of the shadow economy in Malaysia exhibit an inverted U-shaped curve, thus, imply a nonlinear relationship between shadow economy and economic development.

Methods and material: In this study we used several estimators such as Ordinary Least Squares (OLS), Autoregressive Distributed Lag (ARDL), Fully Modified OLS (FMOLS), Dynamic OLS (DOLS) and Canonical Cointegrating Regression (CCR) to estimate the long-run model for the Malaysian shadow economy.

Key findings: The Malaysian data support the view that there is an inverted U-shaped relationship between the size of the shadow economy and the level of economic development. The nonlinear relationship between shadow economy and economic development imply that the early stage of economic development increases the size of the shadow economy, however until a certain optimal point, thereafter, further economic development reduces the size of the shadow economy. Our results further suggest that direct tax and personal tax burden as well as "hardship" push people to participate in the shadow economy in Malaysia. Our study indicates that hardship and personal taxation does matter for the individuals rather than firms in Malaysia to participate in the shadow economy.

Policy implications: An important policy implication is that the Malaysian government as well as the Central Bank of Malaysia should embark on programs that can discourage people or firm from participating in the shadow economy. Accommodative monetary policy that helps in lowering interest rate and reducing the unemployment rate would reduce the misery index. On the fiscal side, the Malaysian government should provide programs to reduce poverty and to narrow the income gap in the country. Fiscal policy that reduces the income tax burden would be able to mitigate the size of shadow economy.

JEL classification: E26, H26, O17

Keywords: Shadow economy; Economic development; Nonlinear relationship; Malaysia

Nonlinear Relationship Between Shadow Economy and Economic Development in Malaysia

1. INTRODUCTION

Most economists recognized that macroeconomic variables are characterized by nonlinearity rather than growing linearly or monotonically over time. For example, in the growth literature, nonlinear growth models are characterized by a country's subsequent performance being critically dependent upon its initial conditions; whereby a country's transformation from an agro-based less developed to an industrialized developed nation after going through several critical phases or stages of economic development. Galor and Weil (2000) explain the growth path of an economy that displays an initial phase of stagnation, followed by a take-off in which growth rates are increasing and eventually reaches a regime of steady growth. These different growth regimes associated to different levels of economic development, are generated by the structural transformations faced by a growing economy. On the other hand, Peretto (1999) argues that a nonlinear growth process is the result of the transition from growth generated by capital accumulation, subject to decreasing returns to scale, to growth based on knowledge accumulation. Nevertheless, nonlinear economic growth can also be derived as a result of gradual reform strategy. For example, China's growth path since 1978, with market-oriented reform and opening to the outside world, through which market opening mechanism that works similar to the East Asian model (the flying geese pattern), is characterized by nonlinear one with serious ups and downs. The main reason for the nonlinear growth pattern is the fluctuation in reform and some inappropriate development policies (such as government-led excessive investment), which is closely associated with excessive state intervention in markets and enterprises (Lai, 2006).

We conjecture that if gross domestic product (GDP) grows in a nonlinear fashion, any economic variables derive and depend on it will also be nonlinear. One particular macroeconomic variable is the size of the shadow economy. It has been argued and portrayed in the works of Schneider (2005, 2008) that the size of the shadow economy dependent on the size of the official GDP. Nevertheless, numerous studies have suggested that the relationship between the size of the shadow economy and economic growth or economic development is linear. Although Pickhardt and Sarda (2015) point out that the expected sign of real GDP is difficult to predict as it might depend on both the structure and development stage of the shadow economy under consideration, but studies have shown that in developed economies, a negative sign for real GDP is more likely (Bajada & Schneider, 2005; Schneider, 2008; Pickhardt and Sarda, 2015).

Nevertheless, the nonlinear relationship between shadow economy and economic development is also likely. Earlier, Nikopour et al. (2008) estimate a shadow economy Kuznets's curve for 21 selected OECD countries for the period 1995 to 2006. The data on the size of shadow economy were taken from Schneider (2007). Nikopour et al. (2008) test both the quadratic as well the cubic functional form using static panel data analysis and they found that the shadow economy in the 21 OECD countries exhibit an N or cubic relationship with the level of economic development. In another study, Nikopour and Habibullah (2011) estimate nonlinear relationship between shadow economy and the level of economic development for a panel of 162 countries for the period 1999 to 2007, by using the data on the size of the shadow economy provided by Schneider et al. (2010). Similarly, they found an N-shaped relationship between the shadow economy and economic development for the 162 countries; imply that initially an increase in the level of economic development increases the size of the shadow economy, but upon reaching a certain optimal level, further increases in the level of economic development decreases shadow economy until it reaches a new turning point at some minimal level, the size of shadow economy ascends again.

