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Trade openness and corporate tax rates determine FDI in Pakistan: a Cointegration-ECM analysis

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Abstract

A number of tries helped estimate a regression model, specifying short run and long run relationship between foreign direct investments (FDIs) and its two major determinants, namely trade openness and corporate tax rates in Pakistan. The estimated model, and both its Co-integration and ECM components, brings on surface certain important implications, for all major stakeholders. The public sector policy makers need to take note of the fact that foreign direct investment has been found being significantly affected positively by trade openness and negatively by corporate tax rates. So, efforts to enhance trade openness need to be encouraged. Similarly, the Federal Board of Revenue officials responsible for taxation policies in the country, should be aware of the fact that rates of corporate tax negatively and significantly affect FDIs in Pakistan; hence they should take this fact in to account while framing taxation policies and determining rates of taxes. The researchers interested in the topic for future research are urged to carry out research on optimizing relationship of tax rates and FDIs, for determining and quantifying the exact levels of relationship between the two variables.

JEL Classification: C13, C22, C32, C52
Keywords: FDI, Cointegration, ECM, Trade openness, Corporate tax rates, Pakistan.

I. INTRODUCTION

Foreign direct investment (FDI) is defined as the investment directly made into the production in a country by an investor or a company located in another country; such an investment is made either by buying a company in the target country or by expanding operations of an existing business in that country. Foreign direct investment is made for a number of reasons, including to take advantage of cheaper wages in the country, special investment privileges such as tax exemptions offered by the country as an incentive to gain tariff-free access to the markets of the country or the region. Foreign direct investment is in contrast to portfolio investment which is a passive investment in the securities of another country such as stocks and bonds (Wikipedia.org, 2012).

Foreign direct investment is influenced and affected by a number of factors. Nasreen, Baskaran and Muchie (2010) have pointed out that, "after adopting the liberalized policy measures in 1990s, there has been a significant increase in the FDI inflow", and both foreign investors and policy makers have identified "low cost labor as the major determinant of FDI inflow in Bangladesh". Beside the necessary logistic support, more simplified bureaucratic procedure, and prioritized investment can contribute to the increased FDI inflows. Stefanović (2008), after referring the OLI model, mentions that returns on foreign investment as a basic motive for FDI can be explained by three groups of factors: the ownership advantage of the firm (O), location factors (L) and internalization of transaction costs (I). Liu (2010) has shown that the source countries, with higher export ratio, depreciated exchange rate, lower borrowing cost, lower GDP per capita, higher relative labor cost, strong intellectual property rights (IPR) protection and higher volatility in their exchange rates, tend to invest more abroad. The author made this conclusion on the basis of a study on FDI inflows to China from 18 major source countries during 1989-2006. There has been some research on FDI and its determinants in Pakistan (Akhtar, 2000; Anjum and Nishat, 2005). This researcher intends to refresh this research, using recent and up-to-date data.

II. METHODOLOGY

A. Data

Data on FDI and its possible determinants (Appendix table I), pertaining to period 1981 – 2010 and converted in to natural logs, were found less varied in terms of standard deviation (SD) and coefficient of variation (COV) relative to the data in levels; hence data of the former form was used.

B. Methods

In accordance with the theory, as well as, on the basis of empirical studies referred earlier in Introductory section, it is concluded that foreign direct investment (FDI) is expected to depend on several factors, including the size of market of host country, costs of the projects, openness of the host country's trade, and so on. In the first attempt, a broader econometric model was used that included variables like GDP, GNP and country's total population (to represent proxies for the size of the market), corporate tax rate, labor wage rates and wholesale price index (to represent the levels of costs), and trade openness, literacy rates and urban population (as proxies to represent the country's openness to foreign investment, along with exchange rate, incidence of terrorist attacks and dummy for political regime/political system prevailed in the

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country.

All variables initially included in the model were then tested for unit root; those found as I(1), were then gone through the Cointegration and ECM analyses, for determining a long and short run relationship between FDI and its major determinants.

