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NEXUS BETWEEN FOREIGN DIRECT INVESTMENT AND EMPLOYMENT IN MANUFACTURING AND SERVICES SECTORS IN TUNISIA: AN ARDL APPROACH

MOULDI BEN AMOR

Abstract:

This study investigated both the cointegration and the causal nexus between foreign direct investment (FDI) and employment in the manufacturing and services sectors in Tunisia by employing the augmented autoregressive distributed lag (ARDL) bounds testing approach. Our findings confirm a long-run relationship among the examined variables. Causality results indicated both short-run and long-run bidirectional causality between FDI and employment in the services sectors as well as between employment in the manufacturing and the services sectors. However, there is a unidirectional causality between FDI and employment in manufacturing running from FDI to employment in Manufacturing. These results are of particular interest and offer new perspectives and insight for new policies toward promoting and diversifying foreign investment as a critical contributor to the manufacturing sector's productive capacity and by extension to its employment level.

Keywords:

FDI, employment, Manufacturing, Services, ARDL, causality

JEL Classification: E24, F21, J21

Authors:

MOULDI BEN AMOR, Department of Economics, college of Economics and Administrative Science, Al Imam Mohammad Ibn Saud Islamic University (IMSIU), PO Box 5701, Riyadh, 11432 Saudi Arabia, Saudi Arabia, Email: elmouldi2015@gmail.com

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1. Introduction

Although one of the theoretical benefits of FDI is its potential to create employment opportunities in the host country, the contribution of FDI to employment in developing countries has not been extensively researched and the majority of the empirical research has focused on its influence on economic growth with mixed results (see Balasubramanyam, Salisu and Sapsford, 1999; Blomstrom, Lipsey and Zejan, 1994; De Mello, 1997).

Indeed, the relationship between employment and investment has been underlined by Keynes since the early 1900s (Keynes, 1936), but some economists have criticized this theoretical statement and have shown that the relationship between these variables is not obvious and may be insignificant in some circumstances (Baldwin, 1995; McDonald, Heinz, & Arn- Hiese, 2002).

Since the government of Tunisia liberalized its FDI regimes and pursued other policies to attract investment in 1987, Tunisians' economic growth has achieved remarkable development, so FDI has always played an essential role in Tunisian's economy (Belloumi, 2014). In 2018, Tunisia ranked sixth among the largest recipients of FDI flows in the MENA region, after Egypt, Oman, Morocco, Saudi Arabia, and Lebanon (OECD, 2020) and its FDI flows in Tunisia accounted for 5.0% of total FDI flows received in the MENA region as a whole, compared to 4.5% in 2017, 2.8% in 2016. We denote also that FDI flows in Tunisia represented 2.4% of its GDP in 2018, which was greater than that for the region as a whole (FDI flows to the region were 1.2% of the region's GDP in 2018). Moreover, FDI as a share of GDP for Tunisia reached its record level in 2006 at 9.43% to decline to 1.93% in 2019, below the level recorded in 2012 when it reached 3.26% of GDP.

The bulk of Tunisian's flows of FDI abroad went to services and manufacturing sectors. In 2006, the total flows received by Tunisia were in the service sector which was 70%. The manufacturing sector increased from 26.5% in 2010 to above 42% in 2016 and has remained the largest share (50.4%) in 2019. Thus, both the manufacturing and services sectors are the major recipients of FDI (Table 1).

Table 1: Distribution of inward FDI in Tunisia by economic activity, as a share of total inflows

	2006	2008	2010	2012	2014	2016	2018	2019
Agriculture	0.3	0.6	0.1	0.2	0.4	1.2	2.8	0.8
Manufacturing	7.9	18.9	26.5	21.2	24.9	41.9	41.2	50.4
Energy	21.4	56.9	60.8	35.4	49.4	42	33.2	36.7
Services	70.4	23.6	12.6	43.2	25.3	14.9	22.8	12.1
Total	100	100	100	100	100	100	100	100

Source: Central Bank of Tunisia, 2020

Given the strategic importance of the two sectors in terms of promoting FDI, job creation, and contribution to GDP (gross domestic product) growth, we conclude that manufacturing and services can be considered as the engines of growth in the national economy. However, the contribution of these two sectors to GDP in 2019 reached 57.3% and their contribution to employment amounted to 62.4% of the total employment (Table 2).

Table 2: FDI as a share of GDP and the contribution of manufacturing and service sectors on employment (%)

	2006	2008	2010	2012	2014	2016	2018	2019
FDI as a share of GDP	9.43	5.8	2.89	3.26	2.04	1.4	2.32	1.93
Percentage contribution from manufacturing in real GDP	9.06	9.32	11.09	14.1	16.9	15.3	15.2	14.8
Percentage contribution from manufacturing in employment	18.77	19.08	18.25	18.5	18.68	19.92	18.48	18.7
Percentage contribution from service in real GDP	41.61	42.88	44.05	43.56	44.75	45.01	46.08	42.5
Percentage contribution from service in employment	39.16	40.25	41.31	40.4	42.38	43.13	43.35	43.7

Source: Central Bank and National Institute of Statistics of Tunisia 2020

According to Baldwin (1994), manufacturing and services could mutually reinforce each other. However, an intermediate (also known as derived) demand for services ranging from logistics and ports to business and finance can be generated if there is diversification of the manufacturing sector to high-value chain activities (Fernandez and Paunov, 2011). Similarly, manufacturing activities can be encouraged by a strong complementarity of the service sector, thus creating a cycle of mutually reinforcing growth (Williams, 1999; Ernst, 2005).

Thus, in recent years and since countries attract FDI to boost employment (among other reasons) a great concern has been given to investigating the possible relationship between FDI and Employment (Singh, 2017; Nahidi and Badri 2014). Within this framework, we search to explore whether there a long-term relationships and causal links between FDI inflows and Employment or not in manufacturing and services sectors in the Tunisian economy.

Based on the fact that the flow of FDI towards Tunisia has created employment and economic growth opportunities and has positively affected inclusive development, the purpose of this study is to explore the possible interactions between FDI inflows and employment in manufacturing and services sectors as well as the employment linkages between manufacturing and services in Tunisia.

The rest of the study is organized as follows. Section 2 reviews the theoretical and empirical related literature. Section 3 describes the data and presents the econometric method and empirical findings. Section 4 provides concluding remarks and policy implications.

