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Does corruption impede economic growth in Pakistan?

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ABSTRACT

The present study reinvestigates the impact of corruption on economic growth by incorporating financial development and trade openness in growth model in case of Pakistan. We have used time series data over the period of 1987–2009. We have applied structural break unit root test to test the integrating order of the variables. The structural break cointegration has also been applied to examine the long run relationship between the variables.

The long run relationship between the variables is validated in case of Pakistan. We find that corruption impedes economic growth. Financial development adds in economic growth. Trade openness stimulates economic growth. The causality analysis has exposed the feedback effect between corruption and economic growth and same inference is drawn for trade openness and corruption. Trade openness and economic growth are interdependent. Financial development Granger causes economic growth implying supply-side hypothesis in case of Pakistan.

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1. Introduction

In recent years, there is a wide spread of corruption in many countries of the world and especially in developing economies where its consequences have serious implications. The role of institutions in fostering economic growth has been recognized widely by the economists in these days. Existence of corruption in any country indicates the weaknesses of the institutions, thus, corruption is the output of weak institutions. A common definition of corruption is the abuse of public office for private gain (World Bank, 1997). Corruption is accepted in various ways such as bribery, the sale of public property by government officials, kickbacks in public procurement, and misuse of government funds (Reinikka and Svensson, 2005).

Corruption is not only an issue of one country or region but also a worldwide issue. Corruption retards economic growth and minimizes the chances of economic development in developing countries. The misuse of the public office by higher political as well as civilian authorities for acquiring national wealth has been taking place in the world at the expense of public welfare (Oni and Awe, 2012). According to World Bank, corruption is "the single greatest obstacle to economic and social development. It undermines development by distorting the role of law and weakening the institutional foundation on which economic growth depends". Corruption as a topic of research has attracted the attention of the economists of global financial institutions like World Bank and IMF in recent years due to its detrimental impacts on economic growth.

Economists have described five reasons behind the corrupt society or political set up, illegal accumulation of wealth and corruption in an economy. *Firstly*, corrupt government is the product of corrupt society and corrupt president cares corrupt government (Aburime, 2009). *Secondly*, the office of the political corrupt government collects national wealth illegally and becomes a major source of corruption in the country. *Thirdly*, the existence of a set of imperatives and incentives in the developing countries encourages the corruption transactions. These imperatives and incentives are such as widespread societal craze with materialism, high income inequality and poverty, exaltation and esteem of ill-gotten wealth by the general public and low and irregular salary packages for government employees with large families to bring up (Aburime, 2009; Frisch, 1996). *Fourthly*, accumulation of illegal wealth through corruption by the corrupt government encourages the other individuals of the society to have access and control over the means of corruption. In this way these corrupt individuals take the controls of the administrative process to have access to offshore accounts and practices of money laundering (Aburime, 2009). *Finally*, when there is no fear of punishment in a society corruption spreads very rapidly. Taxation systems in the developing countries have many flaws and unable to track down individuals' financial activities which further promote corruption in the society.

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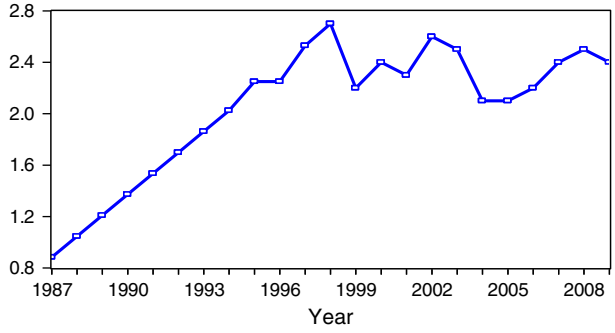


Fig. 1. Corruption index in Pakistan.

1.1. Pakistani context

The economy of Pakistan experienced a very sluggish rate of economic growth and a high level of volatility in its growth rate for the last five years. Moreover, Pakistan failed to achieve the set target of 5.3% growth rate in the last eight years, average 2.6% economic growth rate was registered in these eight years. There is a variety of reasons for this poor economic performance; increasing corruption is the dominating determinant that affected the economic growth in Pakistan. Corruption is the result of institutional weaknesses which discourages the economic growth of a country. Historical background of Pakistan flourishes that the most governance indicators have remained unchanged and corruption apparently spread to all gross root levels of federal, provincial and local governments. In 1995, Corruption Perception Index (CPI) was 2.25 and Pakistan was considered among the most corrupt countries of the globe. Some routine efforts were made by the government of Pakistan to eradicate the corruption from the country. Due to these efforts Corruption Perception Index showed some improvement in 1998, then it improved further to 2.7 from 2.53 in 1997 (International Transparency Report, 2012) (Fig. 1). Today, Pakistan on the basis of Corruption Perception Index is ranked at 139th out of 174 countries of the world, which means that it is the 35th corrupt country of the world (International Transparency Report, 2012).

Pakistan is a country with weak institutions which is the biggest alone cause of corruption. Other reasons of corruption are; insufficient political will to eradicate corruption from the society, bureaucracy is the principal authority for the administration of institutes, salaries in the public sector are very low as compared to the other sectors of the economy and higher rate of inflation. The government bodies are held responsible for spreading corruption in Pakistan because these bodies control and allocate public resources of the country. The department of police is supposed to maintain the law & order situation in a country but known as the most corrupt institution of Pakistan. In Pakistan, police officers are appointed on the basis of political and bureaucratic connections. Thus, the police officers often have divergences of significance due to special loyalties.[1]

The above graph is constructed to display the trend of corruption in Pakistan. It depicts that from 1987 to 1998 the corruption was gradually reduced. In 1999, the corruption again increased during the era of Musharraf's coup, situation of corruption was slightly controlled due to slight improvements in governance. The country had performed better to reduce corruption by improving the rule of law and government effectiveness in 2002 and 2003. In 2005, corruption was worsened due to poor quality of governance in the country. It was indicated in Global Competitiveness Report (2007–08) that bureaucratic culture in the public sector as well as the poor quality of infrastructure and corruption, are the major hurdles for foreign companies to settle their business in Pakistan. Although corruption is a major problem in Pakistan but still it is a better place for new and existing businesses as compared to other countries of the region like India, Bangladesh, Sri Lanka etc. (International Transparency Report, 2012). The Corruption Perception Index ranked Pakistan as the 47th corrupt country out of 180 countries of the globe. The survey of Transparency International (various reports) indicates that the corruption factors and their results in terms of percentage are as follows; lack of accountability is 31.68%, low salaries is 16.54%, monopoly of power is 16.43%, discretionary powers is 12.61%, lack of transparency is 9.97%, power of influential people is 4.59%, redtapism is 4.28%, and others is 4.9% (Government of Pakistan, 2010–11). In 2009, the Corruption Perception Index score of Pakistan was 2.4 which slipped the country to 42nd that declared high corruption in Pakistan.

