# Investigating the Relationship between Trade Liberalization and Foreign Direct Investment: Evidence from Algeria.

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## Abstract

This paper explores the causal relationship among trade liberalization, foreign direct investment, financial liberalization and economic growth for Algeria over the period 1995–2017. The Autoregressive Distributed Lag (ARDL) bounds test is used to test for the presence of co-integration, whereas the Toda and Yamamoto test is used for direction of causality.

The findings of ARDL bounds test validate the existence of co-integration among the included variables. Further, the Toda and Yamamoto test affirms that there is bidirectional causality between trade liberalization and foreign direct investment. Additionally, there is a unidirectional causality running from financial liberalization to foreign direct investment as well as unidirectional causality running from economic growth to foreign direct investment.

**Keywords:** Foreign direct investment; Trade liberalzation; Toda-Yamamoto test; Algeria.

**JEL classification codes**: C32, F12, F21, F41.

**ملخص**

تكشف هذه الورقة البحثية العلاقة السببية بين التحرير التجاري، الاستثمار الأجنبي المباشر، التحرير المالي والنمو الاقتصادي في الجزائر خلال الفترة 1995-2017، باستخدام اختبار الحدود- الانحدار الذاتي للفجوات الزمنية الموزعة المتباطئة (ARDL) لاختبار وجود التكامل المتزامن، كما تم استخدام اختبار Toda-Yamamoto لكشف اتجاه العلاقة السببية طويلة الأجل.

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كشفت نتائج اختبار الحدود–ARDL وجود علاقة تكامل متزامن بين المتغيرات المشمولة، وعلاوة على ذلك أكدت نتائج اختبار العلاقة السببية لـ Toda و Yamamoto وجود علاقة سببية ثنائية الاتجاه بين التحرير التجاري والاستثمار الأجنبي المباشر، إضافة إلى وجود علاقة سببية أحادية الاتجاه تسير من التحرير المالي و النمو الاقتصادي نحو الاستثمار الأجنبي المباشر.

**كلمات مفتاحية:** الاستثمار الأجنبي المباشر، التحرير التجاري، اختبار السببية لـ Toda وYamamto، الجزائر.

## 1. INTRODUCTION

Over the last few decades foreign direct investment has become an important source of external finance worldwide (Maliela & Quattara, 2017). Many countries actively seek to attract foreign direct investment because they believe that multinational enterprises will contribute to economic growth by creating new job opportunities, increasing capital accumulation, new technology, acquisition and diffusion of technical, managerial and organizational skills (Despordes & Wei, 2017). Indeed, a large body of empirical evidence shows that FDI tends to generate net gains for both home and host countries. The growth-enhancing effects of FDI flows have motivated a thorough investigation of their determinants. Robust push and pull factors are market size, financial development, exchange rate, relative labour market endowments, and corporate tax rates (Bayrak, 2013; Blonigen & Piger, 2014; Yang, Xiong, & Ze, 2013). Trade liberalization should certainly be added to this list (Ramasamy & Yeung, 2010).

Global trade liberalization has made it easier for multinational enterprises to set up international production networks, so that a larger share of production is shipped to international customers or Subsidiary companies in other countries rather than sold to local customers. This has reduced the effect of market size and allowed smaller countries to compete for investments that would automatically have been directed to the major markets some decades ago (Vukanović, 2016). Empirical studies have evidenced that foreign direct investment and trade liberalization are

interlinked. This nexus has become more complex in World Trade Organization regime where various developing economies have adopted the import liberalization policies. The growing volumes of the trades of economies in their regime made the policy makers concentrate flicked based on the assumption that whether foreign direct investment causes trade or trade boosts foreign direct investment inwards. especially concern was that what kind of trade boosts foreign direct investment (Khan & Hye, 2014).

The core objective of this paper is to analyze empirically the causal relationship between trade liberalization, financial liberalization, economic growth and foreign direct investment. This paper is different from other works in two folds. Firstly, this paper employs a multivariate framework in contrast to most prior studies on Algeria that use bivariate or at most trivariate frameworks. Using a multivariate framework will avoid biased and inconsistent results caused by the omission of relevant variables. Secondly, this study uses data over the period 1995-2017 in order to verify the long run relationship among the incorporated set of variables. In the process of achieving the objectives, long-run relationship among the variables is tested using ARDL bounds test and causality is tested using Toda and Yamamoto causality test.

The remainder structure arrangement is as follows. Section 2, deals with relevant literature review. Section 3, shows the empirical methodology and data used in this paper. Section 4, explains empirical results. Section 4, concludes the study.