However, on the contrary, a more recent study by Wu and Schneider (2019) using a dataset of 158 countries provided by Medina and Schneider (2018) over the period from 1990 to 2015, found a U-shaped relationship between the size of the shadow economy and the level of economic development. By changing the sample size between advanced economy versus non-advanced economy, high-income country versus non-high-income countries; and by averaging the data for 5-years and 10-years; their results came to the same conclusion that the size of the shadow economy for the 158 countries exhibit a U-shaped curve.

On a similar note, Hanousek and Palda (2015) estimate an evasional Kuznets curve for the Czech Republic by using survey data on the residents of the Czech Republic in 1995, 1997, 1999, 2000, 2002, 2004 and 2006. They found that "at first evasion rose, levelled off, and then fell along an inverse-U path, suggesting the existence of what we call an evasional Kuznets curve" (Hanousek & Palda, 2015: pp.1). On the other hand, Tan et al. (2018) investigate the evasional Kuznets curve for Malaysia. In their study, the size of the shadow economy was estimated using the currency demand model but employing the nonlinear autoregressive distributed lag (NARDL) approach to account for nonlinearity in tax burden. The size of the tax evasion was derived from the estimated size of the shadow economy. Using time series data from 1983to 2013, Tan et al. (2018) found that tax evasion in Malaysia exhibit an inverted U-shaped curve with the level of economic development. These two studies clearly suggest that if tax evasion exhibit an inverted U-shaped curve with the level of economic development in both Czech Republic and Malaysia, we believe that the size of the shadow economy will exhibit the same nonlinear relationship with the level of economic development. In fact, Schneider (2012) and Schneider and Buehn (2018) posit that while the shadow economy and tax evasion are not congruent, activities in the shadow economy in most cases imply the evasion of direct or indirect taxes, such that the factors affecting tax evasion will most certainly also affect the shadow economy.

Thus, the purpose of the present paper is to investigate the nonlinear relationship between the size of the shadow economy and the level of economic development in Malaysia. In this study we extent the data from 1971 to 2015 and estimate the size of the shadow economy using the modified-cash-deposit-ratio approach. Our results suggest that the size of the shadow economy in Malaysia exhibit an inverted U-shaped curve, thus, imply a nonlinear relationship between shadow economy and economic development.

2. METHODOLOGY

In this study we specify a simple long-run shadow economy model for Malaysia as follows,

$$\begin{aligned} lnshadow_t &= \theta_0 + \theta_1 lnrgdppc_t + \theta_2 lnrgdppc_t^2 \\ &+\theta_3 lnmisery_t + \theta_4 lntaxburden_{jt} + \varepsilon_{jt} \end{aligned} \quad (1)$$

where ln denotes variables in logarithm;$lnshadow_t$ is the size of shadow economy (calculated using modified-cash-deposit-ratio (MCDR) approach discussed below); $lnrgdppc_t$ is real GDP per capita to measure economic development;$lnrgdppc_t^2$ is square of real GDP per capita. The quadratic form for the real GDP per capita in Equation (1) is to establish whether the relationship between shadow economy and economic development is non-linear; $lnmisery_t$ is the misery index calculated as inflation rate plus unemployment rate, and $lntaxburden_{jt}$ is a measure of tax burden with j equal to the ratio of total taxation, direct taxation, indirect taxation, corporate taxation, and personal income taxation to GDP. The error term, ε_{jt} is expected to well behave with mean zero and constant variance.