III. ANALYSIS AND FINDINGS

A. Data description

A simple comparison of the data, specifically on the basis of standard deviations (SD), reveals that data in level formulation are more variable relative to the data in natural-log formulation. For a more accurate comparison, coefficients of variation (CV) of various variables are estimated, using the formula:

$$c_v = \frac{\sigma}{\mu} \qquad (1)$$

Where the coefficient of variation (CV or Cv) is defined as the ratio of the standard deviation to the mean. Please refer to Appendix table 1 for Coefficients of variation (level versus natural-log data) which reveal that, after conversion of data in to natural-log formulation, its variations have been smoothened a lot. It further implies that the use of natural-log data would yield relatively better results; so from here onwards, the researcher is going to use natural-log data for further analysis.

B. Unit roots analysis

Since the data being used for this analysis pertains to time-series, and time series data usually have unit roots, meaning series data are non-stationary or are integrated of order 1 or I(1). In such a situation, the use of OLS yields spurious results, and regression is referred to as nonsense regression (Gujarati, 2007; p.825). The use of OLS relies on the stochastic process being stationary; when the stochastic process is nonstationary, the use of OLS can produce invalid estimates. Granger and Newbold (1974) called such estimates 'spurious regression' results, having high R^2 values and high t-ratios, yielding results with no sensible meaning. It is therefore recommended that time-series data should first be tested for unit roots, and then decision about the use of OLS or some other methods should be made. Accordingly, all variables, including both dependent and independent ones, have been tested for unit roots. Please refer to Appendix table II for the results of Augmented Dicky-Fuller (ADF) test.

The Augmented Dicky-Fuller (ADF) test statistic = -0.9936 (at p = 0.742) for variable FDI turns out to insignificant and less negative than the test's critical values at all three significant levels (1%, 5% and 10%); the null hypothesis of a unit root in case of variable FDI is therefore accepted (Panel A of Appendix table II).

Additionally, when the ADF test is again carried out at the First difference (Panel B of Appendix table II), it becomes significant at p < 0.01, and turns out to be more negative (-5.69857) than the critical values at all three significant levels (1%, 5% and 10%); this reconfirms that, after the first-differencing, the unit root of the series at the levels has transformed from nonstationary, I(1), to stationary, I(0).

In the same way, the ADF tests for unit roots have been carried out at level and at the 1st differences for all other variables; please refer to Appendix table III for results. The ADF test statistics, for the variables at levels, have turned out to be statistically insignificant at p-values > 10, suggesting the presence of unit roots in the concerned series of all independent variables. When these variables were re-tested for unit roots at the 1st differences, all variables but one (LWPI) have transformed from nonstationary or I(1) to stationary I(0); LWPI seems to have the 2nd root.

C. Cointegration analysis

With the exception of variable LWPI (which seems to have the 2nd root), all other variables, dependent (LFDI) and independent, have turned out to have unit roots, and are nonstationary or are of the same order of integration, that is, I(1); so these variables can now be subjected to Cointegration test for finding out whether there is a long-run relationship between them. This test is carried out in two steps (Gujarati, 2007: 841-843; Maddala, 2001:.258-260); the steps are:
Step 1: Run regression of the following type:

$$Y = \beta_0 + \beta_1 X + u_t \qquad (2)$$

And save residuals ut, for the use in step 2, as shown below.
Step 2: Regress the 'differenced residuals' on its lagged to test for stationarity, like:

$$\Delta u_t = \alpha_1 u_{t-1} + e_t \qquad (3)$$

Where $\Delta u_t = u_t - u_{t-1}$

If equation (2) is tested for unit root (like in section III (B) above), and it turns out to be stationary, that is, I(0), it would mean regression like equation (2) is cointegrated, and would not yield spurious results if OLS is used. Such a relationship (2 & 3) would prove that Y and X have long-run relationship.