## 2. Literature review

Many studies have explored the connection between trade liberalization and foreign direct investment in recent years. This is particularly due to the important role that trade liberalization plays in foreign direct investment. In relation to the effect of trade liberalization on foreign direct investment, proponents for trade liberalization (Helleiner, 2002; Candros, Orts, & Alguacil, 2004; Liargovas & Skandalis, 2012; Zakaria, Naqui, Fida, & Hussain, 2014; Seyoun, Wu, & Lin, 2013) contend that trade liberalization enhances competition which in turn increases efficiencies, technical change, and product improvement, reduced costs of

production, generate economic growth via increasing profits which encourage growth of foreign capital investment and inflows of expertise, and enhanced equal access to scarce resources which improves the overall resource allocation and eliminates corruption in the system.

(Candros, Orts, & Alguacil, 2004) used quarterly data for Mexico, Brazil, and Argentina, in which they employed a VAR model to investigate the causal relationship among trade, foreign direct investment inflows and production. Their empirical investigation resulted mixed outputs. They found trade openness and foreign direct investment to be complements in Mexico, with causality running from foreign direct investment to trade. Contrary to this finding, their study found that trade and foreign direct investment exhibited substitutive relationship in Brazil, whereas in Argentina they found no causal relationship.

(Liargovas & Skandalis, 2012), examine the importance of trade liberalization policy for attracting Foreign Direct Investment inflows, using a sample of 36 developing economies for the period 1990–2008. It provides a direct test of causality between foreign direct investment inflows, trade openness and other key variables in developing regions of the world as Latin America, Asia, Africa, Commonwealth of Independent States and Eastern Europe. Trade liberalization policy is measured by using eight different indicators. The main empirical results of the panel regression analysis indicate that in the long run, trade liberalization contributes positively to the inflow of foreign direct investment in developing economies.

(Zakaria, Naqui, Fida, & Hussain, 2014) examine the impact of trade liberalization on foreign di-rect investment (FDI) in Pakistan using quarterly data from 1972 to 2010. The findings suggest that there is a significant positive relation between trade liberalization and FDI. The results are robust under alternative trade liberalization measures and different model specifications. The results indicate that the factors that drive foreign investment have a differential impact on FDI flows to Pakistan. Specifically, human and physical capitals, capital re-turn, infrastructure development, terms of trade and urbanization promote FDI in Pakistan.

Foreign debt and inflation lead to deteriorating foreign investment in the country. Another important finding is that the effect of trade liberalization on FDI has been augmented after the inception of a flexible exchange rate system in Pakistan.

By using annual balanced panel data for 25 sub-Saharan African economies over the period 1977-2009. (Seyoun, Wu, & Lin, 2013) investigate the Granger causality relationship between trade openness and foreign direct investment for the region. We took advantage of recent developments in econometric testing techniques for Granger non-causality heterogeneous panels that takes into consideration the impacts of cross section dependence across the units of the panel data set to analyse the trade–foreign direct investment nexus in the region. The empirical result of this study reveals a bidirectional causal relationship between trade openness and foreign direct investment in sub-Saharan economies.

For the period 1970-2009. (Ghani, 2015) identify the major determinant of the inward flows of FDI for Malaysia by employing the bounds testing (ARDL) approach to cointegration. Of all the variables being tested, trade openness is found to be the most influential variable in attracting the inflows of FDI as it shows consistent results in the short run as well as in the long run in all models being tested.

(Grangnon, 2017) uses a panel data set comprising 171 countries spanning the period 1995–2012 to investigate multilateral trade liberalization affect inward foreign direct investment. The results indicate that multilateral trade policy liberalisation is conducive to higher FDI inflows in host countries. Furthermore, our evidence suggests that domestic trade policy almost always positively drives inward FDI in a context of multilateral trade policy liberalisation. Countries which initially have the most restrictive trade policy regimes appear to be the greatest beneficiaries of FDI inflows when they liberalise their trade policy in the context of multilateral trade liberalisation.

In Sub-Saharan Africa, (Cantah, 2018) develop a new measure of trade liberalization to re-examine the relationship between foreign direct investment and trade policy liberalization using principal component analysis. This new measure captures the ease of trading activities and trade

tariffs. Dynamic panel estimation technique was used to analyze the nexus between trade policy liberalization and foreign direct investment in Sub-Saharan Africa countries. The findings indicate that an open economy attracts foreign direct investment.

