



معهد التخطيط القومي
سلسلة أوراق عمل

Analyzing The Dynamic Relationship Between Foreign Direct Investment and Tax Revenues in Egypt

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ورقة عمل رقم (15) 2025

مايو 2025



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ورقة عمل رقم (15) - 2025

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سلسلة أوراق عمل- معهد التخطيط القومي

**Analyzing The Dynamic Relationship
Between Foreign Direct Investment and
Tax Revenues in Egypt**

**تحليل العلاقة الديناميكية بين الاستثمار الأجنبي
المباشر والإيرادات الضريبية في مصر**

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Abstract

Since 1974, Egypt has adopted several economic policies to attract FDI to finance investment needs and boost economic growth. This paper investigates the effect of FDI on tax revenue along with several other factors that affect tax revenue in Egypt, such as GDP growth, inflation, and gross capital formation, using annual data from 1975 to 2023. The findings reveal that FDI has a negative short-run but positive long-run effect on tax revenue. Despite the contradictory results in the short and long run, the negative impact of FDI on tax revenue in the short run could be explained by several causes, such as tax incentives offered by the Egyptian government throughout the study period to attract FDI, as well as profit shifting and repatriation. The results also indicate a negative effect of GDP growth on tax revenue in the short run. The findings further reveal that FDI has a negligible positive impact on tax revenue in the long run. Therefore, the study recommends reforming tax incentives, encouraging linkages between FDI and domestic firms, promoting reinvestment of profits, enhancing international tax cooperation, and diversifying sources of investment.

Keywords: Foreign Direct Investment (FDI) - Tax Revenue - ARDL model - Error correction model ECM - Dynamic analysis - long-run coefficient- Egypt

ملخص

منذ عام 1974 تبنت مصر العديد من السياسات الاقتصادية لجذب الاستثمار الأجنبي المباشر لتمويل احتياجات الاستثمار وتعزيز النمو الاقتصادي، لذا تتناول هذه الدراسة تأثير الاستثمار الأجنبي المباشر على الإيرادات الضريبية إلى جانب العديد من العوامل الأخرى التي تؤثر على الإيرادات الضريبية في مصر مثل؛ نمو الناتج المحلي الإجمالي، والتضخم، وتكوين رأس المال الإجمالي باستخدام البيانات السنوية من عام 1975 حتى عام 2023. توصلت الدراسة إلى أن الاستثمار الأجنبي المباشر له تأثير سلبي في الأجل القصير وتأثير إيجابي في الأجل الطويل على الإيرادات الضريبية. يمكن تفسير التأثير السلبي للاستثمار الأجنبي المباشر على الإيرادات الضريبية في الأجل القصير من خلال عدة أسباب مثل الحوافز الضريبية التي قدمتها الحكومة المصرية خلال فترة الدراسة لجذب الاستثمار الأجنبي المباشر وتحويل الأرباح. كما تشير النتائج إلى وجود تأثير سلبي لنمو الناتج المحلي الإجمالي على الإيرادات الضريبية في الأجل القصير. علاوة على ذلك، تكشف النتائج أيضًا أن الاستثمار الأجنبي المباشر له تأثير إيجابي ضئيل على المدى الطويل على الإيرادات الضريبية. لذلك، توصي الدراسة بإصلاح الحوافز الضريبية، وتشجيع الارتباط بين الاستثمار الأجنبي المباشر والشركات المحلية، وتشجيع إعادة استثمار الأرباح، وتعزيز التعاون الضريبي الدولي، وتنويع مصادر الاستثمار.

الكلمات المفتاحية: الاستثمار الأجنبي المباشر (FDI) - الإيرادات الضريبية - نموذج ARDL - نموذج تصحيح الخطأ ECM - التحليل الديناميكي - معامل المدى الطويل - مصر

I. Introduction:

Foreign Direct Investment (FDI) has long been a topic of interest (Lizondo, 1991); and several reasons exist for this renewed interest. With market access liberalization, financial markets have become a more globally integrated framework. This integration, which has been accelerated by increased competition among market players, has resulted in the introduction of new financial products with greater market access and lower transaction costs. These financial instruments have attracted investors from a variety of countries and economies. Technological breakthroughs in data processing and telecommunication have further accelerated the expansion of cross-border financial transactions. FDI is a key component of this rapidly evolving globalization, known as global economic integration (OECD, 2020). FDI promotes cross-border flows, which refer to the cumulative value of direct investment transactions over time. It occurs when a national investor has a long-term interest in a company headquartered in another country. These flows climbed from only \$47 billion in 1985 to \$462 billion in the first quarter of 2024 (OECD, n.d.).