D. The model:

Before carrying out the test for cointegration or long-run re-

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lationship, the study has to decide on the exact specification of the model. In accordance with the theoretical framework, foreign direct investment (FDI) is expected to depend on several factors, including the size of market available for the products and services for which FDI is intended to be invested, costs expected to be incurred, openness of the country's trade, and so on.

Proxies included for the size of the market are: GDP (LGDP), GNP (LGNP) and country's total population (LPOP). These all three variables have been tested for normality. Please refer to Appendix table IV that provides results of normality tests of all the variables. It is revealed that series of all these three variables are normally distributed (p-vales of both normality tests, Kolmogorov-Smirnov and Shapiro-Wilk, are > 0.10). Hence, our regression process would determine which one of these three variables would better contribute. Proxies included to represent the levels of costs are corporate tax rate (LCTR), labor wage rates (LWR) and wholesale price index (WPI). The variable LWPI seems to have the second root; hence this variable cannot be included in the cointegration analysis. It has been found that LCTR has the lower CV value than that of LWR. Annexure table IV reflects that data of the series on LWR are normally distributed, while that of CTR do not. On the basis of both COV and normality tests, we cannot decide which one of the two variables (LCTR and LWR) would better perform; the decision is left on the regression process itself.

The variables like trade openness (LTO), literacy rates (LLR) and urban-population (LUP) have been included as proxies to represent the country's openness to foreign investment. Trade openness (LTO), though has a little higher CV value, it is the only variable whose data are normally distributed (Appendix table IV). In light of the above discussion, LGDP, LGNP or LPOP, LCTR or LWR and LTO seem suitable candidates, in addition to exchange rate (LER), incidence of terrorist attacks (LTA), dummy for political regime/political system (PSD) and GDP lagged one period (LGDPL), which need to be tested as determinants of the FDI in Pakistan. The econometric model is thus specified, as follows.

FDI = f(LGDP or LGNP or LPOP, LCTR or LWR, LTO, LER, LTA, PSD, LGDPL) (4a)

We gave a number of tries to model 4(a), and had to reduce/eliminate certain highly insignificant variables; the model has left out with the following variables:

FDI = f(LTO, LCTR) (4b)

E. Cointegration step 1: empirical results:

The empirical results of the estimated Model (4b) are provided in Appendix table V. The model gives a good fit to the data; F-statistic = 317.982 shows model as a whole is highly significant at $p < 0.01$, while $R^2 = 0.959$ reflects that 95.90% variation in dependent variable (FDI) has been explained by variations in the two explanatory variables included. DW = 1.420 falls in no-autocorrelation zone (du= 1.339 < DW < 4 – du = 2.661 for n = 30, K' = 2 & p = 0.01). The collinearity statistics provided in the terms of VIF suggest that some moderate type of multicollinearity exists between the two explanatory variables.

As far as explanatory variables are concerned, variable LTO is statistically significant at $p < 0.01$ and LCTR at $p < 0.05$, and both explanatory variables carry expected signs as per the relevant theory.

F. Testing for model misspecification: Ramsey's RESET test

We started with seven explanatory variables (Model 4a), and ended up with only two significant explanatory variables (Model 4b); it seems appropriate to check whether the estimated model is correctly specified. Ramsey's 'Regression Specification Error Test' (RESET) is a good measure to check misspecification of an estimated model (Gujarati, 2007: 532 – 534); this test requires:

$$FDI = f(LTO, LCTR, FDI^2, FDI^3) \quad (5)$$

After running regression like (5), the F statistic is computed using the values of R^2 of the old model (4b) and new model (5), in the following manner.

$$F = \{(R^2_{new} - R^2_{old})/\text{number of new regressors}\} / \{(1 - R^2_{new})/(n-k)\} \quad (6)$$

Please refer to Appendix table VI for results. The empirical results portray very meager contributions of both newly added regressors, FDI^2 and FDI^3; the former was excluded by the model itself while the latter added little change in R^2 (from R2old = 0.959 to R2new = 0.960); putting these values in (6):

$$F = \{(0.960 - 0.959)/1\} / \{(1 - 0.960)/(30-4)\} \quad (7a)$$
$$= 0.6502 \quad (7b)$$

$F_{calculated} = 0.6502 < F_{tabulated;\ 0.05,\ DF\ (1,26)} = 4.26$; hence the estimated model (4b; Appendix table V) is not misspecified as per Ramsey's RESET test.

