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FDI, TRADE AND GROWTH IN TURKEY: EVIDENCE FROM ARDL BOUNDS TESTING APPROACH

Despite the increasing empirical literature on foreign direct investment (FDI)-led growth, export-led growth (ELG) and import-led growth (ILG) hypotheses, this study investigates the validity of the FDI-export-growth and FDI-import-growth hypotheses in Turkey by using quarterly time series data for 1998:1-2009:1 period. To examine these linkages, we use the two-step procedure from the Engle and Granger model: In the first step, we define the order of integration in series and explore the long run relationships among the variables by using four unit root tests and autoregressive distributed lag (ARDL) bounds testing approach of cointegration test, respectively. In the second step, we test causal relationships by using the error-correction based causality models. The ARDL bounds test reveals that there is an evidence of a long-run relationship between the FDI, import (IM) and real gross domestic product (GDP), but no evidence of a long-run relationship between the FDI, export (EX) and GDP in Turkey. According to the causality test results for GDP-IM-FDI equation, there is evidence of two-way (bidirectional) causality between GDP and IM, evidence of one-way (unidirectional) causality from FDI to GDP and evidence of one-way Granger causality from FDI to IM. The existence of unidirectional causal links suggests that FDI strategies should be designed to promote economic growth.

Keywords: FDI, trade, economic growth, ARDL bounds testing, causality.
JEL Classification: C30, F21, F43, O40.

1. INTRODUCTION

Foreign direct investment (hereafter FDI) inflow in a country, similar to domestic investments by means of capital accumulation, generates economic growth and export increase in volume by stimulating the use of new technologies and inputs in the production resources of a host country. Another impact of FDI is associated with its impact on the better training of local workers in foreign subsidiaries which in turn leads to human capital accumulation. Moreover, in most cases FDI inflows do not only lead to capital accumulation, but also enhance the technological fundamentals and managerial skills, thereby increasing the productivity of domestic firms and

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their exportation capabilities. This also facilitates local firms' capacities to develop new products and technologies earlier than other host countries (Temiz and Gokmen, 2009, p. 17).

Turkey is one of the growing economies in the world, especially when compared with the neighbour countries in the same continent. Until 2004, Turkey was not successful in attracting FDI inflows. Turkey's failure to attract FDI inflows was mainly due to economic and political instability in the 1990s and 2000s. During this period Turkey experienced two major economic crises in 1994 and 2001 and the Marmara earthquake in 1999. The EU's December 17, 2004 decision to begin membership negotiations with Turkey was the turning point in FDI inflows to Turkey. As a result the FDI inflows bounced. While FDI inflows amounted to $1.7 billion in 2003, it reached a record level of $9.8 billion in 2005. FDI inflows continued to increase to $20 and $22 billion in 2006 and 2007, respectively (see Table 1). FDI inflows are expected to be $15 billion for 2008. In addition to EU membership negotiations, the rising FDI inflows in Turkey is also related to the increased privatization of state owned enterprises since 2005.

The sectoral analysis of FDI in Turkey shows that with 82% service sectors accounted for the largest share in total FDI inflows received since 2005. Three of the five sectors that attracted the bulk of FDI inflows are service sectors. Among these, the banking and financial intermediation industry, which attracted $28 billion, accounted for 48% of the total FDI inflows from January 2005 through November 2008. The transport, storage and telecommunications industry attracted $11 billion, while the wholesale and retail trade industry attracted $3.4 billion during the same period (Izmen and Yilmaz, 2009, p. 22).

When the FDI inflows in the world are analyzed, the USA is ranked first in the world with an FDI inflow of $232.8 billion, followed by the UK ($223.9 billion) and France ($157.9 billion). China, which led the developing countries with an FDI inflow of $83.5 billion also moved into sixth place worldwide in 2007. Turkey with an FDI inflow of $20.1 billion was ranked 16th in the world and 5th among the developing countries in 2006.

As mentioned by Izmen and Yilmaz (2009, p. 25), although high levels of FDI inflows since 2005 can be seen as a positive sign for the Turkish economy, it is not possible to conclude that Turkey has become a centre of attraction for foreign investors. According to the IMD (International Institute for Management Development) World Competitiveness Report, Turkey is far behind its competitors. Although a certain activity has been observed after 2003, this is mostly related to macroeconomic policies implemented after the crisis, political stability and reforms in public finances. Macroeconomic reforms constitute a necessary condition for attracting FDI in the medium and long run terms, but they are not sufficient. The factors that caused Turkey to lag behind its competitors should be analyzed at institutional and microeconomic levels. Among these factors are: high taxes on labour and energy costs which constitute an important portion of the costs of production, lack of skilled labour, the system of education that is not able to raise employees commensurate with the necessities of the companies that compete worldwide, low level of R&D investments and inadequacy of the infrastructure for technological development.