Direct, reliable, and enduring connections between economies could be established through FDI. It could boost the growth of local businesses and assist both the investing and the host economies in becoming more competitive. The host economy could also use it as a channel to advertise its goods more extensively in foreign markets. In addition to its beneficial impact on the growth of global commerce, FDI is a significant source of funding for various host and home economies (OECD, 2020). With the widening SDG financing gap and the urgent need to expedite investment in combating climate change and achieving digital transformation, FDI is becoming increasingly critical (OECD, 2024). Another aspect is the possibility of FDI directing resources to emerging countries. Despite representing a modest part of total capital inflows into developing countries, FDI may become more essential, as many of these countries have limited access to alternative sources of funding (Lizondo, 1991), especially for emerging economies such as Egypt. Not only is FDI a significant source of funds, but it also enhances technology transfer, creates new job opportunities, transfers expertise across economies, and contributes to overall economic growth in host nations. It also serves as a complement to domestic private investment (Chowdhury & Mavrotas, 2006; Gaspareniene et al., 2022).

On the other hand, mobilizing domestic resources is critical for promoting growth and funding government services. Taxes are an important source of these domestic resources (Modica et al., 2018). Tax revenue is defined as the revenue collected from income and profit taxes, taxes on goods and services, payroll taxes, property ownership and transfer taxes, and other tax sources. Tax revenue could be considered a measure of the government's control over the economy's resources (OECD, n.d.). Different

factors influence the tax-to-GDP ratio's level, including a country's income level, as countries with higher per capita incomes often collect more taxes. Other economic factors include the size of the informal sector, the level of consumption, trade openness, and sectoral composition. For example, nations that rely on agriculture often have lower tax-to-GDP ratios, whereas those with more varied economies typically have higher tax-to-GDP ratios (Modica et al., 2018). Furthermore, local companies may be unable to cope with the advanced production capacity created by FDI, which not only impacts their sustainability but also negatively impacts the tax revenues, which may outweigh the positive impact of FDI on tax revenue.

The studies discussed extensively the relationship between FDI and different variables. For instance, a vast majority of studies showed that FDI and economic growth are positively correlated as FDI may boost economic growth in several ways. Economic growth might also attract FDI when it seeks out consumer markets or when it results in enhanced economies of scale and, consequently, cost efficiency (Kurtishi-Kastrati, 2013). Other studies discussed the relationship between FDI and job creation (Ni et al., 2021). However, few studies address the relationship between FDI and tax revenue in general and especially in Egypt. The study of Abdellatif et al., (2021) shows a significant relationship between FDI inflow and supply-side taxation, while tax incentives do not seem to affect the inflow of FDI using the least squares method. Instead, most of the literature concentrates on developed economies or larger regions like sub-Saharan Africa (Herzer & Morrissey, 2007). With a focus on Egypt's economy, this research will try to answer the study's main question: What is the dynamic relationship between foreign direct investment and tax revenues in Egypt? Analyzing this dynamic relationship will be conducted using the "Autoregressive Distributed Lag (ARDL)" technique over a long period, from 1975 to 2023. The ARDL model was used to calculate each variable's short- and long-term effects on tax revenue. In addition, the ARDL technique was used in many similar studies that examined the relationship between FDI and tax revenue in other countries. The study of Jemiluyi (2023) applied the ARDL-ECM and showed that FDI has a negative effect on tax revenue in South Africa. Another study by Alshubiri (2024) measured the effects of tax revenue in developing and developed countries using several estimation methods including the (ARDL) approach. The study revealed that FDI has a positive effect in the long run and negative impacts in the short run in developing countries.

In this research, we examine the impact of FDI on tax income using various variables such as gross capital formation (% of GDP), GDP growth (annual %), and inflation (consumer prices annual %). The researchers tried to incorporate more factors, such as political stability, however, the data was insufficient because of their short duration in comparison to the other variables.

The study is divided into six sections, the first of which introduces the concept of foreign direct investment and its relation to tax revenue. The second part examines the theoretical and literature review. The third section examines FDI and tax revenue in Egypt. The fourth section discusses the model specifications and techniques, focusing on data description and the ARDL approach, followed by the fifth part, which provides an analysis of the model results. Finally, the sixth section highlights the suggested policy recommendations.

II. Literature Review:

FDI results in the transfer of capital from low-returning economies to high-returning economies. According to the MacDougall-Kemp hypothesis, investing countries benefit from higher national revenue than they do when they maintain their capital, as long as the gain from foreign investment outweighs the loss of output. Due to an increase in the amount of investment brought by the inflows, the host nation also sees a rise in national revenue (Joshua, et al., 2023).

As mentioned by the Neoclassical trade theory, FDI could have a significant effect on the economic well-being of host countries through promoting tax revenue. FDI also affects economic growth positively. However, the influence varies from one study to another. Several studies showed a positive relationship between FDI and economic growth. In a study that tried to explore the relationship between FDI, tax revenue, and economic growth using a fixed effect model, it was found that FDI influences economic growth but not tax revenue as a percentage of GDP in Sub-Saharan countries (Kubaje et al., 2025). Bayar and Ozturk (2018) tried to explore the nexus between FDI, economic growth, and tax revenue in 33 OECD countries. The findings showed a cointegrating relationship among the three variables, a one-way causality from FDI to total revenue, and a bidirectional causality between FDI and economic growth. Another study conducted in Romania examined the relationship between FDI and economic growth; the study found that FDI is the main determinant of economic growth in the country (Ciobanu, 2021). Ayanwale (2007) found that FDI has a positive effect on economic growth in Nigeria. Furthermore, a study on Malaysia demonstrated that an increase in FDI by 1 percent leads to an increase in GDP growth by 0.05% (Har et al., 2008). Similarly, a study conducted in the Eurozone also showed a positive relationship between FDI and economic growth in the area (Pegkas, 2015).