G. Cointegration step 2: empirical results

Before providing an interpretation of the results of cointegration step 1, it is necessary that the second step of cointegration analysis, already explained in the form of equation 3,

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is carried out. Accordingly, we estimated the second part of the model. Please refer to Appendix table VII for results. The τ-computed = - 5.71, which is much more negative than ADF critical values at 1% (-2.66) and 5% (-1.95) provided in Gujarati (2007, Table D.7, p.995), suggests that the first-differenced residuals regressed over residuals lagged one period are stationary, and this fulfills the condition of the cointegration of Model (4b), discussed in terms of Model (2 & 3). Additionally, the results regarding cointegration on the basis of Johansen-Juselius cointegration are also confirmed; the later test reinforces that there is at most one (and the same) cointegration relationship among the variables.

H. Dynamic/short-run: error correction model (ECM)

The results of Model 4(b) portray the long-run relationship of dependent variable FDI with its determinants. Error Correction Model (ECM), popularized by Engle and Granger, states that if a dependent variable and their determinants are cointegrated like they did in our above case (Subsection III-G), then their short-run dynamic relationship can also be measured through Error Correction Model (ECM), postulated, as follows.

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 u_{t-1} + e_t \quad (8)$$

The ECM measure postulated in (8) states that α2 is always zero, and residuals (u_{t-1}) can be both negative and positive; so product term '$\alpha_2 u_{t-1}$' can make changes in dependent variable in both ways, positive and negative, provided α_2 turns out to be statistically significant. Please refer to Appendix table VIII for the estimated results of model (8). The coefficient α_2 of the lagged residual u_{t-1} of Model 8 (coefficient of RESID_LAG = - 0.795 in our case) has turned out to be negative and statistically significant at $p < 0.01$, suggesting that model exhibits both short-run and long-run effects; α_1 reflects the short-run effect of change in explanatory variable (coefficient of DLTO = 2.91 & coefficient of DLCTR = -4.41) on dependent variable, and α_2 is error correction or adjustment coefficient, showing how much adjustment takes place to the equilibrium during each period or how much of the equilibrium error is corrected.

I. Summarizing the results

The cointegartion analysis and ECM modeling, carried out in the preceding sections, yielded the following results.

Cointegrated model:

$$LFDI = f(LTO, LCTR,) \quad (9a)$$

$$= 0.044 + 1.845LTO - 4.365LCTR \quad (9b)$$

(0.0) (0.042)

ECM model:

$$\Delta Yt = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 u_{t-1} + e_t \quad (10a)$$

$$\Delta FDI = - 0.156 + 2.91\Delta LTO - 4.41\Delta LCTR - 0.795u_{t-1} \quad (10b)$$

(0.016) (0.275) (0.001)

(Figures in parentheses are p-values)

Whereas the cointegration analysis yielded a static/equilibrium model (model 9), showing the effects of changes in explanatory variables (LTO & LCTR) on dependent variable (LFDI), occurring instantaneously; the ECM modeling yielded a dynamic model (model 10) wherein the changes in explanatory variables seem to bring disequilibrium in dependent variable in the short-run, however the long-run adjustment coefficient of residuals (through changes in residuals) makes corrections and bring equilibrium back within a short duration (1 / 0.795 = 1.26 period, say years) as the adjustment coefficient happens to have substantial value (0.795).

Trade openness (TO) and corporate tax rates (CTR) have appeared to be the major determinants of foreign direct investment (FDI) in Pakistan, and the both variables seem to be capable of causing elastic changes in FDI (2.914 and -4.411), the former in positive and the latter in negative direction.