Table 1

FDI Inflows in Turkey and World (1990-2007, Million US Dollar)

Years	World	Developed Economies	Developing Economies	Turkey
1990	201,594	165,627	35,892	684
1991	154,803	114,617	39,951	810
1992	170,465	115,494	53,188	844
1993	224,126	143,271	77,585	636
1994	254,259	148,210	103,550	608
1995	342,592	222,000	115,963	885
1996	392,743	239,422	147,048	722
1997	489,243	286,638	190,569	805
1998	709,303	509,095	189,642	940
1999	1,098,896	860,151	228,461	783
2000	1,411,366	1,146,238	256,088	982
2001	832,567	609,027	212,017	3,352
2002	621,995	442,284	166,318	1,137
2003	564,078	361,192	178,699	1,752
2004	742,143	418,855	283,030	2,883
2005	945,795	590,311	314,316	9,803
2006	1,305,852	857,499	379,070	20,120
2007	1,996,000	1,248,000	500,000	21,873

Source: UNCTAD (http://www.unctad.org)

In addition to the increasing of FDI inflows to Turkey, the volume of foreign trade also increased drastically after 2002. As can be seen in the Table 2, the export volume of Turkey tends to increase since the 1990s, however, the import volume also increases and the import volume is more than the export volume. Due to the negative trade balance, balance of payment difficulties and necessary capital accumulation in Turkey, FDI becomes a fundamental support for economic and export expansion.

Table 2

Foreign Trade Indicators for Turkey (Million US Dollar, 1990-2008)

Years	Exports	Imports	Exports/ Imports (%)	Balance of Foreign Trade	Volume of Foreign Trade
1990	12,959	22,302	58.1	-9,343	35,261
1991	13,594	21,047	64.6	-7,454	34,641
1992	14,715	22,871	64.3	-8,156	37,586
1993	15,345	29,428	52.1	-14,083	44,774
1994	18,106	23,270	77.8	-5,164	41,376
1995	21,637	35,709	60.6	-14,072	57,346
1996	23,225	43,627	53.2	-20,402	66,851
1997	26,261	48,559	54.1	-22,298	74,820
1998	26,974	45,921	58.7	-18,947	72,895
1999	26,587	40,671	65.4	-14,084	67,258
2000	27,775	54,503	51.0	-26,728	82,278
2001	31,334	41,399	75.7	-10,065	72,733
2002	36,059	51,554	69.9	-15,495	87,613
2003	47,253	69,340	68.1	-22,087	116,593
2004	63,121	97,540	64.7	-34,419	160,661
2005	73,476	116,774	62.9	-43,298	190,250
2006	85,534	139,576	61.3	-54,042	225,110
2007	107,184	170,048	63.0	-62,864	277,232
2008	131,500	201,400	65.1	-69,900	332,900

Source: Turkish Statistical Institute (www.turksat.gov.tr) and Undersecretariat of the Prime Ministry for Foreign Trade (http://www.dtm.gov.tr)

The purpose of this paper is to investigate the causal relationship between FDI, trade and economic growth in Turkey for the 1998:1-2009:1 period using quarterly data. This study has used four unit root tests and autoregressive distributed lag (ARDL) bounds testing approach of cointegration test to determine the order of integration in series and explore the long run relationships among the variables, respectively. Then, the error-correction based causality models have been employed to examine causal relationships among the variables.

The structure of the paper is as follows: Section 2 reviews the existing literature on the subject. Section 3 presents the model, methodology and data. Section 4 presents the empirical results and also examines the direction of causality between FDI, trade and growth. The last section concludes the paper.

2. LITERATURE SURVEY

The relationship between economic growth and FDI has been well studied in the empirical literature focusing on both developing and developed countries. (See de Mello (1997, 1999), Borensztein et al. (1998), Balasubramanyam et al. (1999), Nair-Reichert and Weinhold (2001), and Ozturk (2007) for a comprehensive survey of the nexus between FDI and growth as well as for further evidence on the FDI-growth relationship). Generally, positive effect of FDI on economic growth is found in the most of these studies.

The relationship with exports and growth has been tested for Turkey in a number of articles. The results of empirical studies based on testing causality between exports and output for Turkey is mixed and contradictory. While some studies have supported export-led growth (hereafter ELG) hypothesis (e.g. Xu, 1996; Alici and Ucal, 2003; Greenaway and Sapsford, 1994; Ozturk and Acaravci, 2010), other studies (e.g. Abdulnasser and Manuchehr, 2000; Panas and Vamvoukas, 2002) do not support the ELG hypothesis. On the other hand, the relationship between imports and growth has also been tested in a number of recent articles. For example, the import-led growth (hereafter ILG) hypothesis is supported in empirical studies of Thangavelu and Rajaguru (2004), Mahadevan and Suardi (2008), Awokuse (2008), and Cetintas and Barisik (2009), among others.

Alici and Ucal (2003) investigated the relationship among growth rate, export and FDI in the Turkish economy. Using vector autoregressive (hereafter VAR) methodology, they analyze the existence of causality between export, FDI and domestic performance of Turkey. Their results are in line with the ELG hypothesis, but do not confirm the existence of FDI-growth nexus, in other words they have not found significant positive spillovers from FDI to output. Furthermore, their findings do not suggest a kind of FDI-led export growth linkage; hence only with more foreign capital investments flowing to Turkey may FDI have a powerful effect over output.