## 3. Data and methodology

The study employs annual time series data from 1995 to 2017. The data of foreign direct investment (FDI). Trade liberalization index (TRL). Financial Liberalization index (FNL). Gross domestic product (GDP) per capita to proxy economic growth. The data of foreign direct investment and gross domestic product were retrieved from the World Development indicators of World Bank database. Trade liberalization and financial liberalization from economic freedom index.

### 3.1. Stationary test:

The first step in causality analysis is to check unit root problem in the data. Therefore we used Augmented Dickey Fuller (ADF) test to investigate the order of integration of all the variables. If a series has constant mean and variance at level form it is represented as I (0) and we call it stationary series. A non-stationary series has changing mean and variance which can be made stationary by taking first difference or second difference of the series denoted as I (1) and I (2). Gujarati and Brooks used the following functional form for ADF test:

$$\Delta Z_t = \beta_1 + \beta_{2t} + \delta Z_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Z_{t-1} + \varepsilon_t \ldots\ldots\ldots (1)$$

$$\Delta Z_t = \beta_1 + \delta Z_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Z_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (2)$$

$$\Delta Z_t = \delta Z_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Z_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where $\Delta$ = the change operator, $Z_t$ = variables series (to be checked for the problem of unit root), $Z_{t-1}$ = lagged values, $\Delta Z_{t-1}$ = ($Z_{t-1}$ - $Z_{t-2}$), $\Delta Z_{t-2}$ = ($Z_{t-2}$ - $Z_{t-3}$) shows the first difference etc, $\beta_1$ = constant, $\beta_2 t$ = trend, t represents time variable and $\varepsilon t$ indicates white noise error term. The decision rule was that if ADF test statistic value was higher than the critical values at 5% significance level then we call it stationary series but if the test statistic value was lower than the critical values then we call it non stationary series (Gujarati, 2011; Brooks, 2008).

### 3.2. Co-integration test:

This study employed ARDL bounds testing approach of co integration which was developed by Pesaran and Shin (Pesaran, Shin, & Smith, 2001) to investigate the causality between trade liberalization and foreign direct investment for Algeria. An advantage of the ARDL co-integration approach over other cointegration methods is that it can be used regardless of whether the regressors are I(1) and/or I(0). So, it can be applied irrespective of whether underlying regressors are purely I(0), purely I(1), or mutually co-integrated, and thus, there is no need for unit root pre-testing. Another advantage is that it is a statistically more significant approach to determine the co-integration relation in small samples. In addition, the ARDL approach tolerates different optimal lags the variables may have, while it is impossible with classical co-integration procedures (Ocal & Aslan, 2013).

A final advantage is the ARDL approach provides unbiased long-run estimates even when some of the variables are endogenous (Adom, 2011). The first step in the ARDL approach is to specify the Unrestricted Error Correction Model (UECM) as follows:

$$\Delta FDI_t = a_{10} + \beta_{10}t + \sum_{i=}^{n} \beta_{11}\,\Delta FDI_{t-i} + \sum_{i=}^{n} \beta_{12}\,\Delta TRL_{t-i} + \sum_{i=}^{n} \beta_{13}\,\Delta FD_{t-i} + \sum_{i=}^{n} \beta_{14}\,\Delta GDP_{t-i} + \delta_{11}FDI_{t-1} + \delta_{12}TRL_{t-1} + \delta_{13}FD_{t-1} + \delta_{14}GDP_{t-1} + ECT_{t-1} + \varepsilon_{t1} \ldots\ldots (4)$$

$$\Delta TRL_t = a_{20} + b_{20} + \sum_{i=}^{n} \beta_{21}\,\Delta TRL_{t-i} + \sum_{i=}^{n} \beta_{22}\,\Delta FDI_{t-i} + \sum_{i=}^{n} \beta_{23}\,\Delta FD_{t-i} + \sum_{i=}^{n} \beta_{24}\,\Delta GDP_{t-i} + \delta_{21}TRL_{t-1} + \delta_{22}FDI_{t-1} + \delta_{23}FD_{t-1} + \delta_{24}GDP_{t-1} + ECT_{t-1} + \varepsilon_{t2} \ldots\ldots (5)$$

$$\Delta FD_t = a_{30} + b_{30} + \sum_{i=}^{n} \beta_{31}\,\Delta FD_{t-i} + \sum_{i=}^{n} \beta_{32}\,\Delta TRL_{t-i} + \sum_{i=}^{n} \beta_{33}\,\Delta FDI_{t-i} + \sum_{i=}^{n} \beta_{34}\,\Delta GDP_{t-i} + \delta_{31}FD_{t-1} + \delta_{32}TRL_{t-1} + \delta_{33}FDI_{t-1} + \delta_{34}GDP_{t-1} + ECT_{t-1} + \varepsilon_{t3} \ldots\ldots (6)$$