2. Literature review

Various studies examined the effects of foreign direct investment on employment during different periods by using different econometric techniques for the different economies in the world and revealed that FDI has a positive impact on employment. These effects vary across countries and income levels in both magnitude and significance.

Mickiewicz, Raosevic, and Varblane (2000) analyzed the role of FDI in job creation and job preservation in the central Europe countries (Czech Republic, Hungary, Slovakia, and Estonia). They found that Hungary is relatively the most successful in terms of creating and preserving employment through FDI. The authors explained their results by Hungary's employment structure, which is similar to developed economies. Furthermore, the authors underline that FDI can do more in generating and recovering domestic employment rather than stimulating growth and increasing the volume of employment.

Fu and Balasubramanyam (2005) examined the relationship between employment and foreign direct investment in China during the period 1987 to 1998. By using the GMM method, they found that a 1% increase in FDI leads to a 0,03% increase in employment.

Wei and He (2006) argued that FDI inflow promotes employment in both foreign investment enterprises (FIEs) and the country as a whole in the long run in China. They concluded that a 1% increase in FDI leads to a 1.27% increase in the growth rate of employment in FIEs and 0.04% in the growth rate of total employment in China.

Jayaraman and Singh (2007) used the autoregressive distributed lag model (ARDL) to analyze the relationship between foreign direct investment and employment creation in Fiji, during the period from 1970 to 2003. They found unidirectional long-run causality running from foreign direct investment to employment and unidirectional causality from foreign direct investment to GDP in the short run.

Nunnenkamp and Bremont (2007) studied the impact of FDI on employment in Mexico's manufacturing sectors from 1994 to 2006 and found that FDI had a significant positive impact on employment.

Abor and Harvey (2008) examined the effect of FDI on employment in Ghana. Their empirical results have shown that FDI has brought in large-scale production and increased the demand for labor and support so that the increased FDI flows can lead to high levels of employment.

Aktar and Ozturk (2009) also examined whether the FDI could solve the unemployment problem or not in Turkey from 2001 to 2007. Their empirical finding indicated that FDI has no impact on increasing employment and thus did not contribute to reducing the unemployment rate during this period.

Saray (2011) scrutinized the relationship between employment and foreign direct investment in Turkey covering the period from 1970 to 2009 by using the autoregressive distributed lag model (ARDL) and revealed that FDI has no impact on reducing unemployment in the country.

Bakkalcı and Argın (2013) concluded that inward FDI had a positive impact on employment and firm performances in Turkey from 1991 to 2011.

Göçer and Peker (2014) tested the effects of foreign direct investment on employment in three countries (Turkey, China, and India) during the period from 1980 to 2011. They found that a 10% increase in foreign direct investment leads to a decrease in employment in Turkey by 0,3% while it decreased in China and India respectively by 0,3% and 0,2%.

According the Jasova et al (2016) research the Czech Republic relies less on job creation from FDI as the country exhibits low unemployment rates over years. This fact can explain the lower inflow of FDI to the Czech Republic compared to other Central European countries nevertheless favorable institutional environment similar to Hungary.

Cermakova et al (2020) analyzed selected institutional factors and tested their influence on economic growth. they proved that soft factors such as property rights, freedom of corruption, level of freedom on different markets and other components of the Index of Economic Freedom and legal framework explain the differences in GDP per capita dynamics across countries. Moreover, they concluded that increasing FDI and population size increase economic growth and reduce unemployment.

3. Econometric Method and Empirical Findings

3.1. Data Sources and Description of Variable

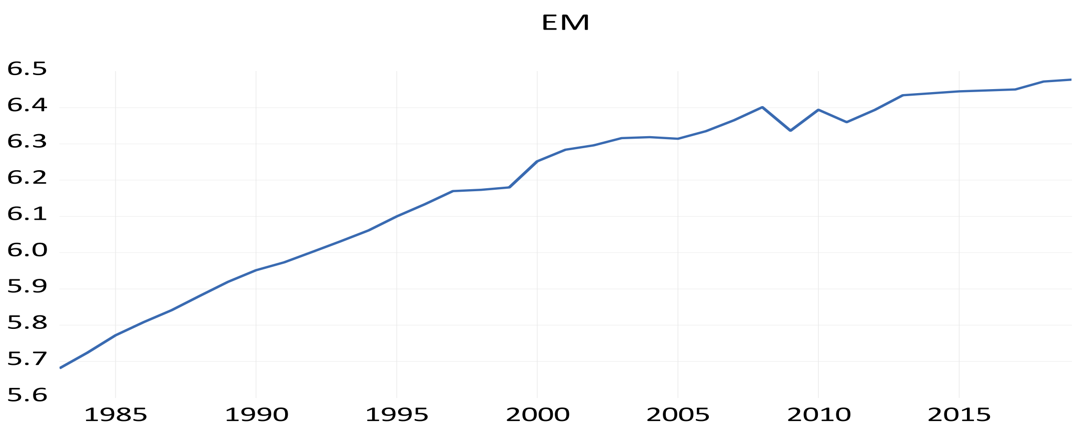
The annual time series data on foreign direct investment (FDI), employment in the manufacturing sector (EM), and employment in the services sector (ES) covering the 1983–2019 period has been used in this study. Data were collected and aggregated from World Bank data and annual reports by the Central Bank and the National Statistics Office of Tunisia. All variables of interest are transformed into natural logarithms (ln) except FDI inflows, which are converted into real terms before the logarithmic transformation occurs. We note also that the price index used to deflate the FDI variable into real terms is the producer price index (PPI).