2. Literature review

The link between corruption and economic growth is not a new concept in the field of Economics. More than a few economists have tried to explore the impact of corruption on economic growth for the last many years, but there is hardly any consensus among economists on the role of corruption. The World Bank (2009) reported that the average annual economic growth rate of East Asian countries including Malaysia, Singapore, South Korea, Thailand, Hong Kong, Indonesia and Philippines was around 7% from 1986 to 1996, whereas it was very poor 2.5% in the rest of the world. These countries excluding Singapore also experienced a high level of corruption during this period. Most of the earlier empirical studies before this period have discovered that corruption impedes economic growth but the coexistence experience of high economic growth and corruption in these countries questions the generality of these studies. Lack of identical yardstick to measure the corruption has given the inconclusive empirical results. The pioneering theoretical work of Leff (1964) discovered a very interesting link between corruption and economic growth; corruption works like the engine of economic growth in the situation when bureaucratic delays and strict regulations imposed by the government enable the private agents to buy their way out of politically imposed inefficiencies. Thus, corruption enhances efficiency in an economy and leaves positive impacts on economic growth (Huntington, 1968; Summers and Heston, 1988; Acemoglu and Verdier, 1998). Similarly or contrary, few economists applied different models, in which the corruption speeds up the working process that enhances the efficiency of economic growth. Lui (1985) used "queue model" by suggesting that bureaucrats allocate business licenses to those firms that gives high amounts as bribe. The "auction models" guided that biding method can enhance competence because most well-organized firms are frequently those who can give the maximum bribe (Beck and Maher, 1986; Lien, 1986). Rock and Bonnett (2004) investigated the relationship between corruption, economic growth and investment. They noted that corruption significantly promotes economic growth in case of China, Indonesia, Korea, Thailand and Japan.

On the contrary, various studies exposed that corruption plunders economic growth by increasing the cost of business and also uncertainty in the decision making process.[2] Existing literature indicates four

[1] It is famous that in Pakistan, powerful landlords select the law enforcement officers in their area and police officers act on their behalf. The illegitimate police system does not only exclusively influence poor people but also businesses person. Basically matured police system is needed as the sole, political, legal, and economic institutions of a country are necessary in recognizing the possible for police wrongdoing.

[2] See Murphy et al. (1991), Gould and Amaro-Reyes (1983), Mauro (1995), Mo (2001), and Monte and Erasmo (2001) etc.

Table 1
Descriptive statistics and pair-wise correlation.

Variables	ln Y_t	ln C_t	ln F_t	ln TR_t
Mean	10.2265	0.6768	4.7104	3.5541
Median	10.2119	0.7884	4.4979	3.5647
Maximum	10.5047	0.9932	5.5794	3.6612
Minimum	10.0007	−0.1232	4.2979	3.3368
Std. Dev.	0.1318	0.3058	0.4171	0.0918
Skewness	0.5076	−1.3176	0.9066	−0.7718
Kurtosis	2.6674	3.6808	2.3802	2.6935
Jarque–Bera	1.0939	0.7100	3.5191	2.3737
Probability	0.5787	0.4870	0.1721	0.3051
ln Y_t	1.0000			
ln C_t	0.7090	1.0000		
ln F_t	0.9469	0.4975	1.0000	
ln TR_t	0.0830	−0.1908	0.0650	1.0000

Table 2
Structural break unit root test.

Variable	Innovative outliers			Additive outlier		
	T-statistic	TB1	TB2	T-statistic	TB1	TB2
ln Y_t	−4.482 (2)	2001	2003	−7.258 (3)*	1991	2002
ln C_t	−3.446 (1)	2003	2005	−5.587 (3)**	1997	2006
ln F_t	−2.081 (3)	1998	2002	−10.684 (3)*	1994	2001
ln TR_t	−5.333 (2)	1998	2004	−5.480 (1)***	1997	2001

Note: *, ** and *** indicates significant at 1%, 5% and 10% levels of significance respectively.

channels through which corruption reduces economic growth; *first*, corruption impedes economic growth by sagging the competence of infrastructure, *second*, corruption lowers public investment that in turn reduces economic growth through lowering the productivity, *third*, due to corruption low government revenues lower the expenditures on health and education, which in turn lower economic growth (Tanzi and Davoodi, 1997). Gupta et al. (1998) unveiled that corruption enhances and augments gain for rich people at the cost of poor segments of the population. Following Barro's (1991) pioneering work, there has been a remarkable expansion in the empirical literature on economic growth and investment. Mauro (1995) by using Business International Index (BII), found a significant negative relationship between corruption and economic growth. He also reported the same inference for corruption and investment. Similarly; Mauro (1995) investigated the impact of corruption on economic growth and found that one standard deviation decrease in corruption index increases economic growth by 0.8%, keeping other things constant. Ehrlich and Lui (1999) noted that government size and corruption are inversely linked with economic growth using the data of 68 developed and developing countries. Mo (2001) used the data of 67 countries to analyze the relationship between corruption and economic growth. The empirical evidence indicated that corruption has an inverse impact on economic growth via political instability, flux and volatility. Furthermore, the rise and escalation in corruption and political instability, wavering and unsteadiness, condense human capital and share of private investment and ventures.[3]

Later on, Shabbir and Anwar (2007) investigated various reasons for perceived level of corruption in 41 developing countries. They included economic as well as non-economic determinants of corruption. Their empirical findings showed that increase in economic freedom, globalization and average level of income have reduced the level of corruption in these countries. But the level of corruption in developing countries is increased with the increase in the level of education. This implies that economic determinants are more important as compared to non-economic determinants in reducing the perceived level of corruption in developing countries. Asiedu and Freeman (2009) probed the impact of dishonesty, sleaze and corruption on the firm's level of investment in the case of Latin America, Sub-Saharan Africa, and transition economies. They found that the relationship between corruption and investment varies across the regions, and no relationship was found in the case of Latin America and Sub-Saharan Africa. They noted that corruption is a fundamental and crucial determinant of investment as recommended in the case of transition countries. Ahmad and Ali (2010) attempted to examine the impact of corruption on financial development in the case of 38 countries by using the GMM estimation method. Their empirical exercise exposed that the augmentation in levels of corruption impedes financial development. Ali et al. (2010) investigated the relationship between corruption and economic growth. They noted that higher corruption in industrialized countries leads to lower economic growth and no relation between economic growth and corruption is found in non-Asian countries but a positive relation exists between both variables in Asian countries.