Ozturk and Kalyoncu (2007) investigated the impact of FDI on economic growth of Turkey and Pakistan over the period of 1975-2004. They used Engle-Granger cointegration and Granger causality tests to analyze the causal relationship between FDI and economic growth. Their findings suggest that it is gross domestic product (GDP) that causes FDI in the case of Pakistan, while there is strong evidence of a bidirectional causality between the two variables for Turkey.

Herzer et al. (2008) examine the FDI-led growth hypothesis for 28 developing countries using cointegration techniques on a country-by-country basis. The paper finds that in the vast majority of countries, there exists neither a long-term nor a short-term effect of FDI on growth; in fact, there is not a single country where a positive unidirectional long-term effect from FDI to GDP is found.

Awokuse (2008) examines the relationship between trade and economic growth in Argentina, Colombia, and Peru with an emphasis on both the role of exports and imports. Granger causality tests and impulse response functions based on vector error correction model (VECM) were used to examine whether growth in trade stimulate economic growth (or vice versa). The results suggest that the singular focus of past studies on exports as the engine of growth may be misleading. Although there is some empirical evidence supporting ELG, the empirical support for ILG hypothesis is relatively stronger.

Temiz and Gokmen (2009) investigate the relationship of export with FDI by using monthly time series data for the Turkish economy over the period 1991-2008. Using VAR methodology they analyzed the existence of causality between export and FDI of Turkey. The Johansen cointegration modeling techniques used revealed that there is a long term relationship between export and FDI in Turkey. VECM and Granger causality tests confirm unidirectional causality running from export to FDI in Turkey. Their findings do not suggest a kind of FDI-led export growth linkage. In other words, they have not found any significant positive spillovers from FDI to export suggesting a kind of FDI-led export growth linkage.

Liu et al. (2009) examine empirically the interplay between export, import, FDI and economic growth for nine Asian economies by conducting multivariate causality tests in the VECM framework. The results reveal two-way causal connections between trade, inward FDI, inward merger and acquisitions (M&As) and growth for most of the sample economies. There is a unidirectional causal link running from outward M&As to growth and trade. These findings suggest that export expansion, import liberalization, FDI inflows and inward M&As are integral elements of the growth process in Asian economies.

However, there are limited studies on the linkage between FDI, trade and growth in the literature. FDI inflows and trade have been widely recognized as an important factor in the economic growth of countries. Previous empirical studies (Balasubramanyam et al., 1996; Borensztien et al., 1998; Lipsey, 2000; Pahlavani et al., 2005) have mostly concluded that trade and FDI inflows promote economic growth. However, the growth effects from FDI inflows and trade vary from country to country; particularly depending on various country specific factors such as trade openness. A positive effect of FDI and trade on economic growth may simply reflect the fact that FDI is attracted to countries that are expected to grow faster and follow open-trade policies. It is, therefore, important to understand the interrelationships among FDI, trade, and economic growth. Since the question of whether FDI and trade trigger economic growth or the economic development brings FDI and trade is an unresolved issue, this issue has been the subject of empirical studies (Makki and Somwaru, 2004).

3. METHODOLOGY, MODEL AND DATA

The long-run relationship among real income (GDP), real trade (hereafter TRADE) and foreign direct investment (percentage of GDP) for Turkey may be expressed as:

$$GDP_t = \alpha + \phi TRADE_t + \gamma FDI_t + \varepsilon_t \qquad (1)$$

where ε_t is the error term. The quarterly time series data for real GDP and real trade variables (fixed at 1998 prices), and FDI (US dollars) are taken for 1998:1-2009:1 period from the Central Bank of the Turkish Republic electronic data delivery system (http://evds.tcmb.gov.tr). We used two trade variables, real export (hereafter EX) and real import (hereafter IM), to test the FDI-export-growth and FDI-import-growth hypotheses. FDI variable (U.S. dollars) is converted into national currency and then divided by GDP. Income and trade variables were seasonally adjusted to remove the seasonal effects by using Census X-12 quarterly seasonal adjustment method. Then their natural logarithms have been taken.

The long-run and causal relationships among GDP, TRADE and FDI in Turkey are examined in two steps. In the first step, we define the order of integration in series and explore the long run relationships among the variables by using four unit root tests and ARDL cointegration method. In the second step, we test the causal relationships by using the error-correction based causality models that allows us to distinguish between "short-run" and "long-run" Granger causality.

3.1. Integration Analysis

However, if the order of integration of any of the variables is greater than one, for example an I(2) variable, then the critical bounds provided by Pesaran et al. (2001) and Narayan (2005) are not valid. They are computed on the basis that the variables are I(0) or I(1). For this purpose, it is necessary to test for unit root to ensure that all the variables satisfy the underlying assumption of the ARDL bounds testing approach of cointegration methodology before proceeding to the estimation stage. In order to determine the order of integration in series, the following four unit root tests are employed:

The standard regression form of the ADF (Dickey-Fuller, 1979) unit root test is as follows:

$$\Delta y_t = \mu + \gamma y_{t-1} + \beta t + \sum_{i=1}^{k} \alpha_i \Delta y_{t-i} + v_t \quad (2)$$

where μ is intercept, t is a linear time trend, Δ denotes the first difference, k is the number of lagged first differences, and v_t is an error term. The null hypothesis is unit root ($\gamma = 0$) and the alternative hypothesis is level stationarity ($\gamma < 0$).