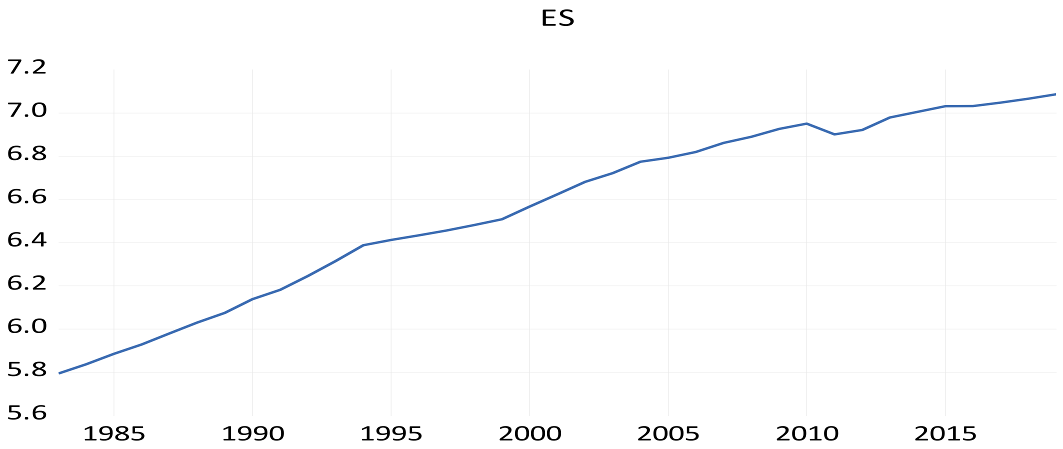
Table 3: Summary statistics of time series variables

Variables Description	FDI	EM	ES
Mean	15.649	499.539	761.995
Median	15.729	535.856	752.881
Maximum	17.434	650.1	1196
Minimum	14.194	293.1	328.5
Std. Dev.	0.755	110.798	279.710
Skewness	0.021	-0.358	-0.023
Kurtosis	2.890	1.805	1.628
Jarque-Bera	0.021	2.992	2.903
Probability	0.989	0.224	0.234
Sum	579.008	18482.97	28193.82
Sum Sq. Dev.	20.525	441948.5	281656.1

Table 3 reports some descriptive statistics (mean, median, standard deviation, skewness, and kurtosis) which are used in the calculation to check the nature of the data distribution. The Jarque Bera test determines the normal distribution of the data. From the description statistic in Table 3, all variables are right deviations (positively skewed), except FDI, which is left-skewed. For the Kurtosis method which measures the peakness or flatness of the distribution of the analyzed series, results plot that FDI, EM, and ES variables are platykurtic. Also, we notice that the probability of all variables has statistical meaning. Thus, according to the Jarque-Bera statistic, the time series data matches a normal distribution.

Figure 1: Plots of time series variables (in log forms)





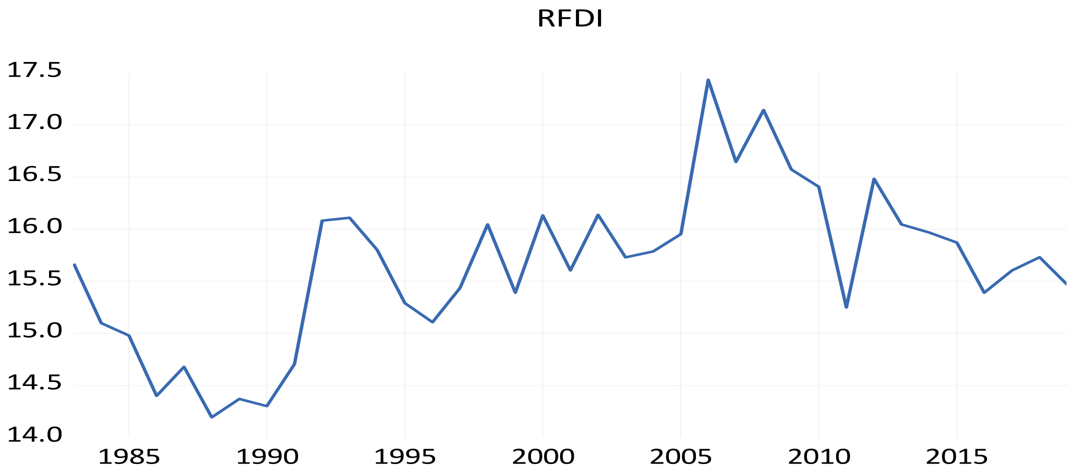


Figure 1 presents the time series plot of each variable (in logarithmic forms). A visual inspection of the time series plots fails to detect any seasonal pattern for both EM and ES, while a cyclical component is present for the EM series. As expected, the FDI inflow variable fluctuates from period to period, with a large fluctuation observed between 2006 and 2019.

Since the 1970s, Tunisia has made FDI one of the pillars of its economic and social development policy; it is expected to strengthen its exports, create employment, and contribute to the industrial development of the country through technological transfer and participation in more harmonious regional development.

The Tunisian government has argued that tax rate reform and political stability are typical factors for attracting FDI. Some studies have realized that tax incentive preferences have completely positive effects on FDI in Tunisia and contributed to improving Tunisian’s comparative advantage in attracting FDI (World Bank, 2014). In addition, political stability is important for foreign investors’ decision-making, and political stability is considered as one of the dominant and necessary factors to create gravitation for foreign investors in Tunisia.

However, the integration policies applied since the 1970s have transformed the Tunisian economy. Following a rapid response from FDI, exports of textiles and clothing (TH) increased significantly, to replace hydrocarbons as the leading export item. The share of hydrocarbons fell from 52 to 13 percent, giving way to TH whose share increased from 18 to 33 percent between 1980 and 2006. Since 1997, participation in European automobile production networks has led to a sharp increase in exports of the Mechanical and Electrical Engineering (GME) leading to the start of a second structural transformation of the industry. The share of GME in total exports increased from 9.5 in 1995 to 19 percent in 2006. Tunisia is among Europe's top 10 automotive cable system suppliers and has a global market share of 2.2 percent in this segment. The impact of integration policies on employment has also been positive. To illustrate, in 1980, 8 years after its creation, the offshore sector employed 10,000 people; in 1990 it employed 70,000 people; and today, with 245,000 workers, it absorbs 54 percent of total manufacturing employment and 8 percent of total jobs in the country. Furthermore, the progressive development of GME induces a more intensive movement of specialization in qualified labor, giving hope that it will eventually be able to absorb more and more young graduates.