In the case of Bangladesh, Paul (2010) unveiled the relationship between economic growth and corruption. He found negative relationship between corruption and economic growth during the rise of market economy in Bangladesh. Ugur and Dasgupta (2011) reviewed the relationship between corruption and economic growth. They explored a negative link between corruption and economic growth in poor income countries as well as in high income countries. The direct effect of corruption on per capita GDP growth in poor income countries is statistically significant and negative (−0.07%). The indirect effects through the public finance and human capital channels are higher (−0.23%, −0.29%, respectively). Hence, the total effect that satisfies the precision-effect test is −0.59%. This should be interpreted as follows; a 1% increase in perceived corruption index of a low-income country can be expected to decline economic growth by 0.59%. The corresponding effect in 'mixed' countries (including poor income and high income countries) is −0.86%. Therefore, economic gains from reducing corruption in poor income countries can be increased if anti-corruption interventions are combined with a wider set of policies aimed at improving institutional quality and providing correct incentives for investment in human capital.[4] Ajie and Wokekoro (2012) investigated the consequences of corruption on sustainable economic growth using data in the case of Nigeria. They found that corruption impedes economic growth. Adenike (2013) reported that corruption is the main root cause of all economic evils in Nigeria. Matthew and Idowu (2013) found that political corruption adversely affects economic growth and increases poverty as well as unemployment. Dissou and Yakautsava (2012) analyzed the relationship between corruption and economic growth by incorporating taxation in endogenous growth model. They argued that corruption impedes

[3] Braun and Tella (2000) examined the relationship between corruption and inflation in the sample of 75 countries. They recommended that "a one standard deviation increase in inflation variance from the median can lead to an increase in corruption by 12-percent of a standard deviation and a decline in growth rates of 0.33 percentage points". Bahmani-Oskooee and Goswami (2005) found that higher level of corruption instigates higher black market premium in the case of 60 countries.

[4] This systematic review also indicates that levels of corruption in poor income countries may be higher than in mixed countries, but the latter stand to gain more from reducing the incidence of corruption.

Table 3
ARDL bounds testing analysis.

Bounds testing to cointegration			Diagnostic tests			
Estimated models	Optimal lag length	F-statistics	χ^2_{NORMAL}	χ^2_{ARCH}	χ^2_{RESET}	χ^2_{SERIAL}
$F_Y(Y/C, F, TR)$	1, 0, 1, 1	6.903**	0.6611	[4]: 0.8917	[1]: 0.5707	[1]: 6.8593
$F_C(C/Y, F, TR)$	1, 1, 1, 0	10.937*	3.7221	[1]: 0.5316	[1]: 2.4454	[3]: 0.1066
$F_F(F/Y, C, TR)$	1, 1, 1, 1	1.014	0.0781	[1]: 0.0375	[1]: 1.3850	[2]: 0.6007
$F_{TR}(TR/Y, C, TR)$	2, 2, 2, 2	8.749**	0.9835	[1]: 0.1426	[1]: 0.0026	[3]: 3.8562

Significant level	Critical values (T = 23)	
	Lower bounds I(0)	Upper bounds I(1)
1% level	7.397	8.926
5% level	5.296	6.504
10% level	4.401	5.462

Note: the asterisks * and ** denote the significant at 1% and 5% levels, respectively. The optimal lag length is determined by AIC. [ ] is the order of diagnostic tests. We use critical bounds generated by Narayan (2005).

economic growth and government increases taxes which discourage the private investment.

Recently, Saha and Gounder (2013) collected data on 100 developed and developing economies to examine the impact of corruption on economic growth using polynomial regression. They reported that corruption has an inverse impact on economic growth. They suggested to designing a comprehensive economic, institutional and social policy to reduce corruption. Ugur (2013) investigated the relationship between corruption and income per capita using meta-analysis and found that corruption is negatively linked with economic growth. Dridi (2013) tested the relationship between corruption and economic growth in the case of Tunisia. He reported that corruption is negatively correlated with economic growth in the presence of political instability.

All of the above studies are the cross-country analysis except some of them. The domino effects and consequences of these studies are not unwavering since these studies have used cross-country data with fixed effects. However, in reality economic conditions are not analogous and corruption levels are also poles apart in urbanized and emergent economies. The recently developed econometrics procedures and methods have given significance to the time series analysis in order to ascertain a long run and short run relationship between corruption and economic growth for country case study. Hence, the endeavor of this study is to fill the gap in economic literature by exploring the link between corruption and economic growth in the case of Pakistan. The current study augments the literature by four ways: *firstly*, this study is an original and revolutionary effort by means of time series data over the period of 1987–2009. *Secondly*, the ARDL bounds testing approach to cointegration is applied to investigate the long run relationship between corruption and economic growth, which has never been used in the previous studies in case of Pakistan. *Thirdly*, Clemente et al. (1998) unit root test is used to test the order of integration of the variables in the presence of structural breaks. *Finally*, the VECM Granger causality approach is also applied to detect the direction of causal relation between the variables.

Table 4
Gregory-Hansen structural break cointegration test.

Estimated model	$T_Y(Y/C, F, TR)$	$T_C(C/Y, F, TR)$	$T_F(F/Y, F, TR)$	$T_{TR}(TR/Y, F, C)$
ADF-test	−5.766*	−4.935**	−3.987	−5.185*
Prob. values	0.0000	0.0000	0.0004	0.0000

Note: * shows significance at 1% and 5% levels respectively. The ADF statistics show the Gregory-Hansen tests of cointegration with an endogenous break in the intercept. Critical values for the ADF test at 1%, 5% and 10% are −5.13, −4.61 and −4.34 respectively.

3. The data, modeling and estimation strategy

The data on real trade openness (exports + imports) and real domestic credit to private sector (proxy for financial development) has been obtained from Government of Pakistan (2010–11). The Government of Pakistan (2010–11) is further combed to collect data on real GDP. The data on Corruption Perceptions Index (CPI) has collected from Transparency International (various reports). Our study covers time series data over the period of 1987–2009.[5] We have used population data to transform the series into per capita following Bowers and Pierce (1975) and Ehrlich (1977) and later on Shahbaz (2012). The general functional form our modeling is as follows:

$$Y_t = f(C_t, F_t, TR_t). \tag{1}$$

We use log-linear specification for our empirical purpose. Log-linear specification provides efficient results.[6] The functional form of our empirical growth model is constructed as follows:

$$\ln Y_t = \alpha_\circ + \alpha_C \ln C_t + \alpha_F \ln F_t + \alpha_{TR} \ln TR_t + \mu_i \tag{2}$$

where, $\ln Y_t$ is the natural log of real GDP per capita, $\ln C_t$ is the natural log of corruption, the natural log of financial development is indicated by $\ln F_t$, $\ln TR_t$ is the natural log of trade openness per capita and μ is the error term having normal distribution with zero mean and finite variance.

3.1. ARDL bounds procedure to cointegration

This paper applies the ARDL bounds testing approach to cointegration developed by Pesaran and Pesaran (1997), Pesaran et al. (2000) and latter on by Pesaran et al. (2001) to investigate the long run relationship between corruption, financial development, trade openness and economic growth in the case of Pakistan. The autoregressive distributive lag model can be applicable without

[5] The availability of data on CPI restricted us to use this time period.
[6] Shahbaz (2012) noted that log-linear speciation improves the precision power of results.

Table 5
Long and short run results.