Phillips and Perron (1988, hereafter PP) modified the t-ratio of γ coefficient so that serial correlation does not affect the asymptotic distribution of test statistic. Elliott et al. (1996, hereafter DF-GLS) propose a simple modification of the ADF tests in which the data are detrended. This modified version of the Dickey-Fuller t test has substantially improved power when an unknown mean and trend is present. Statistics from these tests have to be compared with MacKinnon (1991, 1996) critical values. Ng and Perron (2001, hereafter NP) construct a test statistics that is also based on GLS detrended data y_t. Asymptotic critical values are based on Ng and Perron (2001, Table 1).

3.2. Autoregressive Distributed Lag (ARDL) Cointegration Analysis

This study employed recently developed ARDL bounds testing the approach of cointegration developed by Pesaran (1997), Pesaran and Shin (1999) and Pesaran et al. (2001). Due to the low power and other problems associated with other test methods, the ARDL approach to cointegration has become popular in recent years. The ARDL cointegration approach has numerous advantages in comparison with other cointegration methods such as Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990) procedures: First, the ARDL procedure can be applied whether the regressors are I(1) and/or I(0), while Johansen cointegration techniques require that all the variables in the system be of equal order of integration. This means that the ARDL can be applied irrespective of whether underlying regressors are purely I(0), purely I(1) or mutually cointegrated and thus there is no need for unit root pre-testing. Second, while the Johansen cointegration techniques require large data samples for validity, the ARDL procedure is statistically a more robust approach to determine the cointegration relation in small samples. Third, the ARDL procedure allows that the variables may have different optimal lags, while it is impossible with conventional cointegration procedures. Finally, the ARDL procedure employs only a single reduced form equation, while the conventional cointegration procedures estimate the long-run relationships within a context of system equations.

Basically, the ARDL approach to cointegration involves two steps for estimating long run relationship (Pesaran et al., 2001). The first step is to investigate the existence of long run relationship among all variables in the equation under estimation. The ARDL model for the standard log-linear functional specification of long-run relationship among real GDP, real trade (TRADE) and FDI may follows as:

$$\Delta GDP_t = \alpha_1 + \sum_{h=1}^{p1} \beta_{1h} \Delta GDP_{t-h} + \sum_{i=0}^{q1} \phi_{1i} \Delta TRADE_{t-i} + \sum_{j=0}^{r1} \gamma_{1j} FDI_{t-j} + \delta_1 GDP_{t-1} + \delta_2 TRADE_{t-1} + \delta_3 FDI_{t-1} + \varepsilon_{1t} \quad (3)$$

where ε_{1t} and Δ are the white noise term and the first difference operator, respectively. The ARDL method estimates $(m+1)^n$ number of regressions in order to obtain the optimal lag length for each variable, where m is the maximum number of lags to be used and n is the number of variables in the equation. An appropriate lag selection is based on a criterion such as Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). According to Pesaran and Shin (1999), the SBC is generally used in preference to other criteria because it tends to define more parsimonious specifications. The bounds testing procedure is based on the joint F-statistic or Wald statistic that is tested for the null of no cointegration, $H_0 : \delta_n = 0$, against the alternative of $H_1 : \delta_n \neq 0$, $n = 1, 2, 3$.

Two sets of critical values that are reported in Pesaran et al. (2001) provide critical value bounds for all classifications of the regressors into purely I(1), purely I(0) or mutually cointegrated. If the calculated *F*-statistics lies above the upper level of the band, the null is rejected, indicating cointegration. If the calculated *F*-statistics is below the upper critical value, we cannot reject the null hypothesis of no cointegration. Finally, if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. Recently, the set of critical values for the limited data (30 observations to 80 observations) were developed originally by Narayan (2005).

If there is evidence of long-run relationships (cointegration) of the variables, the second step is to estimate the following long-run and short-run models that are represented in equations (4) and (5):

$$GDP_t = \alpha_2 + \sum_{h=1}^{p2} \beta_{2h} GDP_{t-h} + \sum_{i=0}^{q2} \phi_{2i} TRADE_{t-i} + \sum_{j=0}^{r2} \gamma_{2j} FDI_{t-j} + \varepsilon_{2t} \quad (4)$$

$$\Delta GDP_t = \alpha_3 + \sum_{h=1}^{p3} \beta_{3h} \Delta GDP_{t-h} + \sum_{i=0}^{q3} \phi_{3i} \Delta TRADE_{t-i} + \sum_{j=0}^{r3} \gamma_{3j} \Delta FDI_{t-j} + \psi ECT_{t-1} + \varepsilon_{3t} \quad (5)$$

where ψ is the coefficient of error correction term (hereafter ECT). This shows how quickly variables converge to equilibrium and it should have a statistically significant coefficient with a negative sign.