It is expected that the parameters, $\theta_3, \theta_4 > 0$. Studies have indicated that tax burden being the most important factor driving people into the shadow economy. To avoid paying tax, people participate in activities in the shadow economy. On the other hand, misery index which measure the hardship of the people– seeking for opportunity to support their livelihood would seek employment in the shadow economy. On the contrary, an increase in the level of economic development will shift individuals and firms from the shadow economy to the formal economy, seeking better opportunity from a promising economic growth. Furthermore, an expanding economy generate more income for the government, and government spending on quality public infrastructure and services would refrain the population from entering the shadow economy and increases their tax morale (Torgler, 2005). The expected sign for θ_1 *and* θ_2 are however, ambiguous. We conjecture that there is a nonlinear relationship between shadow economy and the level of economic development, with a *priori* expected sign, $\theta_1 > 0$ and $\theta_2 < 0$. This relationship implies that at lower stage of economic development, shadow economy is increasing until at some turning point, at higher level of economic development, shadow economy starts to decrease, thus, exhibit an inverted U-shaped curve.

Sources of Data

There is no one method that is ideal to estimate the size of the shadow economy exists (Berger et al. 2014). In this study we estimate the size of the shadow economy in Malaysia using the procedure proposed by Pickhardt and Sarda (2011, 2015) by using the following modified-cash-deposit-ratio, which equals the ratio of shadow economy GDP to official GDP,

$$\frac{Curr_t - Curr_0}{Curr_0 + DDep_t} = \frac{GDP_{Ut}}{GDP_{Lt}} \quad (2)$$

where $Curr_t$ denotes currency in circulation at the end of year t; $Curr_0$ is currency in circulation at the end of base year, here 1971; $DDep_t$ represents demand deposits at the end of year t; GDP_{Lt} and GDP_{Ut} denote the size of the legal and shadow economy respectively. Thus, GDP_{Ut}/GDP_{Lt} measures the share of shadow economy to the legal economy (official GDP).

The duration of the study is from 1971 to 2015. Data on gross domestic product (GDP), real GDP per capita, inflation and unemployment rates were collected from the World Development Indicators published online and accessible at the World Bank database (see http://data.worldbank.org/indicator). On the other hand, data on currency in circulation, demand deposit, total taxation, direct and indirect taxation, corporate and personal income taxation were collected from various issues of the Monthly Bulletin published by the Central Bank of Malaysia (Bank Negara Malaysia, 2016). All variables are transformed into natural logarithm and denoted by ln.

3. THE EMPIRICAL RESULTS

To estimate Equation (1) we first determine the order of integration of all variables in the equation. In this study we employ the standard augmented Dickey-Fuller test (ADF, Dickey and Fuller, 1981). The unit root test results using ADF procedure are presented in Table 1, with columns 2 and 3 (intercept, and intercept with trend, respectively) in levels and columns 4 and 5 (intercept, and intercept with trend, respectively) presenting the series in first-differences. Results in Table 1 clearly indicate that all variables are $I(1)$, that is the series becomes stationary after first-differencing. These results clearly suggest that all variables are non-stationary in levels. Thus, estimating Equation (1) using OLS is subject to spurious regression results unless the variables are cointegrated. A cointegrating regression implies a long-run model for the shadow economy as specified in Equation (1). It also implies that there are long-run relationships between shadow economy and all the factors specified in Equation (1).

To estimate the long-run model as per Equation (1) we apply the ordinary least square estimator but with robust procedure due to Newey and West (1987) heteroscedasticity and autocorrelation consistent (HAC) estimates of the standard error. An important property of the robust standard errors approach is that the form of the heteroscedasticity and/or autocorrelation does not need to be specified (Croux et al., 2003). In Tables 2 and 3, we present the results of the cointegration tests from the OLS estimations. For the cointegration test, we employ the conventional Engle and Granger (1987) two-steps procedure for testing the null hypothesis of non-cointegration or the present of unit root in the residuals. For robustness checks, in this study we also employ three other estimators - the fully-modified OLS (FMOLS), dynamic OLS (DOLS)and canonical cointegrating regression (CCR) proposed by Phillips and Hansen (1990), Stock and Watson (1993) and Park (1992), respectively. These estimators are appropriate for small sample and can eliminate simultaneity or endogeneity biases. To test for cointegration when using the FMOLS, DOLS and CCR estimators, we employ the Hansen (1992) instability test. According to Hansen (1992), the L_c statistics is a LM test statistic and can be used to test for the null hypothesis of cointegration against the alternative of no cointegration.