Dependent variable = ln Y_t				
Variables	Coefficient	Std. error	T-statistic	Prob. values
Long run analysis				
Constant	8.4765*	0.1574	53.8255	0.0000
ln C_t	0.1489*	0.0130	11.3771	0.0000
ln F_t	0.2428*	0.0100	24.2446	0.0000
ln TR_t	0.1421*	0.0428	3.3173	0.0036
R^2	0.9809			
F-statistic	326.41*			
D. W	1.7441			
Short run analysis				
Constant	0.0144**	0.0057	2.5293	0.0216
ln C_t	0.0399	0.0453	0.8792	0.3915
ln F_t	0.1045***	0.0574	1.8197	0.0864
ln TR_t	0.0875***	0.0502	1.7425	0.0995
ECM_{t-1}	−0.4829***	0.2465	−1.9585	0.0668
R^2	0.4116			
F-statistic	2.9734**			
D. W	1.5669			

Short run diagnostic tests

Test	F-statistic	Prob. value
χ^2*NORMAL*	1.9948	0.3688
χ^2*SERIAL*	1.3746	0.2581
χ^2*ARCH*	0.0140	0.9068
χ^2*WHITE*	0.6745	0.7063
χ^2*REMSAY*	1.8432	0.1934

Note: *, ** and *** show significant at 1%, 5% and 10% levels of significance respectively.

investigating the stationarity properties of the variables (Pesaran and Pesaran, 1997). Haug (2002) has argued that the ARDL approach to cointegration provides better results for small sample data set such as in our case as compared to traditional approaches to cointegration i.e. Engle and Granger (1987), Johansen and Juselius (1990) and Phillips and Hansen (1990).

Another advantage of the ARDL bounds testing is that unrestricted model of ECM seems to take satisfactory lags that captures the data generating process in a general-to-specific framework of specification (Laurenceson and Chai, 2003). The equation of unrestricted error correction model (UECM) is modeled as follows:

$$\begin{aligned}\Delta \ln Y_t = {} & \alpha_0 + \alpha_T T + \alpha_Y \ln Y_{t-1} + \alpha_C \ln C_{t-1} + \alpha_F \ln F_{t-1} + \alpha_{TR} \ln TR_{t-1} \\ & + \sum_{i=1}^{m} \alpha_i \Delta \ln Y_{t-i} + \sum_{j=0}^{n} \alpha_j \Delta \ln C_{t-j} + \sum_{k=0}^{p} \alpha_k \Delta \ln F_{t-k} \\ & + \sum_{l=0}^{q} \alpha_l \Delta \ln TR_{t-l} + \mu_i. \end{aligned} \tag{3}$$

The decision whether cointegration exists or not depends upon the critical bounds tabulated by Pesaran et al. (2001). The null hypothesis of no cointegration is $H_n : \alpha_C = \alpha_F = \alpha_{TR} = 0$ and alternative hypothesis of cointegration between the variables is $H_a : \alpha_C \neq \alpha_F \neq \alpha_{TR} \neq 0$. Now we compare the calculated F-statistic with LCB (lower critical bound) and UCB (upper critical bound) by Pesaran et al. (2001). There is cointegration among variables if calculated F-statistic is more than UCB. If LCB is more than computed F-statistic then hypothesis of no cointegration may be accepted. Finally, if calculated F-statistic is between lower and upper critical bounds then the decision about cointegration is inconclusive. The stability of the ARDL bounds testing approach to cointegration is analyzed by conducting diagnostic tests and the stability analysis.

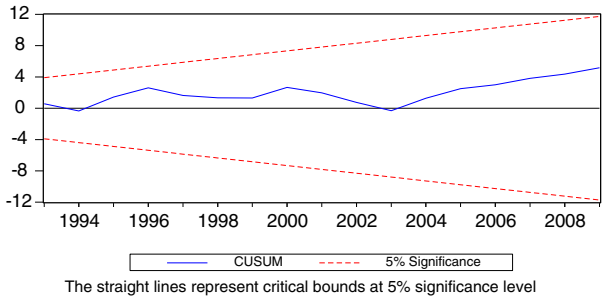


Fig. 2. Plot of cumulative sum of recursive residuals. The straight lines represent critical bounds at 5% significance level.

The diagnostic tests are comprised of serial correlation, ARCH test, functional form of model, normality of residual term, and white heteroskedasticity associated with empirical equation. The stability test of long-and-short run estimates is tested by using the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares (CUSUMsq) of recursive residuals.

3.2. The VECM granger causality

From policy perspective it is necessary to know the causal relation between the variables. To do this we apply the standard Granger causality test augmented with a lagged error-correction term. According to the Granger representation theorem if there is a cointegrating relationship between the variables, then there must be Granger causality between the variables at least from one direction. Engle and Granger (1987) cautioned that if the Granger causality test is conducted at first difference through vector autoregression (VAR) method then it may be misleading in the presence of cointegration. Therefore, an inclusion of an additional variable to the VAR method such as the error-correction term would help us to capture the long run causal relationship. Therefore, if financial development, corruption and economic growth are cointegrated then we must implement the Granger causality test with the VECM framework as follows:

$$\begin{aligned}\begin{bmatrix}\Delta \ln Y_t \\ \Delta \ln C_t \\ \Delta \ln F_t \\ \Delta \ln TR_t\end{bmatrix} = {} & \begin{bmatrix}b_1 \\ b_2 \\ b_3 \\ b_4\end{bmatrix} + \begin{bmatrix}B_{11,1} & B_{12,1} & B_{13,1} & B_{14,1} \\ B_{21,1} & B_{22,1} & B_{23,1} & B_{23,1} \\ B_{31,1} & B_{32,1} & B_{33,1} & B_{34,1} \\ B_{41,1} & B_{42,1} & B_{43,1} & B_{44,1}\end{bmatrix} \times \begin{bmatrix}\Delta \ln Y_{t-1} \\ \Delta \ln C_{t-1} \\ \Delta \ln F_{t-1} \\ \Delta \ln TR_{t-1}\end{bmatrix} \\ & + \ldots + \begin{bmatrix}B_{11,m} & B_{12,m} & B_{13,m} & B_{14,m} \\ B_{21,m} & B_{22,m} & B_{23,m} & B_{24,m} \\ B_{31,m} & B_{32,m} & B_{33,m} & B_{34,m} \\ B_{41,m} & B_{42,m} & B_{43,m} & B_{44,m}\end{bmatrix} \times \begin{bmatrix}\Delta \ln Y_{t-1} \\ \Delta \ln C_{t-1} \\ \Delta \ln F_{t-1} \\ \Delta \ln TR_{t-1}\end{bmatrix} \\ & + \begin{bmatrix}\zeta_1 \\ \zeta_3 \\ \zeta_3 \\ \zeta_4\end{bmatrix} \times (ECM_{t-1}) + \begin{bmatrix}\mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \\ \mu_{4t}\end{bmatrix}\end{aligned} \tag{4}$$

where difference operator is $(1 - L)$ and ECM_{t-1} is the lagged error correction term, generated from the long run association. The long run causality is found by significance of coefficient of lagged error correction term using T-test statistic. The existence of a significant relationship in first differences of the variables provides evidence on the direction of short run causality. The joint χ^2 statistic for the first differenced lagged independent variables is used to test the direction of short-run causality between the variables. For example, $B_{12,i} \neq 0 \forall_i$ shows that corruption