3.3. Causality Analysis

If the variables being considered are cointegrated, there exists Granger causality in at least one direction. The ARDL cointegration methods test for the existence or absence of long-run relationships among variables GDP, TRADE and FDI. But, it does not indicate the direction of causality. Granger (1988) emphasizes that a VEC modelling should be estimated rather than a VAR as in a standard Granger causality test, if variables in model are cointegrated. Following Granger (1988), to test for Granger causality in the long-run relationship, we employ a two step process: Once estimating the long-run model in equation (1) in order to obtain the estimated residuals, the next step is to estimate error-correction based Granger causality models:

$$\Delta GDP_t = \alpha_4 + \sum_{h=1}^{p4} \beta_{4h} \Delta GDP_{t-h} + \sum_{i=0}^{q4} \phi_{4i} \Delta TRADE_{t-i} + \sum_{j=0}^{r4} \gamma_{4j} \Delta FDI_{t-j} + \psi_1 ECT_{t-1} + \varepsilon_{4t} \tag{5.a}$$

$$\Delta TRADE_t = \alpha_5 + \sum_{h=0}^{p5} \beta_{5h} \Delta GDP_{t-h} + \sum_{i=1}^{q5} \phi_{5i} \Delta TRADE_{t-i} + \sum_{j=0}^{r5} \gamma_{5j} \Delta FDI_{t-j} + \psi_2 ECT_{t-1} + \varepsilon_{5t} \tag{5.b}$$

$$\Delta FDI_t = \alpha_6 + \sum_{h=0}^{p6} \beta_{6h} \Delta GDP_{t-h} + \sum_{i=0}^{q6} \phi_{6i} \Delta TRADE_{t-i} + \sum_{j=1}^{r6} \gamma_{6j} \Delta FDI_{t-j} + \psi_3 ECT_{t-1} + \varepsilon_{6t} \tag{5.c}$$

Residual terms, ε_{4t}, ε_{5t} and ε_{6t}, are independently and normally distributed with zero mean and constant variance. An appropriate lag selection is based on a criterion such as AIC and SBC.

The VEC modelling approach allows us to distinguish between "short-run" and "long-run" Granger causality. The Wald-tests of the "differenced" explanatory variables give us an indication of the "short-term" causal effects, whereas the "long-run" causal relationship is implied through the significance or otherwise of the t test(s) of the lagged error-correction term that contains the long-term information since it is derived from the long-run cointegrating relationship. The nonsignificance or elimination of any of the "lagged error-correction terms" affects the implied long-run relationship and may be a violation of theory. The nonsignificance of any of the "differenced" variables that reflects only short-run relationship, however, does not involve such violations because; theory typically has little to say about short-term relationships (see Masih and Masih, 1996).

Rejecting the null hypotheses indicates that FDI or TRADE does Granger cause GDP, GDP or FDI does Granger cause TRADE, and GDP or TRADE does Granger cause FDI, respectively. Using equations (5.a), (5.b), and (5.c), Granger causality can be examined in three ways (see Lee and Chang, 2008):

1) Testing hypotheses that are $H_0 : \phi_{4i} = 0$ and $H_0 : \gamma_{4j} = 0$ for all *i* and *j* in equation (5.a); $H_0 : \beta_{5h} = 0$ and $H_0 : \gamma_{5j} = 0$ for all *h* and *j* in equation (5.b); and $H_0 : \beta_{6h} = 0$ and $H_0 : \phi_{6i} = 0$ for all *h* and *i* in equation (5.c), are evaluated as Granger weak causality. Masih and Masih (1996) and Asafu-Adjaye (2000) interpreted the weak Granger causality as "short run" causality in the sense that the dependent variable responds only to short-term shocks to the stochastic environment.

2) Masih and Masih (1996) point out that another possible source of causation is the *ECT* in equations. The coefficients of the *ECT*s represent how fast deviations from the long-run equilibrium are eliminated following changes in each variable. The long-run causality can be tested by looking at the significance of the *ECT* in equations. Thus, long-run causalities are examined by testing $H_0 :\ \psi_1 = 0$, $H_0 :\ \psi_2 = 0$ and $H_0 :\ \psi_3 = 0$ for equations (5.a), (5.b), and (5.c). For example, when ψ_1 is zero, GDP does not respond to the deviations from the long-run equilibrium in the previous period. Thus, $\psi_i = 0$, $i = 1, 2, 3$ for all *i*, is equivalent to both Granger non-causality in the long-run and the weak exogeneity (Hatanaka, 1996).

3) The joint test of two sources of causation indicates which variable(s) bear the burden of short-run adjustment to re-establish long-run equilibrium, following a shock to the system: Asafu-Adjaye (2000). Lee and Chang (2008) referred it as a strong Granger causality test that are detected by testing $H_0 : \phi_{4i} = \psi_1 = 0$ and $H_0 : \gamma_{4j} = \psi_1 = 0$ for all *i* and *j* in equation (5.a); $H_0 : \beta_{5h} = \psi_2 = 0$ and $H_0 : \gamma_{5j} = \psi_2 = 0$ for all *h* and *j* in equation (5.b); and $H_0 : \beta_{6h} = \psi_3 = 0$ and $H_0 : \phi_{6i} = \psi_3 = 0$ for *h* and *i* in equation (5.c).