On the other hand, some studies show that the role of FDI in economic growth is ambiguous (Alfaro, 2004; Sarker, 2007). For instance, a study in India implied that FDI is unlikely to positively affect economic growth if regulations remain the same (Chakraborty & Nunnenkamp, 2006). Using data from 80 countries from 1979 to 1998,

the results mostly suggest that FDI does not have a direct effect on economic growth (Durham, 2004).

Some studies focused on the direct relationship between FDI and tax revenue. However, the findings are inconsistent and contradictory depending on the countries and economic structures. A paper that examines the impact of international taxation on patterns of FDI indicates that taxation affects the location of FDI; nevertheless, reactions to worldwide tax rates differ from country to another (Hines, 1999). As a result, tax revenue could have a significant effect on attracting FDI. A study conducted on African countries shows that good infrastructure and return on investment have a positive effect on FDI to non-Sub-Saharan countries but no effect on FDI to Sub-Saharan countries (Asiedu, 2002). A study by Klemm and Parys (2012) showed that corporate income taxes are effective in attracting FDI in Latin America and the Caribbean but not Africa.

On the other hand, FDI can also boost income tax by creating jobs in addition to the increase in international taxes by promoting exports (UNCTAD, 2012). Host nations also tax FDI capital gains and profits (Anwar & Nguyen, 2011). Gasparéniené et al. (2022) investigated the relationship between FDI and tax revenue. The study applied the least-squares method using data from the European Union from 1999 to 2009. The results of the study showed that outward FDI has a compelling effect on stimulating tax revenue while inward FDI reduces it. Another study conducted in Kenya, the found showed a positive and a significant impact of FDI on tax revenue (Nalyanya et al., 2020). Fuest and Riedel (2009) clarified that FDI can affect tax revenue indirectly through the creation of new jobs. Pratomo (2020) showed a positive correlation between FDI net flow with total tax revenue in developing countries, but the results are not significant. In Zimbabwe, Binhá (2021) investigated the impact of FDI on tax revenue growth using the OLS method and found a positive fiscal impact of FDI in the country. Another study conducted in West Africa found a strong positive impact of FDI on tax revenue (Okey, 2013). FDI also contributed by 77 percent of tax revenue in Sri Lanka (Aslam, 2015). The positive effect of FDI on tax revenue was also found in another study in Pakistan (Mahmood and Chaudhary, 2013).

However, FDI may have a negative effect on tax revenue due to profit shifting and the extensive use of tax incentives (Zee et al. 2002; Gropp & Kostial, 2001). In the study by Jemiluyi and Jeke (2023), the ARDL-ECM results revealed that FDI negatively affects tax revenue in South Africa using time series data from 1994 to 2021. A study by Alshubiri (2024) captured the effects of FDI on tax revenue in developing and developed countries using several estimation methods, including Feasible Generalized Least Squares (FGLS), a two-step system GMM, and a Pool Mean Group (PMG) panel autoregressive distributed lag (ARDL) approach. The findings of the study showed

contradictory results when comparing developing and developed countries. FDI seems to have negative long-term but positive short-term effects in developed countries. On the other hand, FDI has proven to have positive effects in the long-term and negative impacts in the short-term in developing countries.

The nexus between FDI, economic growth, and tax revenue in Egypt:

Several studies have investigated the relationship between FDI and economic growth in Egypt. A Granger causality test and a VECM method showed a long-run positive impact of FDI on economic growth in Egypt (Alaa et al., 2021). Another study by Ibrahim (2015) showed that FDI has a long-run positive effect on economic growth. By adopting data from 1990 to 2021, an ARDL model revealed that an increase in FDI by 1% leads to an increase in GDP by 1.87%. Another study tried to investigate the impact of both technological innovation and FDI on economic growth in Egypt. The outcome of the applied ARDL model showed that there is a positive and significant effect of FDI on the share of total capital formation in economic growth (Mohamed et al., 2021). Abdelgany (2022) chose Net Official Development Aids (ODA) and migrant remittance (REM) as variables representing FDI in Egypt during the period from 1990 to 2020. The ARDL model showed that the chosen variables have a significant impact on GDP growth in the long run. Omri and Sassi-Tmar (2013) examined the impact of FDI on economic growth for three African Economies (Tunisia, Morocco, Egypt). The authors applied the system GMM and verified the bidirectional linkage between FDI and economic growth in the three economies. In their study, high levels of foreign direct investment inflows have accelerated economic growth, and these economies' rapid economic expansion sends a good message to potential foreign investors.