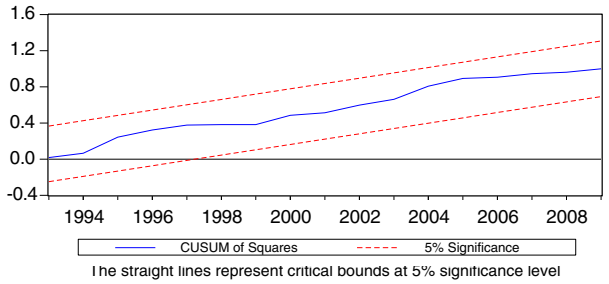


Fig. 3. Plot of cumulative sum of squares of recursive residuals. The straight lines represent critical bounds at 5% significance level.

Granger causes economic growth and corruption is Granger cause of economic growth if $B_{11,i} \neq 0 \forall_i$. The hypotheses of joint (long-and-short runs) can also be drawn similarly.

4. Results and their discussions

Table 1 describes the descriptive statistics and correlation matrices. The analysis of Jarque–Bera normality test shows that all the series are normally distributed. This implies that the series seems to have homoscedastic variance. The correlation analysis points out that a negative and strong correlation is found between economic growth and corruption. Financial development and economic growth are positively and significantly correlated and same inference is about trade openness and economic growth but the correlation is weak. Trade openness is positively correlated with corruption and financial development. Finally, correlation between financial development and corruption is negative.

We apply the ARDL bounds testing approach to cointegration between the variables for long run relationship. The bounds testing approach is flexible with respect to the unit root properties of the variables as compared to traditional cointegration approaches. These conventional techniques require that variables must be integrated at I(1). The ARDL bounds testing approach to cointegration requires that no variables should be stationary at I(2). The ARDL bounds testing assumes that the order of integration of the series is I(0) or I(1) or I(0)/I(1). The procedure of the ARDL bounds testing to compute F-statistic becomes invalid if any series under estimation is stationary at I(2). Various unit root tests such as ADF, DF–GLS, PP, KPSS, and Ng–Perron are available to test the unit root properties of the variables. These tests are objectionable once the series suffers with structural break. To resolve this issue, we have applied Clemente et al. (1998) structural break unit root test. The structural break unit root test developed by Clemente et al. (1998) provides information about two unknown structural breaks stemming in the series. This unit root test is superior and uses two models i.e. additive outliers (AO) model and innovational outliers (IO) model. The IO model updates about a sudden change in the mean of a series and an innovational outliers (IO) model specifies about the gradual shift in the mean of the series. The IO model is appropriate for the series which has sudden structural changes comparatively to steady shifts. The results in Table 2 specify that all the series have unit root problem at their level form[7] and corruption, financial development, trade openness and economic growth are found to be stationary at 1st difference. This implies that all the variables are integrated at I(1).

This postulates that all the variables have the same order of integration i.e. I(1) which is not against the assumptions of the ARDL bounds testing approach to cointegration. The ARDL bounds testing is a two

[7] We used both intercept and trend while testing the order of integration of the variables.

Table 6
VECM Granger causality analysis.

Dependent variable	Direction of causality									
	Short run				Long run	Joint long-and-short run causality				
	$\Delta \ln Y_{t-1}$	$\Delta \ln C_{t-1}$	$\Delta \ln F_{t-1}$	$\Delta \ln TR_{t-1}$	ECT_{t-1}	$\Delta \ln Y_{t-1}, ECT_{t-1}$	$\Delta \ln C_{t-1}, ECT_{t-1}$	$\Delta \ln F_{t-1}, ECT_{t-1}$	$\Delta \ln TR_{t-1}, ECT_{t-1}$
$\Delta \ln Y_t$	....	4.3008** [0.0391]	10.3375* [0.0025]	2.3471 [0.1379]	−0.1035* [−4.8418]	....	19.8834* [0.0001]	11.1138* [0.0009]	17.4472* [0.0001]
$\Delta \ln C_t$	3.3174*** [0.0716]	....	8.8011* [0.0044]	2.2552 [0.1474]	−0.8432* [−4.7419]	8.0391* [0.0033]	....	8.3681* [0.0024]	7.7881* [0.0028]
$\Delta \ln F_t$	0.2207 [0.8507]	4.4529** [0.0414]	....	....	....	....	....	....	....
$\Delta \ln TR_t$	1.8276 [0.2157]	1.7883 [0.2218]	0.4416 [0.6562]	....	−0.5822** [−2.9045]	3.8486** [0.0504]	3.8281*** [0.0511]	4.3837** [0.0367]	....

Note: *, ** and *** show significance at 1, 5 and 10% levels respectively.

step procedure to compute F-statistic for cointegration. The appropriate selection of lag length enables us to avoid the problem of biasness of the ARDL F-statistics. The F-statistic varies with lag order selection. The second column of Table 3 provides information about lag length and we followed AIC criteria to choose suitable lag length of the series.[8] Our results imply that we cannot use lag more than 2 in such small data. The ARDL cointegration analysis reveals that our calculated F-statistic is greater than upper critical bounds reported in Table 3. The results are statistically significant at 5%, 1%, and at 5% levels, once we treated economic growth, corruption and trade openness as dependent variables respectively. This indicates that we have three cointegration vectors in our empirical growth model which confirms the existence of cointegration between economic growth, corruption, financial development and trade openness in the case of Pakistan.

We have applied Gregory-Hansen (1996) to examine cointegration between the variables because the results of ARDL bounds test may be unable to identify the role of structural break stemming in the variables (this is the main demerit of the ARDL bounds testing). Gregory-Hansen (1996) accommodates the single unknown structural break in the series and based on Engle–Granger residual based cointegration test but it is superior to other traditional cointegration techniques. The results are detailed in Table 4. There is no empirical evidence about cointegration provided by Gregory-Hansen (1996) once we used financial development as predicted variable. We have three cointegrating vector as economic growth, corruption and trade openness are used as dependent variables. This implies that the long run relationship between the variables exists in the presence of structural breaks in the series of economic growth, corruption and trade openness over the period of 1987–2009 in the case of Pakistan.