To prevent strong protection from harming non-traditional exports, the government created an “offshore” regime with generous tax and financial incentives to attract foreign direct investment (FDI) and increase manufacturing exports, more likely to increase productivity, more labor intensive, and more consistent with sustainable economic growth. Fully exporting companies then benefit from a favorable business “environment”, including exemption from taxes and customs duties on imports of raw materials and equipment necessary for production, and exemption from tax on profits. during the first 10 years, free repatriation of profits, and greater trade facilitation. Tariffs on these products, which were close to 100% in 1996, have fallen sharply since then, reaching 0 percent in January 2008. Above all, the decision to open the industry to competition was an opportunity to apply a set of policies that allowed the industrial sector to upgrade and strengthen its managerial and technological capacities.

Tunisia's trade policy is based on a primary pillar which consists of promoting exports, through generous incentives intended to attract FDI in the “offshore” sector and trade agreements. However, several incentives were offered to exporting firms. Firstly, fully exporting firms receive a temporary 10-year corporate tax exemption, after which they would face 50 percent of the standard corporate tax (35 percent). Under a December 2006 tax law, exporting firms will face, since 2008, a uniform corporate tax of 10 percent while the standard corporate tax will be reduced to 30 percent. Secondly, Foreign investors are free to transfer or repatriate their profits and enjoy tax relief on reinvested profits and income up to 35 percent of income or profits subject to tax. Thirdly, foreign personnel and investors or their representatives responsible for managing a company based in Tunisia benefit from the payment of the uniform tax rate of 20 percent on gross income and enjoy exemption from customs duties and comparable taxes.

Moreover, since the mid-1990s, the Government has given a new direction to its integration policy, with the opening of Tunisian industry to competition, especially within the framework of the AA with the EU, the main economic and commercial partner of Tunisia. Since 1996, tariffs on imports from the EU have been gradually dismantled, to create a free trade zone for industrial products from January 2008. Tariffs on these products, which were close to 100% in 1996, have fallen sharply since then, reaching 0 percent in January 2008. Above all, the decision to open the industry to competition was an opportunity to apply a set of policies that allowed the industrial sector to upgrade and strengthen its managerial and technological capacities.

In 2011, the number of companies with foreign participation in Tunisia, all sectors included, was 3,135 employing nearly 325 thousand people. 79% of foreign companies are concentrated in manufacturing industries and employ 85% of the workforce. Within manufacturing industries, the textile and clothing sector occupies first place with 54% of employees, followed by the Electrical and Electronics Industry 22% and the Mechanical, Metal, Metallurgy industry 7%. More importantly, despite these various incentives, repatriated FDI income exceeded 75% of FDI in 2011 (FIPA, 2012).

3.2 ARDL approach to Granger causality tests

To empirically investigate the possible causal linkages and the long-run and short-run relationships among the variables of interest, the model has been estimated by using the bounds testing (or autoregressive distributed lag (ARDL)) cointegration procedure, proposed by Pesaran et al. (2001).

According to Pesaran et al. (2001), the ARDL method is adopted for the following reasons. Firstly, the ARDL model is the statistically significant appropriate approach in the case of small sample sizes, aiming to test for co-integration, while Johansen's co-integration technique requires a larger number of samples to achieve reliability. Secondly, As opposed to other multivariate cointegration techniques such as Johansen and Juselius (1990), the ARDL approach allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Thirdly, whereas in the Johansen approach (1991) the bounds testing procedure requires the pre-testing of the variables included in the model for unit roots, the ARDL method is applicable irrespective of whether the regressors in the model are purely I(0), purely I(1) or mutually cointegrated.

Following Pesaran et al. (2001), the ARDL (p,q) model can be expressed as follows;

$$\Delta Y_t = \gamma_0 + \gamma_1 Y_{t-1} + \delta_1 X_{t-1} + \sum_{j=1}^{k1} \varphi_1 \Delta Y_{t-j} + \sum_{j=1}^{k2} \varphi_2 \Delta X_{t-j} + \varepsilon_t \quad (1)$$

As advocated by Pesaran et al. (2001), Narayan (2005), and Tang (2006), in the unrestricted error correction specification, the statistical significance of the error correction term (i.e. the level lagged dependent variable) of the ARDL model (which is adapted with error correction) depicts long run causality, while the joint significance of the lagged first differenced variables captures short-run causality.

Alternatively to Eq.(1), the error correction version of the ARDL framework can be specified as equations (2) to (4);

$$\Delta lnFDI_t = \gamma_0 + \gamma_1 lnFDI_{t-1} + \gamma_2 lnES_{t-1} + \gamma_3 lnEM_{t-1} + \sum_{j=1}^{k1} \pi_1 \Delta lnFDI_{t-j} + \sum_{j=1}^{k2} \pi_2 \Delta lnES_{t-j} + \sum_{j=1}^{k3} \pi_3 + \Delta lnEM_{t-j} + \varepsilon_t \quad (2)$$

$$\Delta lnES_t = \delta_0 + \delta_1 lnFDI_{t-1} + \delta_2 lnES_{t-1} + \delta_3 lnEM_{t-1} + \sum_{j=1}^{k1} \varphi_1 \Delta lnFDI_{t-j} + \sum_{j=1}^{k2} \varphi_2 \Delta lnES_{t-j} + \sum_{j=1}^{k3} \varphi_3 + \Delta lnEM_{t-j} + \varepsilon_t' \quad (3)$$

$$\Delta lnEM_t = \theta_0 + \theta_1 lnFDI_{t-1} + \theta_2 lnES_{t-1} + \theta_3 lnEM_{t-1} + \sum_{j=1}^{k1} \sigma_1 \Delta lnFDI_{t-j} + \sum_{j=1}^{k2} \sigma_2 \Delta lnES_{t-j} + \sum_{j=1}^{k3} \sigma_3 + \Delta lnEM_{t-j} + \varepsilon_t'' \quad (4)$$

Where σ_1, σ_2 and σ_3 are short-run coefficients. θ_1, θ_2 and θ_3 are the long-run coefficients. The symbol Δ denotes the first differences of the variables, while k1, k2, and k3 represent the lags of the variables.

We remind that the goal of this study is to investigate whether there is a cointegrating relationship by using the bounds testing procedure as proposed by Pesaran et al., 2001, and to determine the causal-linkages (i.e. long run and short run causality via t-test and F-tests, respectively) among inward FDI, employment in services (ES), and employment in manufacturing (EM) in the Tunisian economy.