On the other hand, a study applied to 26 Egyptian governorates, using a dataset from 1992 to 2007, investigated the relationship between economic growth and FDI. The findings showed that the effect of FDI on economic growth is insignificant (Hanafy & Marktanner). The same findings were confirmed in a study that employed data from 1985 to 2014 and found a weak effect of FDI on economic growth and employment in Egypt (Abouelfarag et al., 2020).

On the other hand, some studies have investigated the relationship between tax revenue and economic growth in Egypt. Eissa and Khalifa (2023) investigated the relationship between tax revenue and economic growth in Egypt. The results showed that GDP growth significantly affects tax revenue in the short run. Another study applied to some selected African countries, including Egypt, measured the effect of Personal Income Tax (PIT), Companies Income Tax (CIT), Custom Excise Duties (CET), and Value Added Tax (VAT). The results show that there is no significant effect of the selected taxes on economic growth in Egypt (Joseph et al., 2022).

As for the relationship between tax revenue and FDI in Egypt, there are very few studies that directly measure the dynamic relationship between FDI and tax revenue in Egypt. However, a study by Abdellatif and others (2021) found that FDI is more attracted to lower tax rates and simplified provisions rather than tax incentives.

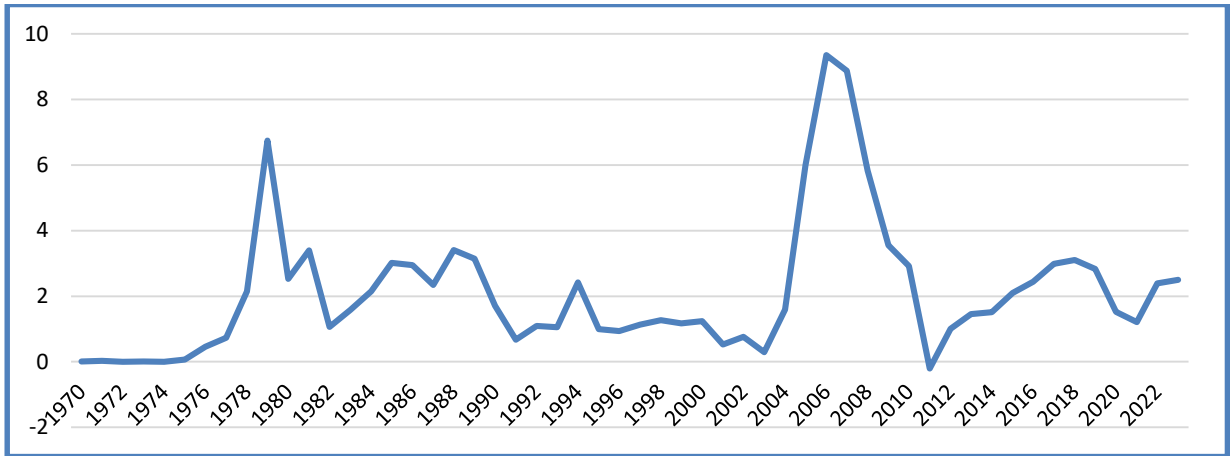
Based on the previously mentioned studies that confirmed the existence of a relationship between FDI and economic growth and tax revenue and economic growth in Egypt, we can hypothesize the existence of a significant relationship between tax revenue and FDI in Egypt. As a result, our study fills a gap in the literature as it directly examines the relationship between FDI and tax revenue in Egypt using an ARDL approach. The model was chosen for measuring both the long and the short run relationship.

III. FDI and Tax Revenue in Egypt

According to figure (1), Egypt's FDI net inflows as a percentage of GDP have fluctuated over time. In the first five years of the 1970s, the FDI net inflows as a percentage of GDP remained very low. They represented only 0.008% in 1970 and reached 0.068% in 1975 due to the circumstances of the Egypt war. In 1979, the open-door policy impacted the inflows, which jumped to 6.7%. After that, the inflows declined again and fluctuated till they reached the lowest point in 2001 with 0.5%. In 2006, the inflows reached the highest point with 9.3%, then deteriorated again till reaching the lowest point in 2011 due to the revolution, where the percentage turned negative with 0.2%, which represents outflows. In 2018, they reached 3% before deteriorating again in 2020 due to COVID-19. In a nutshell, we can say that the highest inflows represented only 9%; however, they represent small inflows compared with other countries.

Figure (2) highlights the flow of FDI and tax revenue as a percentage of GDP from 1975 to 2023. The figure shows that tax revenue as a percentage of GDP follows a fluctuating pattern. It seems that the highest levels were achieved in 1981, as tax revenue represented 26.2% of GDP. However, the lowest levels were achieved in 2020, with tax revenues representing only 12% of GDP. The relationship between the flow of both FDI and tax revenue as a percentage of GDP could not be explained in Figure (2), as they don't seem to follow a specific direct or inverse relationship.