The next step is to find the marginal impact of corruption, financial development and trade openness on economic growth. The results are reported in Table 5. We find the negative impact of corruption on economic growth and it is statistically significant at 1% level of significance. This shows that a 1% rise in corruption retards economic growth by 0.1489% keeping other things constant. These findings are consistent with Paul (2010), Adenike (2013) and Dridi (2013) for Bangladesh, Nigeria and Tunisia respectively. The impact of financial development on economic growth is positive. This relationship is statistically significant at 1% significance level. A 0.2428% of economic growth is boosted by 1% increase in financial development, all else is same. These findings are consistent with Shahbaz (2009, 2012) in the case of Pakistan. Trade openness is positively linked with economic growth and significant at 1% level of significance. This implies that a 1% increase in trade openness enhances economic growth by 0.1412% if other things remain the same. This result supports the view of Shahbaz (2012) who reported that trade openness enhances economic growth by improving the total factor productivity. The value of R^2 shows that economic growth is 98.06% explained by corruption, financial development and trade openness in long run and the rest is for hidden factors.

The short run dynamics of corruption, financial development and trade openness on economic growth are reported in lower segment of Table 5. The results reveal that corruption impedes economic growth but it is statistically insignificant. Financial development adds in economic growth at 10% level of significant. Trade openness contributes to economic growth and it is statistically significant at 10% level of significant. The statistically significance of coefficient of lagged error term further validates our established long run relationship between the variables. Our results find that the estimate of lagged error terms has negative sign at 10% level of significance. Our estimate of lagged error term that (ECM_{t-1}) is −0.4829 confirms the validation of our estimated long run relationship between the series. The estimate of lagged error term (ECM_{t-1}) also indicates the speed of adjustment from short run towards long run equilibrium path. Our results expose that deviations in short run are corrected by 48.29% towards the long run and it would consume almost 2 years to reach equilibrium path in the case of Pakistan.

The short run model seems to fulfill the assumption of classical linear regression model (CLRM) regarding normality of error term, serial correlation, ARCH, white heteroskedasticity and specification of short run model. Our results find that error term has homoscedastic variance, normal distribution and no problem of serial correlation as well as ARCH is found. There is no evidence of white heteroskedasticity and functional form of short run model is designed well. Figs. 2 and 3 show results of stability tests such as CUSUM and CUSUMsq.

The results of CUSUM and CUSUMsq tests indicate that graphs of both are between the critical bounds at 5% level of significance. This confirms that the ARDL parameters are stable and efficient.

The results of VECM Granger causality approach provide long-and-short run relationships between the variables. In long run, the feedback hypothesis exists between corruption and economic growth. The bidirectional causal relationship is found between trade openness and economic growth and the same is true for trade openness and corruption. Economic growth is Granger cause of financial development validating supply-side effect (Table 6).

For short span of time, bidirectional causality is found between economic growth and corruption. The feedback hypothesis also exists between corruption and financial development. Trade openness and corruption are not interdependent. Finally, unidirectional causality is found running from financial development to economic growth. The joint long-and-short run analysis confirms the long run and short run causality relationships between the variables such as economic growth, corruption, financial development and trade openness.

5. Conclusion and policy implications

This paper explored the relationship between corruption and economic growth by incorporating financial development and trade openness in growth model using the data of Pakistan. The study has covered the period of 1987–2009. We applied structural break unit root test to test the order of integration of the variables. The ARDL bounds testing approach to cointegration was applied to examine long run relation between corruption, financial development, trade openness and economic growth. The robustness of long run results is tested by Gregory-Hansen structural break cointegration test. The direction of causal relationship between the series was tested by applying the VECM Granger causality approach.

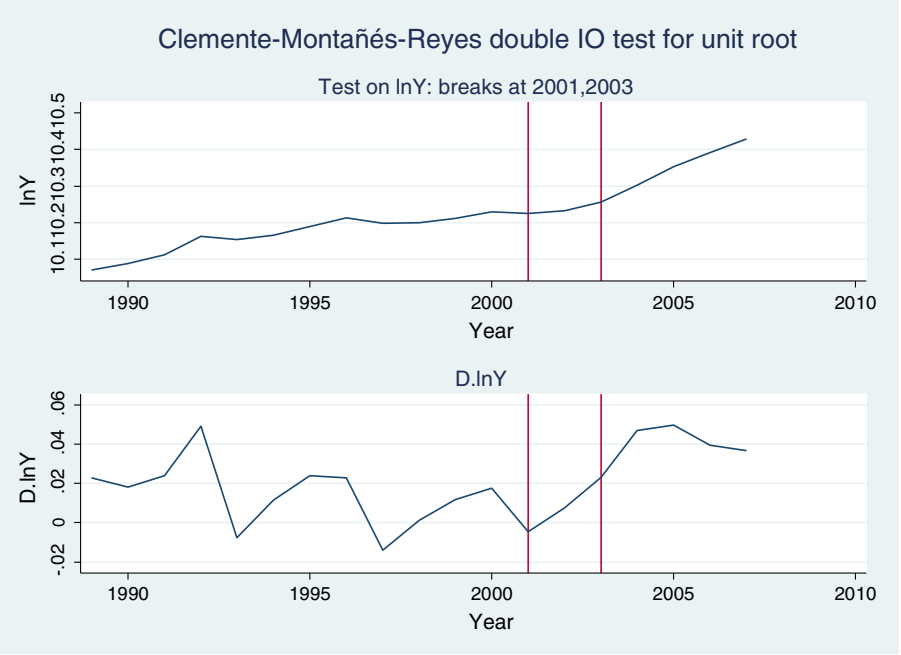
Our results found that the long run relationship exists between the variables. Further, we find that corruption impedes economic growth. Financial development enhances capitalization and hence boosts economic growth. Trade openness leads total factor productivity as well as increases domestic production and in resulting economic growth is boosted. The causality analysis reveals the feedback effect between corruption and economic growth. The bidirectional causality exists between trade openness and economic growth and, the same is true for corruption and trade openness. Financial development Granger causes economic growth, trade openness and corruption.

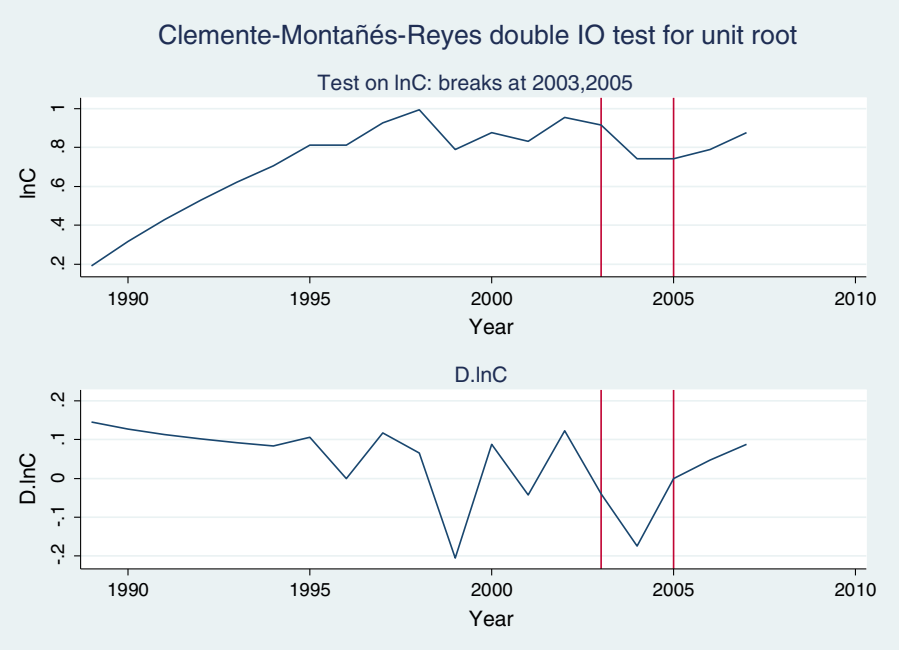
Our findings indicate the detrimental impact of corruption on economic growth. This implies that the government must take measures to reduce the level of corruption via improving the governance in the country. Improved governance will not only control corruption but also improve the quality of domestic institutions. Efficient institutions will have positive impact on trade through effective trade policies which result in accelerated economic growth. Due to improved governance, low level of corruption will be helpful in collecting tax revenues and increased tax revenue would be a fuel for development projects and hence economic growth. This shows that improved governance will be helpful in attaining optimal fruits of trade in the presence of financial development and hence economic growth is accelerated.