Within this framework, the first step in the ARDL bounds testing approach which is mainly based on the F-statistic (Wald test) to test the co-integration between observed variables is to estimate equations (2 to 4) by ordinary least squares (OLS) to define the long-run relationship that exists among these among the variables, i.e. FDI, ES, and EM in equation (2) (Pesaran et al. (2001) and Qamruzzaman et al. (2019)) by handling an F-test with the hypothesis:

Null hypothesis H_0: $\begin{bmatrix} \gamma_1 = \gamma_2 = \gamma_3 \\ \delta_1 = \delta_2 = \delta_3 \\ \theta_1 = \theta_2 = \theta_3 \end{bmatrix} = 0$ there is no co-integration relationship between variables;

Alternative hypothesis H_1: $\begin{bmatrix} \gamma_1 \neq \gamma_2 \neq \gamma_3 \\ \delta_1 \neq \delta_2 \neq \delta_3 \\ \theta_1 \neq \theta_2 \neq \theta_3 \end{bmatrix} \neq 0$ a co-integration relationship exists between variables.

The null hypothesis of no long-run relationship can be rejected when the value of the F-statistic is above the upper critical bounds value, and conversely, it is not rejected if the test statistic falls below the lower critical value. Finally, when the nexus of co-integration between these variables is indeterminate, the error correction model (ECM) is implemented to identify the co-integration relationship.

In the second step, once co-integration is established the conditional ARDL long-run model for Eq.(2), (3), and (4) can be estimated, where the orders of each variable are fixed using the Akaike information criterion (AIC). We denote that the lagged dependent variable in level (i.e. ln FDIt-1, lnESt-1, and lnEMt-1) can be interpreted as an error correction term in this ARDL equation (or augmented error correction model). As underlined by Bahmani-Oskooee and Brooks (1999), co-integration is supported if the lagged error correction term turns out to be negative and significant and thus the significance of the estimated coefficients of ln FDIt-1, lnESt-1, or lnEMt-1 (or error correction term) appears to be robust indicating that there is a co-integrating relationship among these three variables.

In the third and final step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta lnFDI_t = \gamma_0 + \sum_{j=1}^{k1} \pi_1 \Delta lnFDI_{t-j} + \sum_{j=1}^{k2} \pi_2 \Delta lnES_{t-j} + \sum_{j=1}^{k3} \pi_3 \Delta lnEM_{t-j} + \mu ECT_{t-1} + \omega_t \quad (5)$$

$$\Delta lnES_t = \delta_0 + \sum_{j=1}^{k1} \varphi_1 \Delta lnFDI_{t-j} + \sum_{j=1}^{k2} \varphi_2 \Delta lnES_{t-j} + \sum_{j=1}^{k3} \varphi_3 \Delta lnEM_{t-j} + \tau ECT_{t-1} + \omega'_t \quad (6)$$

$$\Delta lnEM_t = \theta_0 + \sum_{j=1}^{k1} \sigma_1 \Delta lnFDI_{t-j} + \sum_{j=1}^{k2} \sigma_2 \Delta lnES_{t-j} + \sum_{j=1}^{k3} \sigma_3 \Delta lnEM_{t-j} + \emptyset ECT_{t-1} + \omega''_t \quad (7)$$

Here π, φ and σ are the short-run dynamic coefficients of the model's convergence to equilibrium ,and μ, τ and ∅ are the speed of adjustment in Eq.(5), Eq.(6), and Eq.(7) respectively.

To ensure the robustness and validity of the econometric analysis, it is imperative to address the quantitative limitations of the Autoregressive Distributed Lag (ARDL) model, such as endogeneity and bias from omitted variables. It is evident that when significant factors that affect both the dependent and independent variables are excluded from the model, omitted variable bias may result. Moreover, when there is a correlation between the independent variable(s) and the error term, it is known as endogeneity and can result in skewed parameter estimates. To address it, we need to think about utilizing instrumental factors.

It should be highlighted that because different industries have different markets, legal frameworks, and investor inclinations, FDI might vary greatly amongst them. The ARDL model assumes that all sectors have the same correlations between the variables. In actuality, though, various sectors could exhibit unique traits and behaviors that a universal model is unable to adequately represent. The data may be oversimplified as a result of this assumption.

Furthermore, the way that various sectors react to external variables, policy changes, or economic shocks may vary. Sector-specific reactions cannot be sufficiently captured by the symmetric ARDL model, which may obscure significant subtleties in the FDI data. The model might give a broad overview of FDI dynamics, but it might not give precise insights into what influences FDI variance in different sectors. For sector-specific assessments, the ARDL model might not be sufficient for researchers or policymakers.

Regarding causation, the ARDL model might not fully address issues when looking at FDI and sectoral differences. When sectoral variations are present, causality can become more complex, and the model might not be able to properly separate causative links. Because a symmetric ARDL model implies homogenous relationships, its findings might not be easily generalized to all sectors. This restriction may have an impact on the results' external validity and their suitability for use in various economic contexts.

Lastly, the examination of the symmetric ARDL model frequently necessitates aggregated data, which may lead to the loss of sector-specific information. This could be an issue if you want to study particular sectors alone or comprehend the nuances of each one.

When addressing the qualitative constraints associated with FDI variations among sectors, we took the following into consideration:

- an asymmetric ARDL model to better capture sectoral trends and variability. If required, apply various models or strategies specific.
- To allow for sector-specific coefficients or variable responses, which show that some variables have different impacts in different sectors, including interaction terms in the model.

3.3 Unit Root Test

Before we proceed with ARDL bounds tests, a unit root test is performed to ensure that none of the variables is integrated of order 2 or beyond to avoid spurious results. In this framework, Augmented Dickey-Fuller (ADF) (1981) and Phillips-Perron (PP) (1988) are the unit root tests that are reasonably straightforward and nonparametric unit-root tests. The variables are tested with both "intercept" and "intercept and linear trend" on the level and first difference of each series to determine whether each series contains more than 1 unit root or not. We also used the minimization of MAIC to determine the optimal lag for each variable.

The hypotheses of the test are:

- The null hypothesis (H0) = There is a unit root (the time series is not stationary).
- The alternative hypothesis (H1) = There is no unit root (the time series is stationary).

We note that the null Hypothesis (H1) will be rejected if the calculated test statistic is less than the critical value of the test statistic.