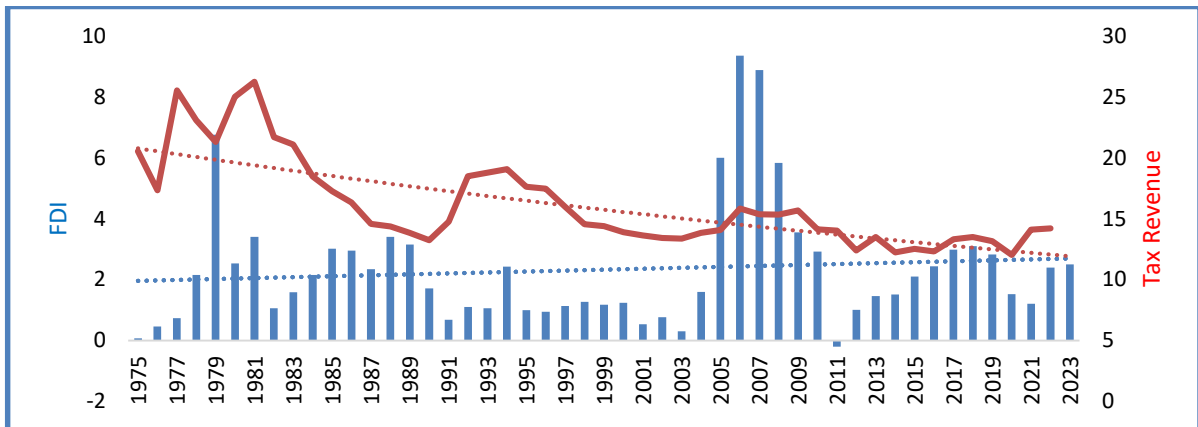
Figure 1: FDI net inflows (% of GDP) in Egypt from 1970 to 2023



Source of data: World bank database

“FDI is the net inflows of capital to purchase a long-term management stake (10 % or more shares) in a business that operates in an economy that differs from the investor's own.”

Figure 2: FDI net inflows (% of GDP) and tax revenue (% of GDP) in Egypt from 1970 to 2023



Source of data: World Bank database and the Ministry of Finance

IV. Model specification and Data description:

1. Data description:

The variables were selected depending on the examination of empirical and theoretical studies. The choice of GDP as an explanatory variable is derived from the previously mentioned studies in the literature that discuss the nexus between FDI, tax revenue, and GDP. The study of Abdullah and Hassan (2017) found a long run relationship between tax revenue and gross capital formation and the increase in tax revenue crowds out gross capital formation in the long run. In addition, the results indicate that gross capital formation has a significant impact on tax revenue. As for inflation, many studies found a significant relationship between tax revenue and inflation. Nalyanya and others (2020) found that inflation in Kenya has a negative effect on tax revenue. As a result, we expect to find a positive effect of GDP and gross capital formation on tax revenue but a negative effect of inflation on tax revenue in Egypt. Nonetheless, the relationship

between FDI and tax revenue in Egypt may vary from weak to strong positive effect. Furthermore, the study uses annual data from 1970 to 2023 that was obtained from the Ministry of Finance and World Bank databases. Table (1) shows the variables used in the study.

Table 1: Variables description

Variable name	Description	Abbreviation
Tax revenue	Tax revenue (% of GDP)	TAXR
Foreign direct investment	Foreign direct investment, net inflows (% of GDP)	FDI
Gross capital formation	Gross capital formation (% of GDP)	GCF
Gross domestic products,	GDP growth (annual %)	GDP
Inflation	Inflation, consumer prices (annual %)	INF

2. Empirical methodology

To deeply explain the relationship between FDI and tax revenue, this study will employ the ARDL model to investigate the long-run relationship between the variables. Numerous comparable studies that looked at the connection between foreign direct investment and tax income in other nations employed the ARDL technique. Using the ARDL-ECM, Jemiluyi's (2023) analysis showed that foreign direct investment (FDI) had a detrimental impact on South Africa's tax income. Alshubiri (2024) used several estimating techniques, including the ARDL approach, to quantify the effects of tax income in both developed and developing nations. According to the study, foreign direct investment (FDI) has both short-term and long-term detrimental effects in developing nations.

The ARDL model was first presented by Pesaran and Shin (1998) and then developed by Pesaran, Shin, and Smith (2001). The ARDL model is preferable when dealing with variables of various orders, unlike other cointegration techniques such as Johansen, VAR, and Granger causality tests that require variables integrated of the same order (Nkoro and Uko, 2016). In addition, the model also provides consistent results even when dealing with small datasets. However, it cannot deal with variables integrated into order two I (2). Using a linear transformation, we will also derive an Error Correction Model (ECM). The use of ECM helps in employing short-run dynamics with long-run equilibrium and supports avoiding problems that may result from non-stationary data such as superius output (Shrestha and Bhatta, 2018).