$$\Delta GDP_t = a_{40} + b_{40} + \sum_{i=}^{n} \beta_{41}\,\Delta GDP_{t-i} + \sum_{i=}^{n} \beta_{42}\,\Delta TRL_{t-i} + \sum_{i=}^{n} \beta_{43}\,\Delta FD_{t-i} + \sum_{i=}^{n} \beta_{44}\,\Delta FDI_{t-i} + \delta_{41}GDP_{t-1} + \delta_{42}TRL_{t-1} + \delta_{43}FD_{t-1} + \delta_{44}FDI_{t-1} + ECT_{t-1} + \varepsilon_{t4} \ldots\ldots (7).$$

Where $\Delta$ represents the First differenced operators, $a_{10}, \ldots\ldots a_{40}$ are the constant terms, $b_{10}t, \ldots\ldots b_{40}t$ are the trend terms, $\beta_{11} \ldots\ldots \beta_{44}$ represents the short-run coefficients, $\delta_{11} \ldots\ldots \delta_{44}$ represents the long-run coefficients

and $\varepsilon_{t1} \ldots\ldots \varepsilon_{t4}$ are the error terms. After specifying the UECM, the nest step is to test for joint significance on the lagged variables in Eqs. (4), (5), (6), (7) using the F-test. The null hypothesis of no co-integration is specified as:

$$H_0: \delta_{11} = \delta_{12} = \delta_{13} = \delta_{14} = 0, \delta_{21} = \delta_{22} = \delta_{23} = \delta_{24} = 0, \delta_{31} = \delta_{32} = \delta_{33} = \delta_{34} = 0, \delta_{41} = \delta_{42} = \delta_{43} = \delta_{44} = 0.$$

Once the F-test has been computed it should be compared to the critical values. This study employs the critical values proposed by Narayan which is specifically generated for small sample size (Narayane, 2005). If the computed F-statistic falls below the lower bound critical value, the null hypothesis is not rejected and it can be concluded that there is no cointegration. If the F-statistic exceeds the upper bound, the null hypothesis is rejected, implying that there is cointegration among the variables. However, if F-statistic falls in between lower and upper bound, there is indecision.

**3-3- Causality test:**

For causality test, we applied Toda and Yamamoto tests which are available whether the series is I(0), I(1), or I(2), non co-integrated, or co-integrated of any arbitrary order (Toda & Yamamoto, 1995). The key aspect of the Toda & Yamamoto approach is to augment the standard VAR model by the maximum order of integration $(k + d_{max})$. The first step in this approach is to determine the maximum order of integration $(d_{max})$ for the set of variables. The second step is to specify the VAR model. The VAR models are specified as:

$$\mathrm{FDI_t} = \mathrm{A_1} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \theta_{1\mathrm{i}}\, \mathrm{FDI_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \theta_{2\mathrm{j}}\, \mathrm{FDI_{t-j}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \gamma_{1\mathrm{i}}\, \mathrm{TRL_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \gamma_{2\mathrm{j}}\, \mathrm{TRL_{t-j}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \pi_{1\mathrm{i}}\, \mathrm{FD_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \pi_{2\mathrm{j}}\, \mathrm{FD_{t-j}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \varphi_{1\mathrm{i}}\, \mathrm{GDP_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \varphi_{2\mathrm{j}}\, \mathrm{GDP_{t-j}} + \mu_{1\mathrm{t}} \ldots\ldots \quad (8)$$

$$\mathrm{TRL_t} = \mathrm{A_2} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \epsilon_{1\mathrm{i}}\, \mathrm{FDI_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \epsilon_{2\mathrm{j}}\, \mathrm{FDI_{t-j}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \vartheta_{1\mathrm{i}}\, \mathrm{TRL_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \vartheta_{2\mathrm{j}}\, \mathrm{TRL_{t-j}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \rho_{1\mathrm{i}}\, \mathrm{FD_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \rho_{2\mathrm{j}}\, \mathrm{FD_{t-j}} + \sum_{\mathrm{i=1}}^{\mathrm{k}} \tau_{1\mathrm{i}}\, \mathrm{GDP_{t-i}} + \sum_{\mathrm{j=k+1}}^{\mathrm{dmax}} \tau_{2\mathrm{j}}\, \mathrm{GDP_{t-j}} + \mu_{2\mathrm{t}} \ldots\ldots \quad (9)$$