In Table 2, Panel A presents the result for total taxation; Panel B shows the results for direct taxation; while Panel C is for indirect taxation. In all three panels we observe that the null hypothesis of no cointegration between shadow economy and its determinants can be rejected at the 5% significant level for the OLS estimation; while the null hypothesis of cointegration cannot be rejected in the cases of FMOLS, DOLS and CCR. The L_c statistics are larger than the 5% significant level. These results imply that there are long-run relationships between the size of the shadow economy and the level of economic development, misery index and tax burden (total taxation, direct and indirect taxation).

Interestingly, in all three panels and for all four estimators, the quadratic form of the level of economic development suggests that the estimated parameters, $\hat{\theta}_1 > 0$ and $\hat{\theta}_2 < 0$ and are significant at the 1% level in all cases; implying an inverted U-shaped curve. This suggests a nonlinear relationship between the size of the shadow economy and the level of economic development in Malaysia – initially the size of the shadow economy increases with the level of economic development, but up to a certain optimal point, further increase in the level of economic development, reduces the size of the shadow economy.

On the other hand, the misery index and direct taxation indicate positive impact on the size of the shadow economy as shown in Panel B. Thus, an increase in hardship and direct taxation will increase the size of the shadow economy in Malaysia. However, in Panel A, misery index is only significant in the OLS estimation; while total taxation is only significant in the DOLS estimation. In Panel C, misery index is significant in the OLS estimation while indirect taxation shows no impact on the size of the shadow economy in Malaysia.

Results in Table 2 clearly suggest that tax burden in the form of direct taxation does matter for people to participate in the shadow economy. In Table 3, we present the results of segregating direct taxation into corporate taxation and personal taxation. In Panel A, corporate tax has no impact of the size on shadow economy; while misery index is only significant in the OLS equation. Nevertheless, cointegration or long-run relationship is only detected for OLS, FMOLS and DOLS; while in the CCR estimation the null hypothesis of cointegration can be rejected at the 5% significant level. The relationship between the size of the shadow economy and the level of economic development is nonlinear, where the estimated parameters, $\hat{\theta}_1 > 0$ and $\hat{\theta}_2 < 0$ and are significant at the 1% level in all cases.

Turning to the results presented in Panel B in Table 3 clearly exhibit long-run relationships between the size of the shadow economy and its determinants; where cointegration was established in all four estimations – the null hypothesis of no cointegration is rejected in the case of OLS, while the null hypothesis of cointegration cannot be rejected in the cases of all three FMOLS, DOLS and CCR. The nonlinear, inverted U-shaped curve type of relationship between the shadow economy and economic development is clearly shown by the significant of the estimated parameters, $\hat{\theta}_1 > 0$ and $\hat{\theta}_2 < 0$, at least at the 5% significant level. The misery index is statistically significant in three estimated equations – OLS, FMOLS and DOLS; while personal taxation is statistically significant in OLS, FMOLS and CCR. Both variables show positive impact on the size of the shadow economy. Results in Table 3 suggest that misery and personal taxation do play an important role in influencing individuals to participate in the shadow economy compared to the firms or corporations.

4. CONCLUSION

In this study, we estimate the size of the shadow economy in Malaysia for the period 1971-2013 by using the modified-cash-deposit-ratio approach. Further in the analysis, we relate shadow economy with its determinants – the level of economic development, tax burden and "hardships" measured by the misery index. We test the nonlinear relationship between the size of the shadow economy and the level of economic development by specifying a quadratic function form for economic development. Generally, our estimated long-run models suggest that there are long-run relationships between the size of the shadow economy with all three determinants – the level of economic development, tax burden and misery index.

The most important result from this study is that we have established the nonlinear relationship between the size of the shadow economy and the level of economic development in Malaysia - to exhibit an inverted U-shaped curve: the size of the shadow economy increases at lower level of economic development but as the level of economic development becomes more sophisticated, the size of the shadow economy ultimately shrinks. Our results further suggest that individuals'' hardship in life or miserable life experience, as well as personal tax burden does matter that would encourage peoples to participate in the shadow economy.