4. EMPIRICAL RESULTS

Time series univariate properties were examined using four unit root tests that are the ADF, the PP, the DF-GLS and the NP unit root tests. It has been observed that the size and power properties of the unit root tests are sensitive to the number of lagged terms (*k*) used. Several guidelines have been suggested for the choice of *k*. The optimal lags for unit root tests are to include lags sufficient to remove any serial correlation in the residuals. In this study, *k* is determined according to SBC for the ADF and the DF-GLS unit root tests. Newey-West bandwidth selection using Bartlett kernel is used to determine maximum lags for the PP unit root test. Spectral GLS-detrended AR based on SBC is used to determine maximum lags for the NP unit root test.

Results from the unit root tests are reported in Table 3. Neither of these tests failed to reject the null hypothesis of a unit root at 5% significance level but strongly rejected at their first difference for GDP, EX and IM (except NP for IM). This implies that GDP, EX and IM variables are non-stationary at levels but stationary at the first differences. But neither of these tests rejects the null hypothesis of a unit root for FDI at 5% significance level. This means that FDI is stationary at levels.

Table 3

Unit Roots Test Results

Levels	**ADF**	**PP**	**DF-GLS**	**NP**
GDP	- 2.14 (2) $^{c+t}$	- 1.88 (3) $^{c+t}$	- 1.55 (1) $^{c+t}$	- 1.77 (1) $^{c+t}$
EX	- 2.94 (0) $^{c+t}$	- 2.73 (6) $^{c+t}$	- 2.50 (0) $^{c+t}$	- 2.09 (0) $^{c+t}$
IM	- 2.08 (2) $^{c+t}$	- 1.93 (3) $^{c+t}$	- 2.29 (2) $^{c+t}$	- 3.95 (0) $^{c+t}$
FDI	- 4.25 (0) $^{c+t}$	- 4.47 (4) $^{c+t}$	- 4.34 (0) $^{c+t}$	- 3.04 (0) $^{c+t}$
CVs at 5%	- 3.52	- 3.52	- 3.19	- 2.91
1st Differences	**ADF**	**PP**	**DF-GLS**	**NP**
GDP	- 4.55 (0) ^{c}	- 4.62 (2) ^{c}	- 3.91 (0) ^{c}	- 2.70 (0) ^{c}
EX	- 6.89 (0) ^{c}	- 6.65 (7) ^{c}	- 6.52 (0) ^{c}	- 3.33 (0) ^{c}
IM	- 3.25 (3) ^{c}	- 5.09 (2) ^{c}	- 2.38 (1) ^{c}	
FDI				
CVs at 5%	- 2.93	- 2.93	- 1.95	- 1.98

Notes: Number of lags, *k*, are in ( ). Models $^{c+t}$ and ^{c} contain constant and intercept, and only constant, respectively. Critical values (CVs) depend on MacKinnon (1991, 1996).

Source: authors' own elaboration

Although the order of integration for variables in our model is mixed, the bounds testing cointegration procedure may use to test the presence of long-run equilibrium relationship, while Johansen cointegration techniques require that all the variables in the system be of equal order of integration.

According to Pesaran and Shin (1999), the SBC is generally used in preference to other criteria because it tends to define more parsimonious specifications. With the limited observations, this study used the SBC to select an appropriate lag for the ARDL model.

Table 4 presents the estimated ARDL(1,1,0) models for FDI-export-growth and FDI-import-growth that are based on SBC. The bounds *F*–test for cointegration test yields no evidence of a long-run relationship among variables GDP, EX and FDI. In other words, there is no cointegration among these variables in Turkey for 1998:1-2009:1 period. Thus, the econometric analysis suggests that any causal relationships within dynamic VEC model cannot be estimated for FDI-export-growth hypothesis.

Table 4

Estimated ARDL Models and Bounds *F* –Test for Cointegration

Model	**ARDL Model**	**F-Test**	**CV 1%**		**CV 5%**	
			I(0)	**I(1)**	**I(0)**	**I(1)**
GDP-EX-FDI	(1,1,0)	1.1204	4.770	5.855	3.435	4.260
GDP-IM-FDI	(1,1,0)	4.2798	4.770	5.855	3.435	4.260

Notes: The critical values for the lower *I*(0) and upper *I*(1) bounds are taken from Narayan (2005, Appendix: Case II).

Source: authors' own elaboration

On the other hand, the bounds *F*–test for cointegration test yields evidence of a long-term relationship among variables GDP, IM and FDI at a 5% significance level in Turkey. Table 5 presents the estimated coefficients from the ARDL (1,1,0) model for FDI-import-GDP equation that has passed several diagnostic tests indicating no evidence of serial correlation and heteroscedasticity. Besides this, the ADF unit root test for the residuals revealed that they are stationary. The estimated log-linear long-run coefficient of the import and FDI are positive. The coefficient of imports (IM) implies the elasticity of import for income and an increase in import will raise the real GDP per capita to 47 per cent. This result is implied that there is a strong positive impact of imports on productivity growth, and it is a source of output growth. The estimated *ECT* is also negative (-0.2948) and statistically significant at 1% confidence level. *ECT* indicates that any deviation from the long-run equilibrium between variables is corrected about 30% for each period, and it takes about 3 periods to return the long-run equilibrium level.