Table 4: Time series unit root tests

Variable	ADF			PP		
At Level						
	Intercept	**Inter. + Trend**	**I**	**Intercept**	**Inter. + Trend**	**I**
lnFDI	-2.469799 (0.1310)	-3.038024 (0.1364)	I(0)	-2.315059 (0.1729)	-3.038024 (0.1364)	I(0)
lnEM	-4.000500*** (0.0039)	-1.346654 (0.8589)	I(1)	-11.26906*** (0.0000)	-1.394030 (0,8457)	I(1)
lnES	-3.627326*** (0.0100)	-0.233917 (0.9897)	I(1)	-3.637996*** (0.0097)	-0.065182 (0.9936)	I(1)
At First Difference						
Variable	**ADF**			**PP**		
	Intercept	**Inter. + Trend**	**I**	**Intercept**	**Inter. + Trend**	**I**
ΔlnFDI	-8.406093*** (0.0000)	-8.291854*** (0.0000)	I(1)	-9.628508*** (0.0000)	-10.00222*** (0.0000)	I(1)
ΔlnEM	-6.786214*** (0.0000)	-8.775609*** (0.0000)	I(1)	-6.722480*** (0.0000)	-17.71287*** (0.0000)	I(1)
ΔlnES	-3.580157** (0.0114)	-4.600032*** (0.0041)	I(1)	-3.580157** (0.0114)	-4.673965*** (0.0034)	I(1)

Notes: *1. Table 3 shows values of t-statistics and p-values in parentheses. 2. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively. 3. Intercept and Trend and Intercept are conditions of unit root test. 4. The symbol "I" indicates an order of integration.*

The ADF and PP unit root test results are given in Table 3 and indicate that the null hypothesis cannot be rejected at the level form for the FDI variable as the test statistic calculated in level value is higher than the critical value. While EM and ES variables are stationary at the level form only when not using the trend. Moreover, all the variables are stationary after being converted into the first difference. In summary, unit-root test results confirm the fact that all the variables are free from the unit root in the second difference. Considering this fact, we can proceed to the bounds testing procedure.

3.4 Empirical Findings

3.4.1 Optimal lag length

Formally, before estimating the ARDL model and examining the existence of a long-run relationship between variables, the order of lag length for the VAR has to be determined. The optimal lag length is identified based on a set of statistical selection information criteria viz. final prediction error (FPE), Akaike information criterion (AIC), Schwarz criterion (SC), and Hannan-Quinn information criterion (HQ).

Based on the Akaike information criterion (AIC), the appropriate lag length for the estimated VAR models is three as provided in Table 5.

Table 5: The optimal number of lags results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	35.71383	NA	2.76e-05	-1.982656	-1.846610	-1.936881
1	146.8042	195.2498*	5.70e-08	-8.169953	-7.625768*	-7.986851*
2	155.9820	14.46196	5.73e-08	-8.180727	-7.228404	-7.860299
3	166.3550	14.45931	5.49e-08*	-8.263938*	-6.903477	-7.806185
4	169.4194	3.714401	8.48e-08	-7.904204	-6.135604	-7.309124

** indicates the optimal number of lags.*

3.4.2 The Bound Test and the Long-Run Dynamic Model

We remind you that the purpose of the bound test is to explore the possible dynamic relationship between FDI inflows and employment in manufacturing and services sectors in the Tunisian economy. If the value of F-statistics exceeds the upper critical bound I(1), the null hypothesis of no co-integration is rejected. However, if the value of F-statistics is less than the lower critical bound I(0), then no co-integration relationship exists between observed variables. Table 4(a) reports the results of the calculated F-statistics when each variable is considered as a dependent variable in the ARDL-OLS regressions.

For the first and the second models (Eq.2 and Eq.3), when FDI and ES are considered as dependent variables respectively, the calculated F-statistics are 7.017 and 10.961, which are higher than the upper critical bound (5.85) at the 5% level. Thus, the null hypotheses of no cointegration are rejected, implying long-run cointegration relationships amongst the variables of interest. While, for the third model (Eq. 4) when EM is considered as a dependent variable, the calculated F-statistic FEM (EM|FDI, ES) = 4.099 is less than the lower bound critical value, 4.19, 4.87, and 6.34 at the 10, 5, and 1 percent levels respectively.

The estimated coefficient of the long-run relationship presented in Table 6(a), shows that in model 1 when FDI is considered as the dependent variable, a significantly positive effect of employment in the service sector, while employment in manufacturing has no significant effect on FDI in the long-run term. Precisely, a rise in the level of employment in the service sector by one unit results in an increase in FDI inflows by 8.833 units. However, in model 2, when ES is considered as the dependent variable, both FDI and employment in manufacturing have a significantly positive effect on employment in the service sector.

Table 6: Autoregressive distribution lag model result.

Model 1: ΔlnFDI as the Dependent Variable ARDL (3,2,0) selected based on AIC.			Model 2: ΔlnES as the Dependent Variable ARDL (2,1,2) selected based on AIC.			Model 3: ΔlnEM as the Dependent Variable ARDL (1,1,3) selected based on AIC.		
(a) The Long-Run Relation model								
Variables	**Coefficients**	**prob.**	**Variables**	**Coefficients**	**prob.**	**Variables**	**Coefficients**	**prob.**
lnES	8.833882***	0.0015	lnFDI	0.044589***	0.0001	lnFDI	-0,038501*	0.0611
lnEM	-2.898939	0,3703	lnEM	0.912162***	0.0000	lnES	0.982196***	0.0000
F-Bound Test	7.017401 (Co-integration)		F-Bound Test	10.96157 (Co-integration)		F-Bound Test	4.099643 (No Co-integration)	
ECM			ECM					
Critical value at a 5% Level of significance	I(0) 4.87	I(1) 5.85	Critical value at a 5% Level of significance	I(0) 4.87	I(1) 5.85			
(b) The Short-Run Dynamic ECT Model								
C	-18.87640***	0.0001	C	-0.001345***	0.9079			
Trend	-0.208884***	0.0001	Trend	0.007720***	0.0000			
ΔlnFDIt-1	0.178818***	0.3098	$\Delta lnES_{t-1}$	0.351615**	0.0070			
ΔlnFDIt-2	0.354421**	0.0185	$\Delta lnFDI_t$	0.014415***	0.0020			
$\Delta lnES_t$	13.66191	0.0015	$\Delta lnEM_t$	-0.292044**	0.0331			
$\Delta lnES_{t-1}$	-13.67881***	0.0013	$\Delta lnEM_{t-1}$	-0.547937**	0.0287			
ECTt-1	-0.938084	0.0001	ECTt-1	-0.547937	0.0000			
(c) Diagnostic test								
R-squared	0.683510		R-squared	0.758907				
F-statistics	9,718462	0.000010	F-statistics	14.68959	0.000000			
LM	7.835398	0,0199	LM	0.278617	0.8700			
ARCH	1.194457	0.2744	ARCH	0.775068	0,3787			
Jarque-Bera	1.227005	0.541451	Jarque-Bera	1.178671	0.554696			
RESET	0.111905	0.7409	ARCH	0.489690	0,4905			

Note: ***, **, and * indicate significant levels at 1%, 5% and 10% respectively.