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Table 1: Results of unit root tests

	Level: Intercept	Intercept+trend	First-difference: Intercept	Intercept+trend
$shadow_t$	-1.604 (3)	-1.773 (3)	-2.036** (1)	-3.610** (1)
$misery_t$	-1.399 (2)	-2.794 (2)	-8.271** (0)	-7.786** (1)
$rgdppc_t$	-2.166 (0)	-2.293 (0)	-4.566** (0)	-4.952** (0)
$rgdppc_t^2$	-1.962 (0)	-2.288 (0)	-4.680** (0)	-4.981** (0)
tax_t	-2.293 (0)	-3.005 (0)	-7.746** (0)	-7.552** (0)
$directtax_t$	-2.462 (0)	-3.381 (0)	-6.764** (0)	-6.489** (0)
$indirecttax_t$	-0.258 (0)	-3.302 (0)	-6.320** (0)	-6.393** (0)
$corporatetax_t$	-2.312 (0)	-2.345 (0)	-5.632** (0)	-5.503** (0)
$personaltax_t$	-2.352 (0)	-2.283 (0)	-5.305** (0)	-5.207** (0)

Notes: Asterisk ** denotes statistically significant at 5% level. The figures in round (…) bracket are lag length truncation. Critical values are from McKinnon (1996).

Table 2: Results of shadow economy with total taxation, direct and indirect taxation

	Intercept	$rgdppc_t$	$rgdppc_t^2$	$misery_t$	$taxburden_t$
Panel A: total taxation					
OLS	-104.27***	22.934***	-1.2358***	0.2670**	0.4410
(robust estimates)	(4.0732)	(4.1770)	(4.2794)	(2.3679)	(1.2100)
	E-G test: **	SER=0.163	*adjusted* R^2=0.843		
FMOLS	-121.14***	25.976***	-1.3797***	0.3696	0.6954
{Prewhitening	(4.0911)	(4.0188)	(4.0391)	(1.7288)	(1.3423)
lag=1}	L_c=0.739 [0.120]	SER=0.218	*adjusted* R^2=0.707		
DOLS	-67.270***	14.743***	-0.8008***	0.1702	1.0224**
{lead=1, lag=1}	(3.3150)	(3.3686)	(3.4964)	(0.7120)	(2.5094)
	L_c=0.062 [>0.20]	SER=0.104	*adjusted* R^2=0.929		
CCR	-86.965***	18.537***	-0.9845***	0.3637	0.9414
{Prewhitening	(2.9174)	(2.7942)	(2.7981)	(1.4540)	(1.5706)
lag=1}	L_c=0.532 [>0.20]	SER=0.221	*adjusted* R^2=0.698		
Panel B: Direct taxation					
OLS	-101.48***	22.554***	-1.2236***	0.2976***	0.4588**
(Robust estimates)	(4.4219)	(4.6596)	(4.8468)	(2.7881)	(2.1066)
	E-G test: **	SER=0.153	*adjusted* R^2=0.862		
FMOLS	-116.50***	25.322***	-1.3599***	0.4468**	0.7936***
{Prewhitening	(5.2208)	(5.3577)	(5.4959)	(2.4752)	(3.0180)
lag=1}	L_c=0.487 [>0.20]	SER=0.207	*adjusted* R^2=0.735		
DOLS	-72.899***	16.292***	-0.8873***	0.4292**	0.6068**
{lead=1, lag=2}	(5.0593)	(5.4894)	(5.8329)	(2.1109)	(2.4311)
	L_c=0.049 [>0.20]	SER=0.085	*adjusted* R^2=0.953		
CCR	-82.343***	18.046***	-0.9790***	0.4279	1.0333***
{Prewhitening	(4.1788)	(4.2777)	(4.4396)	(1.8955)	(3.1980)
lag=1}	L_c=0.518 [>0.20]	SER=0.213	*adjusted* R^2=0.721		
Panel C: Indirect taxation					
OLS	-139.44***	31.019***	-1.6750***	0.2978**	-0.3034
(Robust estimates)	(5.4073)	(5.6545)	(5.7568)	(2.4063)	(1.4737)
	E-G test: **	SER=0.163	*adjusted* R^2=0.843		
FMOLS	-170.93***	37.703***	-2.0242***	0.4700	-0.6992
{Prewhitening	(4.5087)	(4.5330)	(4.4991)	(1.8953)	(1.7253)
lag=1}	L_c=0.754 [0.113]	SER=0.221	*adjusted* R^2=0.699		
DOLS	-108.44***	24.277***	-1.3153***	0.4782	-0.1532
{lead=1, lag=1}	(3.3549)	(3.4206)	(3.4248)	(1.4226)	(0.3564)
	L_c=0.042 [>0.20]	SER=0.128	*adjusted* R^2=0.893		
CCR	-141.12***	31.113***	-1.6661***	0.4890	-0.5044
{Prewhitening	(5.7922)	(5.8130)	(5.7123)	(1.6865)	(1.2941)
lag=1}	L_c=0.476 [>0.20]	SER=0.224	*adjusted* R^2=0.690		