The following is the generalized ARDL (p, q) model:

$$Y_t = \gamma_{0i} + \sum_{i=1}^p \delta_i Y_{t-i} + \sum_{i=0}^q \beta'_i X_{t-i} + \varepsilon_{it}$$

Where: Y is the dependent variable for tax revenues; X is a vector of the independent variables; δ_i and β' are coefficients; γ is the constant; $i = 1, 2, \dots, k$; p lags of Y and q lags of X; ε_{it} is a vector of the error term.

Hence, the study model is expressed as follows:

$$= f(\beta_0 + \beta_1 FDI + \beta_2 GCF + \beta_3 gdp + \beta_4 INF)$$

Where TAXR is the dependent variable for tax revenue, FDI, GCF, GDP, and INF are the explanatory variables for foreign direct investment, gross capital formation, gross domestic product, and inflation, respectively.

$$\begin{aligned} \Delta TAXR = & \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta TAXR_{t-i} + \sum_{i=0}^q \beta_{2i} \Delta FDI_{t-i} + \\ & \sum_{i=0}^q \beta_{3i} \Delta GCF_{t-i} + \sum_{i=0}^q \beta_{4i} \Delta GDP_{t-i} + \sum_{i=0}^q \beta_{5i} \Delta INF_{t-i} + \\ & \beta_6 TAXR_{t-1} + \beta_7 FDI_{t-1} + \beta_7 GCF_{t-1} + \beta_8 GDP_{t-1} + \beta_9 INF_{t-1} + \varepsilon_{it} \end{aligned}$$

To include the long-run estimate, we applied the following error correction model (ECM):

$$Y_t = \gamma_{0i} + \sum_{i=1}^p \delta_i Y_{t-i} + \sum_{i=0}^q \beta'_i X_{t-i} + \lambda ECT_{t-1} + \varepsilon_{it}$$

$$\begin{aligned} \Delta TAXR = & \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta TAXR_{t-i} + \sum_{i=0}^q \beta_{2i} \Delta FDI_{t-i} + \\ & \sum_{i=0}^q \beta_{3i} \Delta GCF_{t-i} + \sum_{i=0}^q \beta_{4i} \Delta GDP_{t-i} + \sum_{i=0}^q \beta_{5i} \Delta INF_{t-i} + \\ & \lambda ECT_{t-1} + \varepsilon_{it} \end{aligned}$$

While dealing with the ECM, the long-run imbalance between the explanatory variables and the dependent variables should be corrected over time. This should be verified when the coefficient λ of the error correction term ECT_{t-1} proves to be significant with a negative sign. The negative sign ensures the stability of the model.

3. Empirical results:

In this section, the research includes the results of required data tests, findings of the applied ARDL model, and their related analysis.

Unit root analysis:

Even though the ARDL model does not require unit root tests, it does not work in the case of integrated variables of level two I (2). As a result, we applied the following unit root tests.

Table 2: Augmented Dickey-Fuller (ADF) & Phillips-Perron (PP) unit roots tests

Variables	ADF		PP	
	level	first differences	Level	first differences
TAXR	1.190118	-4.21728**	2.21479	-3.73202**
FDI	-0.50507	-6.4534***	-0.45211	-6.45793***
GCF	-1.74629	-7.25148***	-1.74629	-7.21633***
GDP	- 3.26906**		-4.64931***	
INF	- 3.52007**		-3.50513***	

*** Significant at 1%, **Significant at 5%.

Source: Calculated by the authors.

Table (2) shows the results of applying both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to check the level of integration of the series. The results of both tests are consistent and show that the integration of the series is a mix between I (0) and I (1). As noticed in Table (2), TAXR, FDI, and GCF are integrated at level one while GDP and INF are integrated at level zero. These results imply that the use of the ARDL model is suitable.

Lag length criteria:

Before performing the ARDL bounds test, the appropriate lag length must be determined. Since lag selection influences the model's output, it is essential. There are several ways to determine the optimal latency for each variable. To decide if a lag period is sufficient, the "Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ)" are used. Based on all the criteria in table (3), Lag 3 was considered the best option.