Table 5

Estimated Coefficients

Variables	**Short-Run**	**Long-Run**
Constant	2.8045 [0.000]	9.5125 [0.000]
GDP(-1)	0.7052 [0.000]	
IM	0.2545 [0.000]	0.4748 [0.000]
IM(-1)	-0.1149 [0.008]	
FDI	0.0030 [0.060]	0.0101 [0.046]

R^2	0.9941	RESET	2.9306 [0.087]	NORM	2.4306 [0.297]
Adj. R^2	0.9935	LM	6.2945 [0.178]	*ECM*	-0.2948 [0.000]
SEE	0.0125	HET	1.7526 [0.186]	ADF	-6.1821 (-4.7638)

Notes:
SEE is the standard error of the regression.
RESET is Ramsey's specification test with a χ^2 distribution with only one degree of freedom.
NORM is a test for normality of residuals with a χ^2 distribution with two degrees of freedom.
LM is the Lagrange multiplier test for serial correlation with a χ^2 distribution with four degrees of freedom.
HET is test for heteroskedasticity with a χ^2 distribution with only one degree of freedom.
ECM is the estimated coefficient of error correction term.

ADF is unit root test statistics for residuals and its 5% critical value is in ( ).
p-values for the estimated coefficients and statistics are in [ ].

Source: authors' own elaboration

In addition, Figure 1 presents the plot of cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) test statistics that falls inside the critical bounds of 5% significance. This implies that the estimated parameters are stable over the period of 1998:1–2009:1.

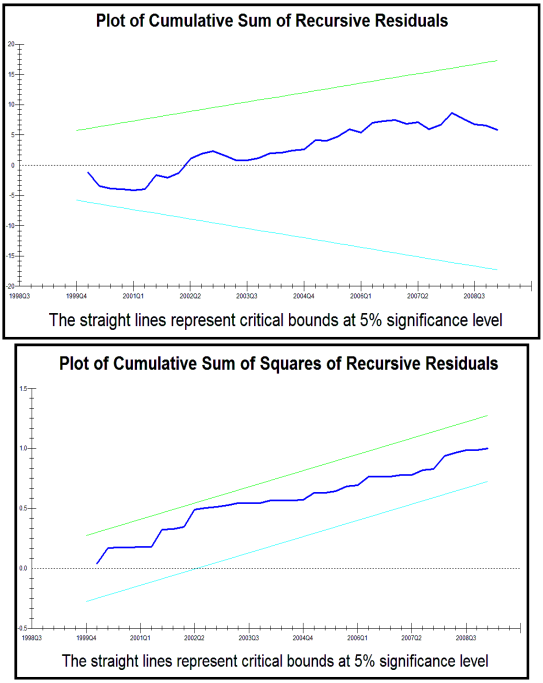

Figure 1. Plot of Cusum of Squares and Cusum Test

Source: authors' own elaboration

The existence of a cointegration relationship among GDP, IM and FDI in Turkey suggests that there must be Granger causality in at least one direction. This study also explores causal relationship among variables in terms of the three error-correction based Granger causality models: i) weak (short-run) Granger causality, ii) long-run Granger causality, and iii) strong Granger causality. The causality test results for GDP-IM-FDI equation in Turkey are as follows (see Figure 2 and Table 6 for details):

i) There is an evidence of two-way (bidirectional) both weak (short-run) and strong Granger causality between GDP and IM. The bidirectional causality supports that economic growth has been driven by growth in imports and at the same time with higher level of income, more intermediate factors and foreign technology are imported.

ii) There is evidence of one-way (unidirectional) both weak and strong Granger causality from FDI to GDP. There is evidence of one-way strong Granger causality from FDI to IM. A high level of FDI has spurred both import and GDP growth. The existence of unidirectional causal links suggests that FDI strategies should be designed to promote economic growth.

iii) There is evidence of long-run Granger causality for GDP and IM equations, while there is no evidence of long-run Granger causality for FDI equations.

The overall results support that there is evidence of the validity for the FDI-import-growth hypothesis, while there is no evidence for the validity for the FDI-export-growth hypothesis for Turkey. FDI and import have a significant long-run impact on the level of real GDP. Thus, the effect of FDI on economic growth will be stronger when host country encourages export oriented FDI, improve human capital conditions (especially education), liberalized trade regime, maintain political and economic stability, and increasing R&D investments.