$$FD_t = A_3 + \sum_{i=1}^{k} \omega_{1i} FDI_{t-i} + \sum_{j=k+1}^{dmax} \omega_{2j} FDI_{t-j} + \sum_{i=1}^{k} \aleph_{1i} TRL_{t-i} + \sum_{j=k+1}^{dmax} \aleph_{2j} TRL_{t-j} + \sum_{i=1}^{k} \beth_{1i} FD_{t-i} + \sum_{j=k+1}^{dmax} \beth_{2j} FD_{t-j} + \sum_{i=1}^{k} \sigma_{1i} GDP_{t-i} + \sum_{j=k+1}^{dmax} \sigma_{2j} GDP_{t-j} + \mu_{3t} \ldots\ldots (10)$$

$$GDP_t = A_4 + \sum_{i=1}^{k} \emptyset_{1i} FDI_{t-i} + \sum_{j=k+1}^{dmax} \emptyset_{2j} FDI_{t-j} + \sum_{i=1}^{k} \ni_{1i} TRL_{t-i} + \sum_{j=k+1}^{dmax} \ni_{2j} TRL_{t-j} + \sum_{i=1}^{k} \alpha_{1i} FD_{t-i} + \sum_{j=k+1}^{dmax} \alpha_{2j} FD_{t-j} + \sum_{i=1}^{k} \beta_{1i} GDP_{t-i} + \sum_{j=k+1}^{dmax} \beta_{2j} GDP_{t-j} + \mu_{4t} \ldots\ldots (11)$$

Where k is the optimal lag length of the VAR and $d_{max}$ is the maximum order of integration of the variables. The third step is to decide on to decide on the optimal number of lags to use in the VAR model. The optimal number is chosen after reviewing AIC criterion. The fourth step is to conduct the Granger test on Equations (8), (9), (10), (11).Following, the hypothesis should be specified. For the four equations the null hypothesis is specified as:

$H_{08}: \gamma_{1i} = \pi_{1i} = \varphi_{1i} = 0$ (No causality relationship)

$H_{09}: \epsilon_{1i} = \rho_{1i} = \tau_{1i} = 0$ (No causality relationship)

$H_{010}: \omega_{1i} = \aleph_{1i} = \sigma_{1i} = 0$ (No causality relationship)

$H_{011}: \emptyset_{1i} = \ni_{1i} = \alpha_{1i} = 0$ (No causality relationship)

The decision on whether to accept or reject the null hypothesis should be based on the modified WALD test. If p value is < 0.05, the null hypothesis of no causality should be rejected and vice-versa if p value is > 0.05.

**3-4- Diagnostic and stability tests :**

One of the most important and crucial assumptions in the ARDL Bounds Testing methodology is that the errors must be serially independent. Therefore, Breusch-Godfrey Serial Correlation LM test will be used for testing Serial Independence. The heteroscedasticity will also be checked using ARCH test. In addition the Jarque-Bera test for testing normality of errors.

It is obligatory to ensure the dynamic stability of any model having autoregressive structure. The stability of the model will be checked by using the cumulative sum of recursive residuals (CUSUM) and cumulative

sum of recursive residuals of squares (CUSUMSQ) tests as suggested by Pesaran and Pesaran (1997) (Rahman & Kashem, 2017).

## 4. Results and discussion

### 4.1. Stationary test:

The time series properties of the various variables in the model are investigated by employing the Augmented Dickey-Fuller (ADF). The ADF stationary test results are displayed in the following table (Table 1):

**Table 1**. Results of augmented Dickey-Fuller test (ADF).

| Variables | Level | | | 1st difference | | | Decision |
|---|---|---|---|---|---|---|---|
| | Constant & Trend | Constant | Without | Constant & Trend | Constant | Without | |
| FDI | -3.102 | -3.179** | -1.109 | -5.447* | -5.039* | -5.184* | I(0) |
| TRL | -2.574 | -1.995 | 0.048 | -4.342** | -5.851* | -5.970* | I(1) |
| FNL | -1.562 | -1.320 | -1.330 | -4.565* | -4.584* | -4.463* | I(1) |
| GDP | -0.248 | -1.623 | 3.605 | -2.963 | -2.687 | -2.015** | I(1) |

Notes: FDI: Foreign direct investment, TRL: Trade liberalization, FNL: Financial liberalization, Y: GDP per capita, *, **: denotes statistical significance at 1% and 5% respectively.