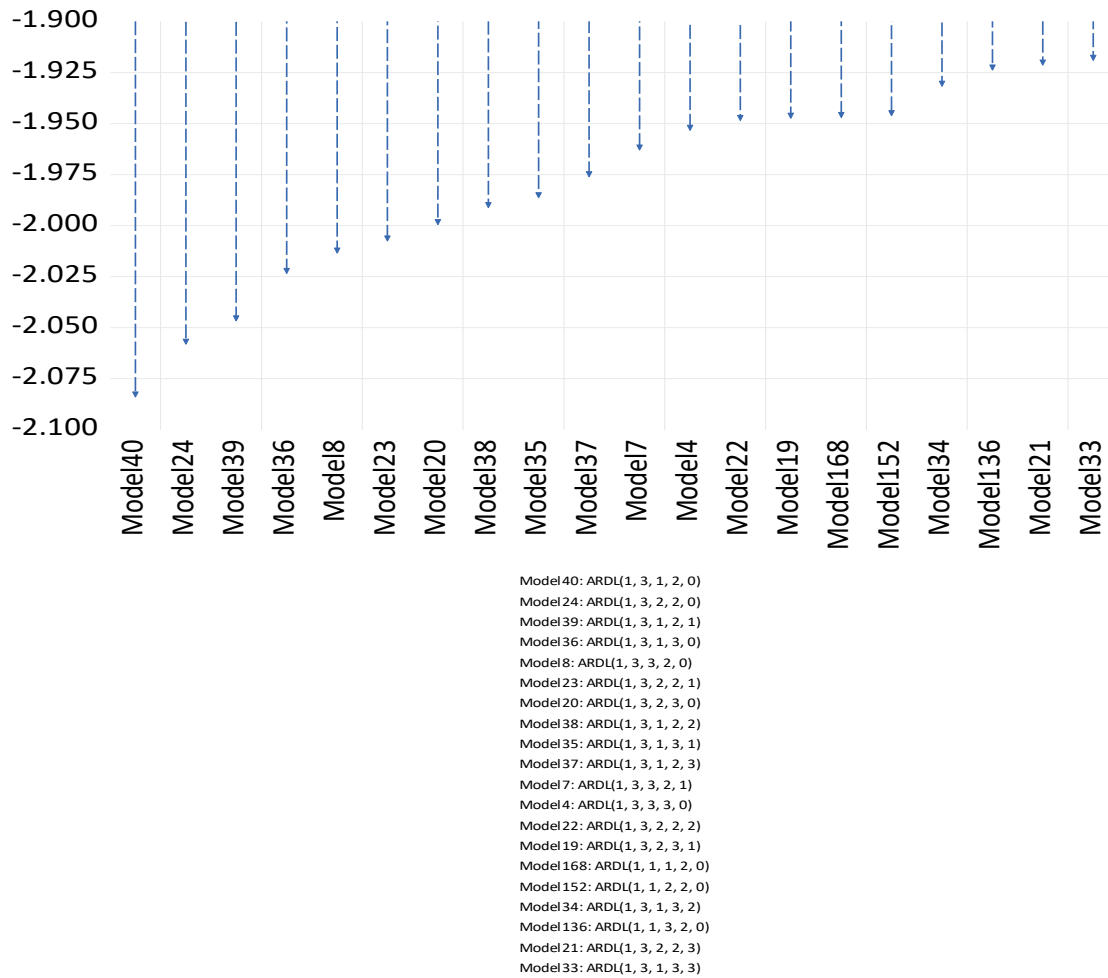
Table 3: Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	21.0009 8	NA	0.017974	-1.185258	-0.945288	-1.113903
1	32.4377 5	17.79052	0.008323	-1.958352	-1.670388	-1.872725
2	32.9012 5	0.686671	0.0087	-1.918611	-1.582653	-1.818713
3	36.1323 6	4.547495 *	0.007421 *	- 2.083879*	- 1.699927*	- 1.969710*

The symbol * denotes the lag order chosen by the criteria.

Figure 3: Model Selection Criteria Graph

Akaike Information Criteria (top 20 models)



Bound test approach:

We applied the F-test of the joint significance of the coefficient of lagged variables to confirm the long-run relationship among them. The use of the F-statistic approach is beneficial in figuring out the cointegrating vectors even when they are a lot (Nkoro & Uko, 2016). When interpreting the results of the test, it is crucial to compare the F-value with the upper critical

bound (UCB). If the F-test value is bigger than the UCB, we can conclude that the variables are cointegrated; if not, the variables are not co-integrated (Chandio & Rehman, 2019)

Table (5) depicts the results of the F-cointegration test where the estimated value of F-statistic is 10.44747. Hence, it is greater than UCB at all significant levels of I (0) and I (1). So, the results imply the existence of a long-run relationship between tax revenue and other explanatory variables.

Table 4: F-Cointegration test

Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	10.44747	10%	3.03	4.06
k	4	5%	3.47	4.57
		2.50%	3.89	5.07
		1%	4.4	5.72

Source: Calculated by the authors.

Long-run and short-run analysis:

After confirming the long-run relationship between tax revenue and other explanatory variables, we estimated the short-run results of the model in Table (6). Table (6) shows short-run estimation. As shown, the increase of FDI (-2) of one percent decreases tax revenue by 0.18 percent in the short run. Likewise, a 1 percent increase in GDP growth diminishes tax revenue by 0.09 percent after one year. However, the model found no significant effect of gross capital formation on tax revenue in the short run analysis. Table (6) does not include the inflation since it was dropped by the EViews program due to high insignificance.