Table 6

Wald-Tests for Granger Causality Test Results from FDI-Import-GDP Equation

The Null Hypotheses		Short-run Granger Causality
$\Delta IM \rightarrow \Delta GDP$	$(H_0 : \phi_{4i} = 0)$	96.1095 (0.0000)
$\Delta FDI \rightarrow \Delta GDP$	$(H_0 : \gamma_{4j} = 0)$	6.2661 (0.0436)
$\Delta \mathrm{GDP} \rightarrow \Delta IM$	$(H_0 : \beta_{5h} = 0)$	95.7159 (0.0000)
$\Delta FDI \rightarrow \Delta IM$	$(H_0 : \gamma_{5j} = 0)$	3.0392 (0.2188)
$\Delta \mathrm{GDP} \rightarrow \Delta FDI$	$(H_0 : \beta_{6h} = 0)$	1.7185 (0.4235)
$\Delta IM \rightarrow \Delta FDI$	$(H_0 : \phi_{6i} = 0)$	1.8188 (0.4028)
The Null Hypotheses		**Long-run Granger Causality**
$\mathrm{ECT} \rightarrow \Delta GDP$	$(H_0 : \psi_1 = 0)$	13.3249 (0.0000)
$\mathrm{ECT} \rightarrow \Delta IM$	$(H_0 : \psi_2 = 0)$	7.9410 (0.0048)
$\mathrm{ECT} \rightarrow \Delta FDI$	$(H_0 : \psi_3 = 0)$	0.9846 (0.3211)
The Null Hypotheses		**Strong Granger Causality**
$\Delta IM, \mathrm{ECT} \rightarrow \Delta GDP$	$(H_0 : \phi_{4i} = \psi_1 = 0)$	123.5173 (0.0000)
$\Delta FDI, \mathrm{ECT} \rightarrow \Delta GDP$	$(H_0 : \gamma_{4j} = \psi_1 = 0)$	16.0779 (0.0011)
$\Delta GDP, \mathrm{ECT} \rightarrow \Delta IM$	$(H_0 : \beta_{5h} = \psi_2 = 0)$	97.5278 (0.0000)
$\Delta FDI, \mathrm{ECT} \rightarrow \Delta IM$	$(H_0 : \gamma_{5j} = \psi_2 = 0)$	9.1077 (0.0279)
$\Delta GDP, \mathrm{ECT} \rightarrow \Delta FDI$	$(H_0 : \beta_{6h} = \psi_3 = 0)$	1.8334 (0.6077)
$\Delta IM, \mathrm{ECT} \rightarrow \Delta FDI$	$(H_0 : \phi_{6i} = \psi_3 = 0)$	1.8962 (0.5942)

Notes: The null hypothesis is that there is no causal relationship between variables.
Values in parentheses are p-values for Wald tests with a χ^2 distribution.
Δ is the first difference operator.

Source: authors' own elaboration

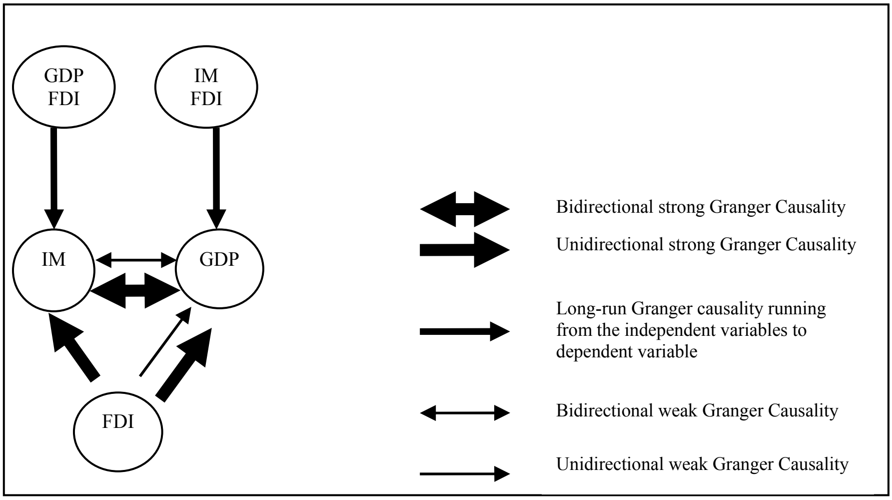

Figure 2. Granger Causality Relationships from FDI-Import-GDP Equation for Turkey

Source: authors' own

5. CONCLUSION

Despite the increasing empirical literature on FDI-led growth, export-led growth and import-led growth hypotheses, this study investigates the validity of the FDI-export-growth and FDI-import-growth hypotheses in Turkey by using quarterly time series data for 1998:1-2009:1 period. To examine this linkage, we use the two-step procedure from the Engle and Granger (1987) model. Firstly, we define the order of integration in series and explore the long term relationships among the variables by using four unit root tests and autoregressive distributed lag (ARDL) bounds testing approach of cointegration test, respectively. Secondly, we test causal relationships by using the error-correction based causality models.

The bounds test of cointegration yields no evidence of a long-term relationship among real GDP, real export and FDI. In other words, there is no cointegration among these variables in Turkey for 1998:1-2009:1 period. Thus, the econometric analysis suggests that any causal relationships within dynamic VEC model cannot be estimated for FDI-export-growth hypothesis. On the other hand, the bounds *F*–test for cointegration test yields evidence of a long-term relationship among variables GDP, IM and FDI.

According to the causality test results for GDP-IM-FDI equation, there is evidence of two-way (bidirectional) both weak and strong Granger causalities between GDP and IM; evidence of one-way (unidirectional) both weak and strong Granger causalities between FDI to GDP; evidence of one-way strong Granger causality between FDI to IM; and evidence of long-run Granger causality for GDP and IM equations.

The most important implication of the econometric results of this research for the current literature is to use inward FDI and imports as the main engine of growth. However, foreign trade policies for import-based growth may result in a gradual deterioration in the balance of payments deficits. Thus, in order to avoid serious financing problems and to maintain sustainable growth, it is important that import demands in Turkey be covered with adequate FDI inflows and more export revenues.

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