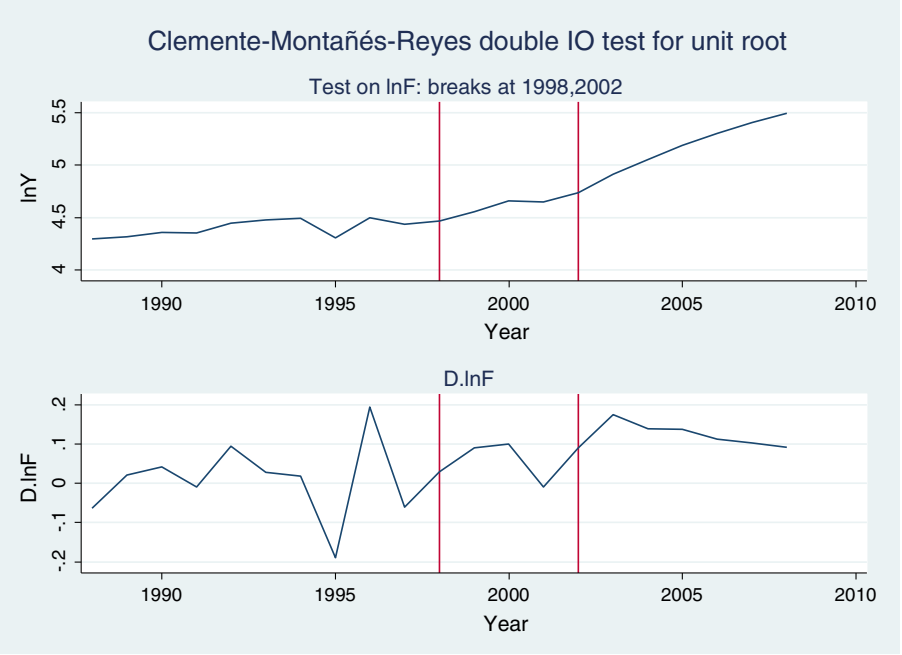
[8] Lütkepohl (2006) documented that dynamic link between the series can be captured by lag length selection.

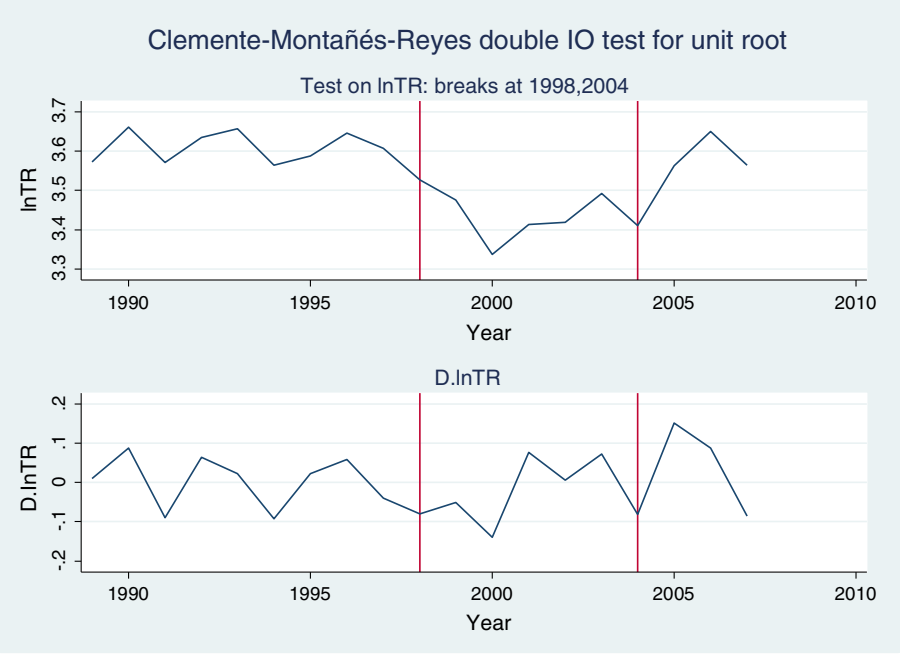
Appendix A

Clemente–Montanes–Reyes detrended structural break unit root test at level.