**Source:** Based on outputs eviews10.

It can be inferred from the above estimates that under ADF test variables of TRL, FNL, GDP are non-stationary at levels, but attains stationarity after taking first difference and hence of order I(1). While FDI is stationary at level I(0). This mix and uncertain order of integration of the variable justifies using the ARDL approach of cointegration, and toda-yamamo to for causality test.

### 4.2. Co-integration test:

**Table 2**. ARDL bound test results.

| Model | F-stat | Optimal lag | I(0)-I(1) Bounds test at (%) | | | Decision |
|---|---|---|---|---|---|---|
| | | | 1% | 5% | 10% | |
| Fdi/trl,fnl,y | 5.630 | (1,0,3,2) | 4.3-5.23 | 3.38-4.23 | 2.97-3.74 | Cointegration |
| Trl/fdi,fnl,y | 6.801 | (2,3,3,3) | 4.3-5.23 | 3.38-4.23 | 2.97-3.74 | Cointegration |
| Fnl/trl,fdi,y | 6.573 | (2,2,1,1) | 4.3-5.23 | 3.38-4.23 | 2.97-3.74 | Cointegration |
| y/trl,fnl,fdi | 2.634 | (3,3,3,3) | 4.3-5.23 | 3.38-4.23 | 2.97-3.74 | No. Cointegration |

Notes: Critical values are for the model with trend but no constant as provided by Narayan (2005). I(0)= Lower bound critical values. I(1)= Upper bound critical values.

**Source:** Based on outputs eviews10.

After proving that all the variables are stationary at either I(0) or I(1) and none of the variables are I(2), the next step is to test the existence of co-integration among the variables. Table (2) reveals the results of ARDL bounds test for co-integration. The F-statistic for equation (4) (5.630) exceeds the upper bound critical values at 1%,5% and 10% significant levels. Similarly, the F-statistic for equations (5) and (6) (6.801), (6.573) exceeds the upper bound critical values at all significant levels. The null hypothesis is rejected and we conclude that there is co-integration.

lternatively, the F-statistic for equation (7) (2.634), is below the lower bound critical values at 1%, 5% and 10% significant levels. Accordingly, the null hypothesis of no co-integration is not rejected and we conclude that there is no co-integration.

**Table 3.** Estimated Long-run coefficients using the ARDL (1, 0, 3, 2) approach, dependent variable is FDI.

| **Independent variables** | **Coefficients** | **Std-Error** | **T-Ratio** | **P-Value** |
|---|---|---|---|---|
| Trend | -0.597 | 0.201 | -2.961 | 0.015** |
| TRL | 0.046 | 0.015 | 2.972 | 0.015** |
| FNL | 0.218 | 0.088 | 2.475 | 0.035** |
| GDP | 0.010 | 0.003 | 2.611 | 0.028** |

**indicate significance at 5%.

**Source:** Based on outputs eviews10.

The long-run coefficients of the variables are estimated (sse table 3). There is positive relationship between trade liberalization and foreign direct investment, and the coefficient is 0.046 with statistical significance at 5% meaning that a unit in trade liberalization will result in a 0.046 increase in foreign direct investment in the long-run. Financial liberalization has a positive and statistically significant on foreign direct investment at 5%. A coefficient of 0.218 implies that a unit increase in trade liberalization will led to 0.218 increase in foreign direct investment in the long-run. In the same vein economic growth (market size) has a positive and statistically significant on foreign direct investment at 5%. A coefficient of 0.010 implies that a unit increase in economic growth will led to 0.010 increase in foreign direct investment in the long-run.

**Table 4.** Error correction representation for the selected ARDL model, dependent variable is ΔFDI.

| Independent variable | Coefficients | Std-Error | T-Ratio | P-Value |
|---|---|---|---|---|
| C | -53.868 | 19.676 | -2.737 | 0.022** |
| Trend | -0.732 | 0.243 | -3.008 | 0.014** |
| Δ(FNL) | 0.042 | 0.025 | 1.692 | 0.124 |
| Δ(GDP) | 0.000 | 0.001 | 0.178 | 0.862 |
| ECT(t-1) | -0.915 | 0.192 | -6.376 | 0.000* |

*,**indicate significance at 1% and 5% respectively.