Notes: Asterisks *** and ** denote statistically significant at 1% and 5% level respectively. The figures in round, (…) and square, […] brackets are the t-statistics and *p*-values, respectively. *E-G* test denote the DF *t*-statistic on the cointegrating regression's residuals. L_c-statistic measures Hansen parameter instability test for cointegration. The *E-G* tests with null hypothesis of no cointegration, while the Hansen test the null hypothesis of cointegration. SER denotes the standard error of regression.

Table 3: Results of shadow economy with corporate and personal taxation

	Intercept	$rgdppc_t$	$rgdppc_t^2$	$misery_t$	$taxburden_t$
Panel A: Corporate taxation					
OLS	-120.74***	26.744***	-1.4368***	0.2639**	-0.1056
(Robust estimates)	(4.9022)	(5.1923)	(5.3140)	(2.2982)	(0.5987)
	E-G test: **	SER=0.167	*adjusted* R^2=0.835		
FMOLS	-129.42***	28.282***	-1.4971***	0.3177	-0.5013
{Prewhitening	(4.6225)	(4.7942)	(4.8232)	(1.2528)	(1.3762)
lag=1}	L_c=0.869 [0.067]	SER=0.225	*adjusted* R^2=0.688		
DOLS	-93.852***	21.182***	-1.1486***	0.3314	-0.1911
{lead=1, lag=1}	(4.5342)	(5.0338)	(5.3215)	(0.9762)	(0.4946)
	L_c=0.044 [>0.20]	SER=0.125	*adjusted* R^2=0.899		
CCR	-104.07***	22.856***	-1.2119***	0.3319	-0.2462
{Prewhitening	(5.2985)	(5.6431)	(5.6550)	(1.1601)	(0.6337)
lag=1}	L_c=1.181 [0.019]**	SER=0.223	*adjusted* R^2=0.693		
Panel B: Personal taxation					
OLS	-94.384***	21.075***	-1.1401***	0.3468***	0.4482
(Robust estimates)	(4.6870)	(4.9881)	(5.1527)	(3.1055)	(2.0005)
	E-G test: **	SER=0.155	*adjusted* R^2=0.857		
FMOLS	-96.475***	21.122***	-1.1290***	0.5133**	0.8551**
{Prewhitening	(3.1069)	(3.2075)	(3.2562)	(2.2165)	(2.4409)
lag=1}	L_c=0.718 [0.133]	SER=0.214	*adjusted* R^2=0.719		
DOLS	-58.764**	13.139**	-0.7100**	0.7828**	0.5649
{lead=1, lag=1}	(2.4929)	(2.6250)	(2.6934)	(2.4824)	(1.7515)
	L_c=0.041 [>0.20]	SER=0.112	*adjusted* R^2=0.918		
CCR	-66.554**	14.743**	-0.7905**	0.5492	0.8802**
{Prewhitening	(2.2418)	(2.3054)	(2.3297)	(1.6899)	(2.2162)
lag=1}	L_c=0.417 [>0.20]	SER=0.208	*adjusted* R^2=0.734		

Notes: Asterisks *** and ** denote statistically significant at 1% and 5% level respectively. The figures in round, (…) and square, […] brackets are the t-statistics and *p*-values, respectively. *E-G* test denote the DF *t*-statistic on the cointegrating regression's residuals. L_c-statistic measures Hansen parameter instability test for cointegration. The *E-G* tests with null hypothesis of no cointegration, while the Hansen test the null hypothesis of cointegration. SER denotes the standard error of regression.

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