3.4.3 The Short-Run Dynamic Model

The short-run dynamic coefficients associated with the long-run relationships for mode 1(Eq. 2) and model 2 (Eq. 3) are obtained from ECM equations (Eq. 5 and Eq.6) and are reported in Table 6(b). Model 1(Eq. 5), results show that the ΔlnFDIt model is associated positively with the lagged values of $\Delta lnES_t$ and negatively with the lagged values of $\Delta lnES_{t-1}$. For model 2 (Eq. 6), the lagged values of ΔlnFDIt are associated positively with the lagged values of the ΔlnESt model, while the lagged values of $\Delta lnEM_t$ and $\Delta lnEM_{t-1}$ are negatively associated with the $\Delta lnES_t$ model.

The error correction term (ECT_{t-1}) = -0.938, (ECT_{t-1}) = -0.548 has the correct sign and is significant at a 1% level in both models, indicating the short-run adjustment among variables of interest. Model 1 records the highest ECT_{t-1} coefficient in absolute value with highly significant implies a quit speed of reaching the long-run equilibrium and suggesting that 93.8% of any previous disequilibrium in the long-run would be shortly corrected back in the current year. For Model 2, the ECT_{t-1} coefficient indicates that approximately 55% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year.

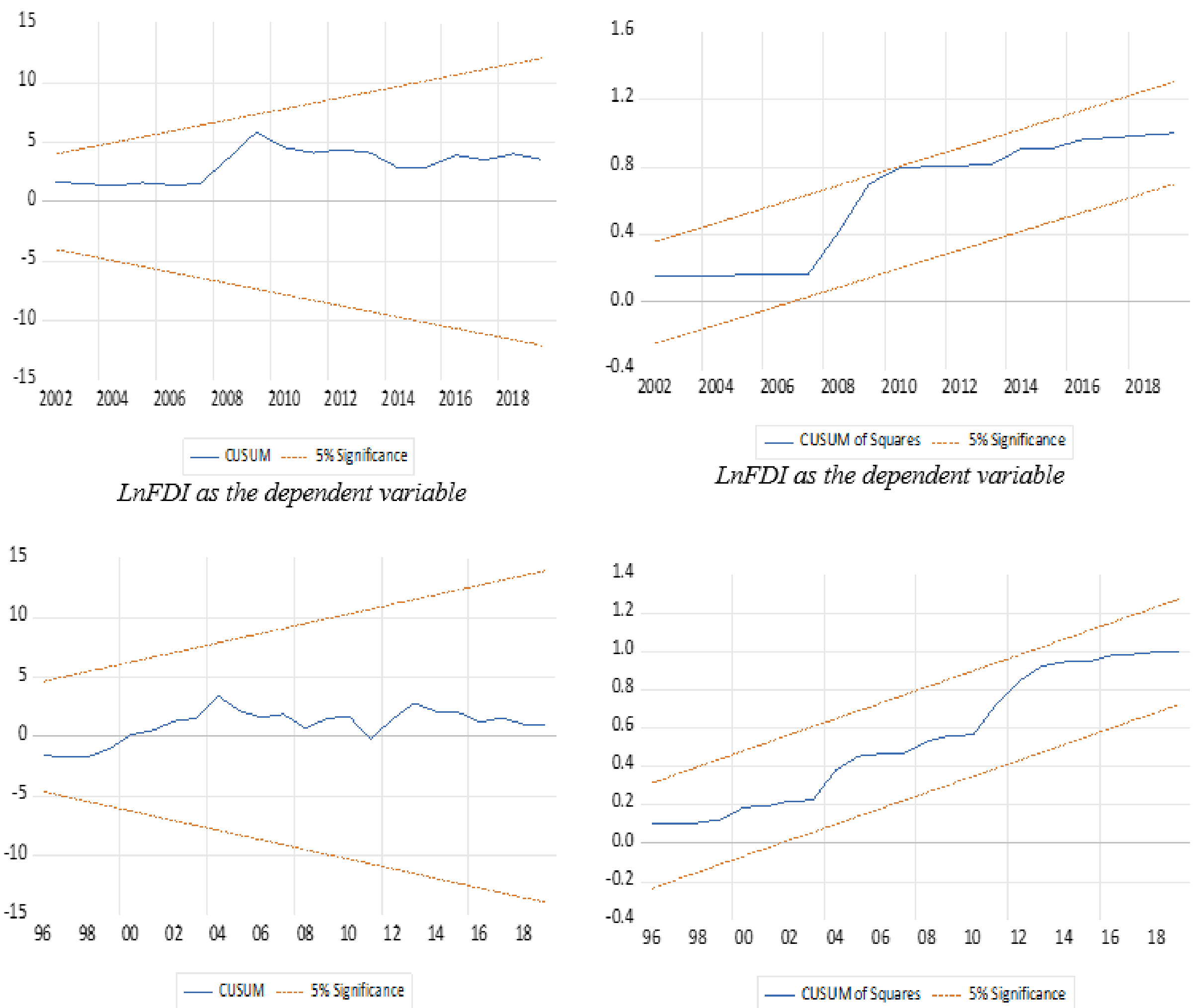
3.4.4 Diagnostic Test

To check the robustness of the entire model, a set of tests was conducted for the two models (eq. 5 and Eq. 6), such as Lagrange Multiplier (LM) test for autocorrelation, Autoregressive conditional heteroskedasticity (ARCH) test for heteroskedasticity, the Jarque-Berra (JB) test for error normality, RESET test for functional misspecification, and CUSUM and CUSUMSQ test for parameter Stability. The empirical statistics of the Breusch-Godfrey LM test and the Jarque-Bera normality test indicate that residuals are uncorrelated and normally distributed. Furthermore, the homoskedasticity hypothesis of the residuals is upheld. The computed Ramsey RESET statistic does not reject the hypothesis of the correct functional form of above Eq. (5) and Eq. (6).