**Source:** Based on output eviews10.

After establishing that the variables are cointegrated, the unrestricted error correction model (UECM) is estimated within the framework of the ARDL to derive the short-run coefficient of the relationships among the variables. The findings are presented in table 4. The coefficients of financial liberalization and economic growth are insignificant and therefore, there is no short-run relationship between variables and foreign direct investment.

The lagged Error Correction Term ($ECT_{t-1}$) is of the right negative sign and is statistically significant which means that an equilibrium relationship could be restored any time there are deviations. The coefficient of $ECT_{t-1}$ is (-0.915) implies that approximately 91.5% of the shocks to the model are restored in the next period.

### 4.3. Causality test:

**Table 5.** Toda &Yamamoto test results.

| Equations | $H_0$ | Chi-sq | Df | P-value | Decision |
|---|---|---|---|---|---|
| 8 | TRL/FDI | 6377.56 | 3 | 0.00 | Reject $H_0$ |
| | FNL/FDI | 4207.05 | 3 | 0.00 | Reject $H_0$ |
| | GDP/FDI | 8045.71 | 3 | 0.00 | Reject $H_0$ |
| 9 | FDI/TRL | 20.43 | 3 | 0.00 | Reject $H_0$ |
| | FNL/TRL | 5.57 | 3 | 0.13 | Don't reject $H_0$ |
| | GDP/TRL | 9.55 | 3 | 0.02 | Reject $H_0$ |
| 10 | FDI/FNL | 6.97 | 3 | 0.07 | Don't reject $H_0$ |
| | TRL/FNL | 6.70 | 3 | 0.08 | Don't reject $H_0$ |
| | GDP/FNL | 3.82 | 3 | 0.28 | Don't reject $H_0$ |
| 11 | FDI/GDP | 2.18 | 3 | 0.53 | Don't reject $H_0$ |
| | TRL/GDP | 0.46 | 3 | 0.92 | Don't reject $H_0$ |
| | FNL/GDP | 0.79 | 3 | 0.85 | Don't reject $H_0$ |

**Source :** Based on output eviews10.

After determining the existence of co-integration in three equations, the possibility of causality is plausible. Therefore, causality is tested using Toda and Yamamoto test. Based on the unit root results specifically ADF test, variable TRL (Trade Liberalization), FNL (Financial Liberalization) and Y (GDP) are stationary after first difference I(1). Alternatively, FDI (Foreign Direct Investment) is stationary at level I(0). Hence, the maximum order of integration $d_{max}$ is I(1). Subsequently, the optimal lag length (k) chosen after reviewing AIC and SC is 3. Having determined the maximum order of integration $d_{max}$ and optimal lag length k, the VAR order now becomes (3+1). The chosen VAR order is used to estimate the VAR equations (8), (9), (10), (11). The findings of Toda and Yamamoto test are reported in table 3. Based on the results, p-value is less than 0.05 in equation (8). Hence, evidence of causality exists either from trade liberalization, financial liberalization and economic growth to foreign direct investment. There is evidence of causality running from foreign direct investment and economic growth to trade liberalization in equation (9). Alternatively, the p- value is greater than 0.05 in both equations (10) and (11). Hence, no evidence of causality exists between variables.

## 4.6. Diagnostic and stability tests:

**Table 6.** Diagnostic test results.

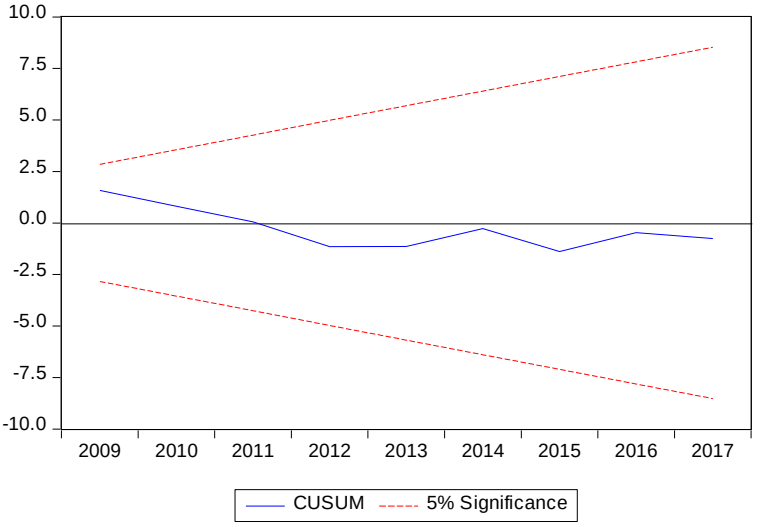
| | Tests | P-Value |
|---|---|---|
| Dependent variable is FDI | Serial Correlation(Breusch-Godfrey) | 0.259 |
| | Hetroscedasticity(ARCH) | 0.583 |
| | Normal Distribution(Jarque-Bera) | 0.538 |

**Source:** Based on output eviews10.

Based on the Breusch-Godfrey test, the p-value is more than 0.05, therefore the null hypothesis of no serial correlation is not rejected. The ARCH test result indicates that the model is free of heteroscedasticity. The Jarque-Bera normality test concludes that the residuals of the model have a normal distribution.