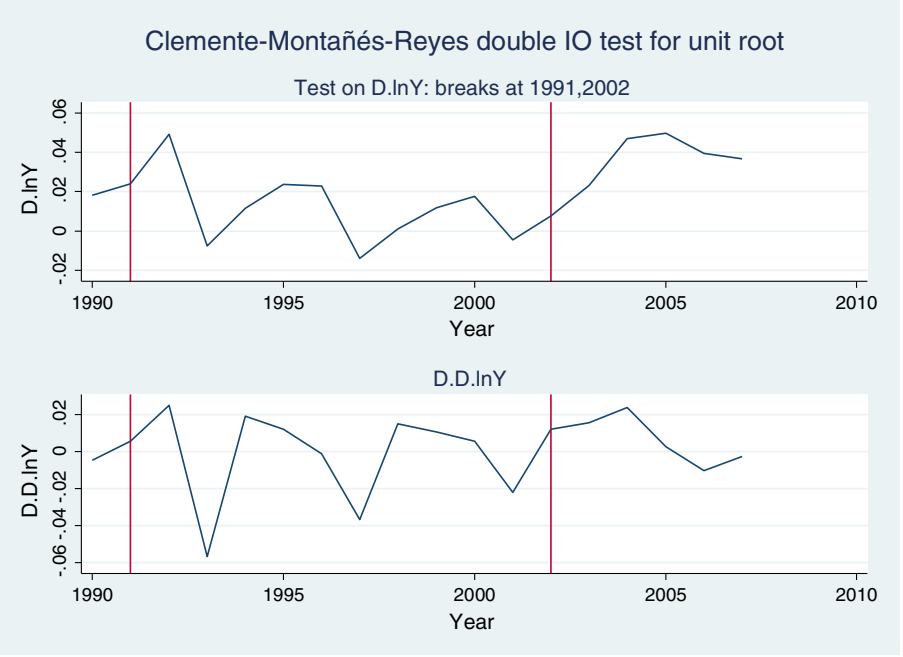


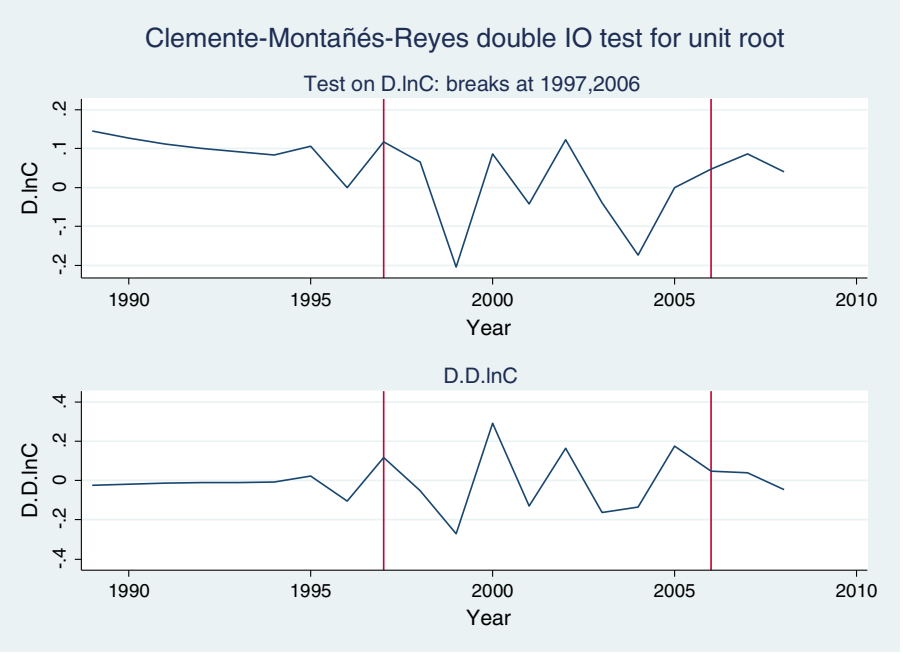


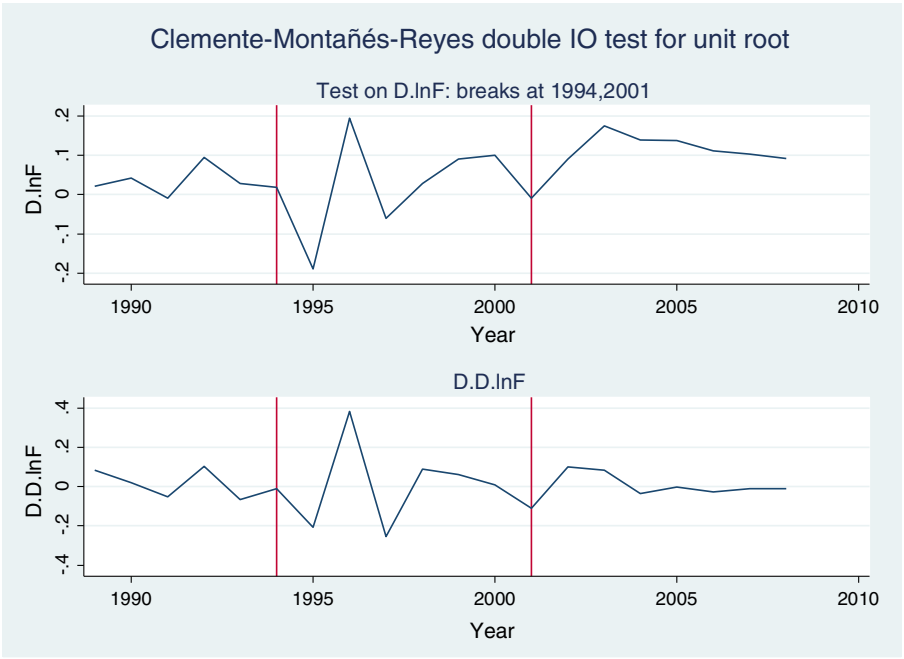

Clemente-Montañés-Reyes double IO test for unit root
Test on lnF: breaks at 1998,2002
lnY
4
4.5
5
5.5
1990
1995
2000
2005
2010
Year
D.lnF
-.2
-.1
0
.1
.2
Year

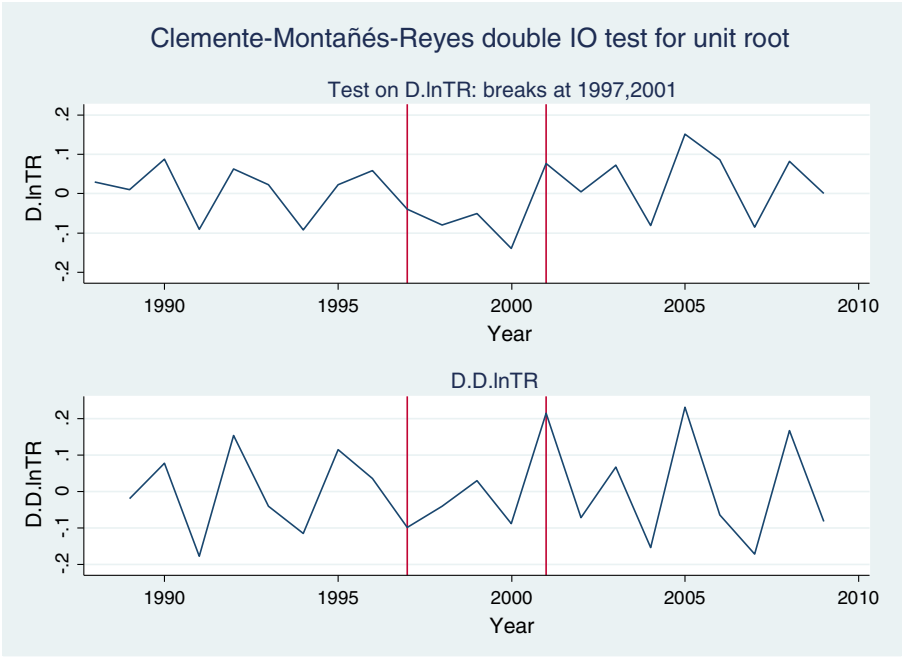

Clemente-Montañés-Reyes double IO test for unit root
Test on lnTR: breaks at 1998,2004
lnTR
3.3
3.4
3.5
3.6
3.7
1990
1995
2000
2005
2010
Year
D.lnTR
-.2
-.1
0
.1
.2
Year

Clemente–Montanes–Reyes detrended structural break unit root test at 1st difference.









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