A number of tries helped estimate a regression model, specifying relationship between foreign direct investments (FDI) and its two major determinants, namely trade openness (TO) and corporate tax rates (CTR) in Pakistan; the model adopts the form: lnFDI = 0.044 + 1.845lnTO – 4.365lnCTR. The model gives a good fit to the (log) data for 1981 – 2010 in terms of F-statistic = 317.982 ($p < 0.01$) and $R^2 = 0.959$. As far as explanatory variables are concerned, variable lnTO is statistically significant at $p < 0.01$ and lnCTR at $p < 0.05$, and both explanatory variables carry expected signs as per the relevant theory. Ramsey's RESET test yielded $F_{calculated} = 0.6502$, which is less than $F_{tabulated; 0.05; DF = (1, 26)} = 4.26$, suggesting that the original estimated model is not under-fitted or misspecified. Since the three time-series (FDI, TO & CTR), used in estimation of the aforementioned model, were I(1), they were checked for the second condition of Cointegration, that required testing of the first-differenced residuals for I(0); the model fulfilled this condition of the cointegration. The estimated model thus portrays the long-run relationship of dependent variable FDI with its two major determinants. The model was further checked for the short-run dynamic relationship, using Error Correction Mechanism (ECM), which resulted in: $\Delta FDI = - 0.156 + 2.91\Delta TO - 4.41\Delta CTR - 0.795u_{t-1}$. The coefficient of the lagged residual (u_{t-1}), having value = -0.795, has turned out to be negative and statistically significant at $p < 0.01$, suggesting that this model exhibits both short-run and long-run effects. The coefficient of lagged residual (u_{t-1}), being the long-run adjustment coefficient makes corrections and brings

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equilibrium back within a short duration (1 / 0.795 = 1.26 period, say years); this adjustment coefficient happens to have a substantial value (0.795).

IV. CONCLUSION AND RECOMMENDATIONS

The aforementioned estimated model (both its Cointegration and ECM components) helps us to draw three major conclusions, namely:

First, whereas the cointegration analysis yields a static/equilibrium model, showing effects of changes in explanatory variables (LTO & LCTR) on dependent variable (LFDI), occurring instantaneously; ECM measure yields a dynamic model, wherein the changes in explanatory variables seem to bring disequilibrium in dependent variable in the short-run, however the long-run adjustment coefficient of residuals (through changes in residuals) makes corrections and brings equilibrium back within a short duration (1 / 0.795 = 1.26 periods, say years) as the adjustment coefficient happens to have substantial value (0.795).

Second, trade openness (TO) and corporation tax rates (CTR) appear to be the major determinants of foreign direct investment (FDI) in Pakistan, and the both variables seem to be capable of causing elastic changes in FDI (2.914 and -4.411), the former in positive and the latter in the negative direction.

Third, both of the above referred conclusions have certain important implications, for all major stakeholders including foreign investors, government of Pakistan and the local investors interested in bringing foreign investments in Pakistani domestic market. The public sector policy makers should take note of the fact that foreign direct investment (FDI) has been found being significantly affected positively by trade openness and negatively by corporate tax rates. The estimated model, both its Cointegration and ECM components, have certain important implications, for all major stakeholders. The public sector policy makers should take note of the fact that foreign direct investment (FDI) has been found being significantly affected positively by trade openness and negatively by corporate tax rates. So efforts to enhance trade openness should be encouraged. Similarly, the Federal Board of Revenue (FBR), which is responsible for taxation policies in the country, should take note of the fact that rates of corporate tax negatively and significantly affect FDIs; hence they should take this fact in to account while framing taxation policies and determining rates of taxes. The researchers interested in the topic for future research are urged to carry out research on optimizing relationship of tax rates and FDIs, for determining and quantifying the exact levels of relationship between the two variables.