The evidence, as reported in Table 6(c), shows that the p-value of all tests is greater than 5% and indicates that the regression for the underlying ARDL equations (5 and 6) passes the diagnostic tests against serial correlation, functional form misspecification, and non-normal errors.

Additively, both The cumulative sum of recursive residuals (CUSUM) and the cumulative sum of square (CUSUMSQ) test from a recursive estimation of the model are applied to check the long-run stability and the structural variation of residuals for the FDI, ES, and EM in the model 1 and 2 respectively, (Pesaran and Pesaran, 1997). The results (Figure 5) indicate that the recursive residual of models 1 and 2 are positioned within critical bounds at the 5% level of significance, which means that CUSUM statistics reveal no structural break(s) for the underlying equations (5 and 6). Thus, it can be concluded that the error correction model is relatively stable and that the long-run and short-run outcomes of the estimated models are reliable and stable.

Figure 2: Plots of Cusum and Cusumq for coefficients stability for ECM model



LnFDI as the dependent variable *LnFDI as the dependent variable*

LnES as the dependent variable *LnES as the dependent variable*

Source: Conducted by researcher based on Eviews 12

3.4.5 Wald test causality analysis

Identifying the causal direction among FDI, ES, and EM, provides policymakers to understand the role and interaction of FDI and employment in manufacturing and services sectors. The direction of causality between the dependent and independent variables is analyzed by using a test based on the Wald test procedure. The results of the causality test displayed in Table 7 confirm the bidirectional causal relationship between FDI and ES as well as between ES and EM. Whereas there is unidirectional causality between FDI and EM running from FDI inflows to employment in the manufacturing sector.

Table 7: Result of causality test

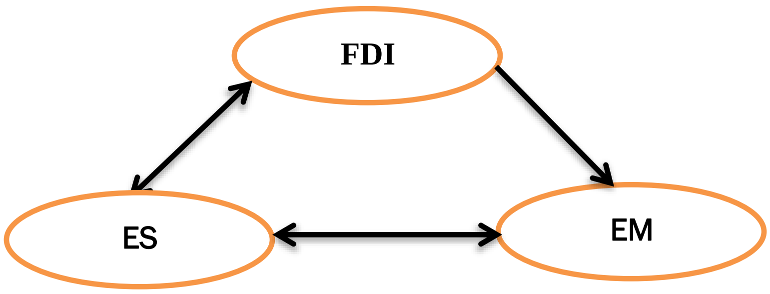
	Model 1: lnFDI as dependent variable		
	Wald-statistics	**df**	**p-value**
Ln FDI	-	-	-
lnES	6.513692	(3,25)	0.0021**
lnEM	0.747160	(1,25)	0.3956
	Model 2: lnES as dependent variable		
	Wald-statistics	**df**	**p-value**
Ln FDI	9.278151	(2.26)	0.0009**
lnES	-	-	-
lnEM	7.623017	(3,26)	0.0008*
	Model 3: lnEM as dependent variable		
	Wald-statistics	**df**	**p-value**
Ln FDI	2.903137	(2,25)	0.0735*
lnES	3.776670	(4,25)	0.0155**
lnEM	-	-	-

*Note: **, and * represent 5% and 10% significance levels, respectively*

Source: Author's computation from Eviews results output.

The summary of the direction of the short-run causality among FDI, EM, and ES for Tunisia is outlined in Figure 3, which indicates the short-run bidirectional causality between Inward FDI and ES and between EM and ES but only a short unidirectional causality between FDI and EM.

Figure 3: Short-run inter-linkage between inward FDI, manufacturing employment and services employment



4. Conclusions and policy implication

Based on the Bound testing (ARDL) approach, the purpose of this study was to look for evidence regarding a possible long-run and short-run relationship between foreign direct investment, employment in manufacturing and service sectors as well as to investigate the inter-linkage between these variables using Tunisia as the case study. The bounds test suggested that the variables of interest are bound together in the long run. The long-run effect of FDI is found to be positive and statistically significant only on employment in the services sector. The associated equilibrium correction was also significant confirming the existence of long-run-relationship. Moreover, our empirical results suggest that an increase in FDI leads to higher employment, as it has been confirmed by past studies that FDI is said to generate employment in two ways: direct employment within multinational companies (MNEs) and indirect employment through backward and forward linkages of MNEs in host countries, (Asiedu, 2002 and 2004).

Besides, the findings of this study show that there is a bidirectional causation that runs from FDI to employment in the service sector but an unidirectional causation that runs from FDI to employment in manufacturing service in the long run. This in turn implies that the scope of interaction and feedback between MNEs and local industries of the manufacturing sector has a lower propensity to establish linkages with the services sector in Tunisia, while the services employment can be seen as a complement to manufacturing employment given these sectors are mutually supporting.

More importantly, empirical results suggest that short-run causation runs from FDI inflows to manufacturing employment, and in turn, employment linkage is running from manufacturing to services, which can be explained by the move up of the value chain in the manufacturing sectors, generating employment spill-over effect in the services sector.

In light of these empirical findings, some crucial policy implications can be generated. Firstly, given the large fluctuation of the inward FDI flows (especially between 2006 and 2019), political stability must be maintained in the country because it represents the most crucial contributor to attracting FDI. Secondly, Tunisian authorities should focus on the policies that attract more inward FDI related to the manufacturing sector to increase their production and so create new activities in service sectors, and generate new employment opportunities. Thirdly, Tunisia should implement policies that favor foreign investors not only to avoid fluctuation in FDI inflows but also to diverse type of FDI spillovers and skill spillovers which can diversify the manufacturing base and allows more value-added manufacturing activities and thus create more employment opportunities, along with growth-generating effect, in both manufacturing and services as an interlinked sector.

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