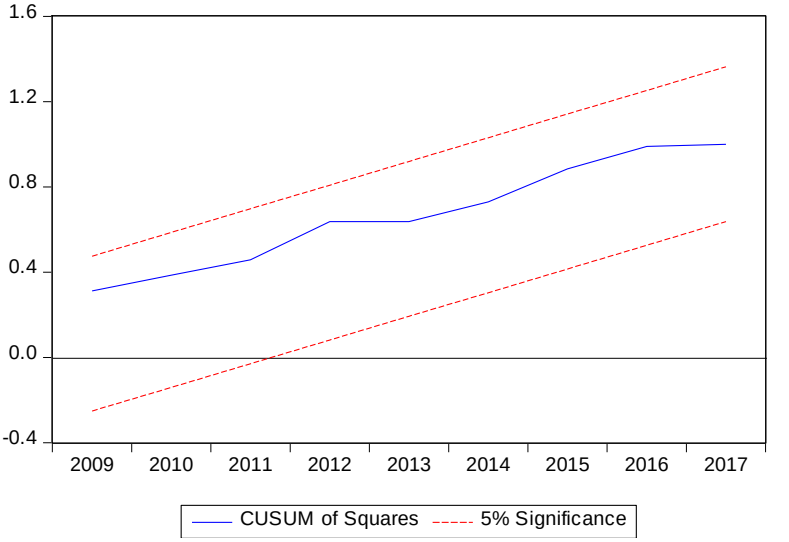
To ensure the robustness of our results we employ structural stability tests on the parameters of the long-run results based on (CUSUM) and (CUSUMSQ) tests as suggested by Pesaran (1997). A graphical representation of CUSUM and CUSUMSQ statistics are provided in figures, 1and 2 below. If the plots of the CUSUM and CUSUMSQ remain within the 5 per cent critical bound, it would signify the parameter constancy and the model stability. Both the plots indicate that almost none of the straight lines (drawn at the 5% level) are crossed by CUSUM and CUSUMSQ i.e., the plots of both the CUSUM and CUSUMSQ are within the boundaries (shown by the dotted red lines). Therefore these findings confirm the model stability and that there is no systematic change identified in the coefficients at 5% significance level. It is concluded that the coefficients of the parameters are stable over the sample period (1995-2017).

**Fig.1.** CUSUM test.




**Source:** Based on output eviews10.

**Fig. 2.** CUSUM of squares test:




**Source:** Based on output eviews10.

## 5. Conclusion

This study examines empirically the causal relationship between trade liberalization, financial development, economic growth and foreign direct investment for Algerian for the period 1995-2017. The Autoregressive Distributed Lag bounds test is used to test for the presence of co-integration, whereas the Toda and Yamamoto test is used for direction of causality. The

findings of ARDL bounds test validate the existence of co-integration among the included variables. Further, the Toda and Yamamoto test affirms that there is bidirectional causality between trade liberalization and foreign direct investment. Additionally, there is a unidirectional causality running from financial liberalization to foreign direct investment as well as unidirectional causality running from economic growth to foreign direct investment.

The empirical results indicate that trade policy liberalization has positive impact on the foreign direct investment. However, these inflows remain weak in Algeria. The implication of this result is that, for Algeria to attract FDI, the policy framework on liberalization should be geared toward a more liberalized economy in terms of policy. Thus Algeria should rather make efforts to reduce the number of days it takes to undertake an international trading activity, the cost of undertaking an international trading activity, the number of documentations as well as the tariff. If this is done, the economy would be able to attract more inflows into the country. This creates an enabling environment for global interaction which benefits the source of foreign direct investment into the country.

Also to have more benefits of foreign direct investment through trade liberalization, the certainty and credibility of liberalization policy need to be improved that may be through the removal of corruption level, removal of monopolies of big loanees from the private financial sector, and political stability. By providing the good investment environment, not only the foreign direct investment may be attracted but it may also be oriented to other industries.

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