APPENDIX I

Coefficients of variation (level versus natural-log data)

Names of Variables	Coefficient of Variation (CV)	
	Level data	Natural-log-data
FDI	1.663377	0.201319
GDP	1.217415	0.100722
GNP	1.103857	0.081245
Trade openness (LTO)	1.144034	0.092416
Exchange rate (LER)	0.570055	0.183907
Corporate tax rate (CTR)	0.098173	0.028275
Wage rate (LWR)	0.703163	0.086862
LWPI	0.720169	0.189934
Literacy rate (LLR)	0.260326	0.072490
Urban population (LUP)	0.297730	0.081862
Terrorist attacks (LTA)	1.415366	0.426614
Political system (LPS)	1.245000	1.245000
Population (LPOP)	0.204732	0.043078

APPENDIX II

PANEL A: ADF TEST OF FDI AT LEVEL

Null Hypothesis: LN_FDI has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic - based on SIC, maxlag=7)			
		t-statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.9936	0.742
Test critical values:	1% level	-3.6793	
	5% level	-2.9677	
	10% level	-2.6229	

PANEL B: ADF TEST OF FDI (AT 1ST DIFFERENCE)

Null Hypothesis: D(LN_FDI) has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic - based on SIC, maxlag=7)			
		t-statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.6985	0.0001
Test critical values:	1% level	-3.6891	
	5% level	-2.9718	
	10% level	-2.6251	

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APPENDIX III

Unit root analysis of independent variables

Variables	At Level		At 1st Difference	
	ADF test statistic	p-value	ADF test statistic	p-value
LGDP	0.421949	0.9802	-8.01136	0.0000
LGNP	0.539623	0.9852	-4.89068	0.0005
LTO	0.501967	0.9838	-2.91789	0.0586
LER	-1.35114	0.5918	-3.97167	0.0061
LCTR	-0.57087	0.8623	-4.03142	0.0044
LWR	0.497844	0.9837	-5.04167	0.0003
LWPI	-0.59377	0.8572	-1.73435	0.4034
LLR	-1.17181	0.6727	-3.59597	0.0125
LUP	-0.59377	0.8572	-5.89072	0.0000
LTA	-2.37628	0.1568	-6.23567	0.0000

APPENDIX IV

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
LGDP	.103	30	.200*	.946	30	.136
LGNP	.083	30	.200*	.957	30	.253
LPOP	.081	30	.200*	.960	30	.315
LCTR	.239	30	.000	.797	30	.000
LWR	.120	30	.200*	.950	30	.167
LTO	.088	30	.200*	.954	30	.217
LLR	.115	30	.200*	.919	30	.025
LU P	.113	30	.200*	.938	30	.082

APPENDIX V

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.979a	.959	.956	.40000	1.420

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	101.753	2	50.876	317.98	.000a
	Residual	4.320	27	.160		
	Total	106.072	29			

COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	.044	5.107		.009	.993
TO (Ln)	1.845	.163	1.182	11.35	.000
CTR (Ln)	- 4.365	2.050	-.222	-2.13	.042

APPENDIX VI

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.980a	.960	.955	.40491	1.423

COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	.044	5.107		.009	.993
TO (Ln)	-.698	5.321	-.698	5.321	-.698
CTR (Ln)	2.076	.424	2.076	0.424	2.076
FDI	-4.914	2.274	-4.914	2.274	-4.914

APPENDIX VII

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.728	.530	.513	.35298	.728

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.067	1	4.067	32.638	.000a
	Residual	3.613	29	.125		
	Total	7.680b	30			

COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Residual lagged	-1.05	.185	-.728	-5.71	.000

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APPENDIX VIII

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.670	.449	.383	.39711	1.694

ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.	
1	Regression	3.219	3	1.073	6.803	.002a
	Residual	3.942	25	.158		
	Total	7.161	28			

COEFFICIENTS

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.156	.183		-.85	.402
DLTO	2.91	1.12	.410	2.58	.016
DLCTR	-4.41	3.955	-.175	-1.11	.275
RESID_LAG	-.795	.216	-.558	-3.68	.001

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BIOGRAPHIES

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