Table 5: Short-run Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
			7.83485	
C	3.608608	0.460584	5	0.0000
@TREND	-0.02266	0.003118	-7.26544	0.0000
D(LOGFDI)	-0.07914	0.051239	-1.54449	0.1381
D(LOGFDI(-1))	-0.07961	0.049551	-1.60658	0.1238
				0.0045**
D(LOGFDI(-2))	-0.17753	0.055552	-3.1957	*
			0.55349	
D(LOGGCF)	0.073436	0.132676	9	0.5861
			0.53309	
D(LOGGDP)	0.013564	0.025443	3	0.5998
				0.0009**
D(LOGGDP(-1))	-0.09289	0.023872	-3.89135	*

*** Significant at 1%, ** Significant at 5%.

In the long run, all variables have a considerable influence on tax revenue as shown in table (7) except for inflation. Unlike the short run analysis, FDI and tax revenue seem to have a direct relationship in the long run, as a 1 percent increase of FDI increases tax revenue by 0.18 percent. Furthermore, the rise of GDP growth by 1 percent leads to a rise in tax revenue by 0.2 percent. However, the results show a negative impact of gross capital formation on tax revenue. The rise in gross capital formation by 1 percent decreases tax revenue by 0.72 percent. Finally, there is no significant effect of inflation on tax revenue in the long run. The short run estimates also show that the adjusted R-squared of the model is 64 percent, which implies that the chosen explanatory variables explain the change in tax revenue by 64 percent, after adjusting for the number of predictors.

Table 6: Long-run Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGFDI	0.18301	0.073385	2.493843	0.0215* *
LOGGCF	-0.719756	0.288646	-2.493562	0.0215* *
LOGGDP	0.201352	0.085354	2.359031	0.0286* *
LOGINF	0.108103	0.071323	1.515694	0.1452

*** Significant at 1%, ** Significant at 5%.

The error correction term ECT_{t-1} is -0.70226 and it is significant at 1 percent. This means that 70 percent of the deviation from the long run relationship will be corrected in each period. The duration of correction ($1 / ECT_{t-1}$) is 1.4 of the year. In other words, 70 percent of the disequilibrium from the long run will be corrected in 1.4 years.

Diagnostic Testing

We examined the models' Heteroskedasticity and serial correlation through **Breusch-Pagan-Godfrey** and **Breusch-Godfrey LM test** in table (8) and (9), respectively. The heteroskedasticity test ensures that the variance of the residuals is constant across all levels of the explanatory variables. As for the serial correlation tests, table (9) shows that the model does not include a serial correlation problem.

Table 7: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.895594	Prob. F(12,20)	0.5658
Obs*R-squared	11.53458	Prob. Chi-Square(1)	0.4837

Source: Calculated by the authors.

Table 8: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.948135	Prob. F(2,18)	0.1714
Obs*R-squared	5.872092	Prob. Chi-Square(2)	0.0531

Source: Calculated by the authors.

To check for the stability of coefficients over time, we ran the CUSUM and CUSUMQ stability tests. As depicted in figure (4) and figure (5), the cumulative sum of recursive residuals and the cumulative sum of squares of recursive residuals are within the confidence interval of 95 percent, suggesting that the coefficients of the model are stable.

Figure 4: Cumulative sum recursive residuals (CUSUM) stability test

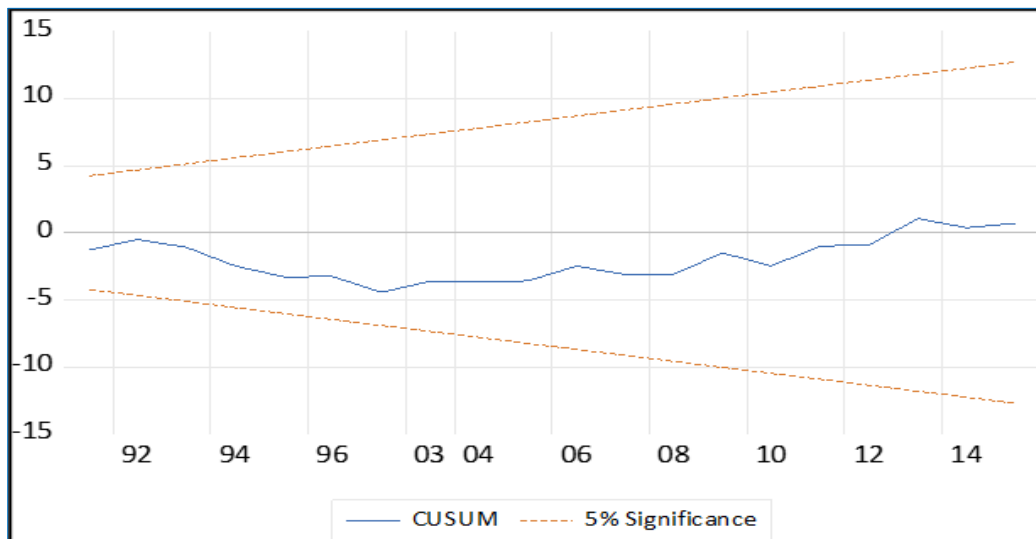
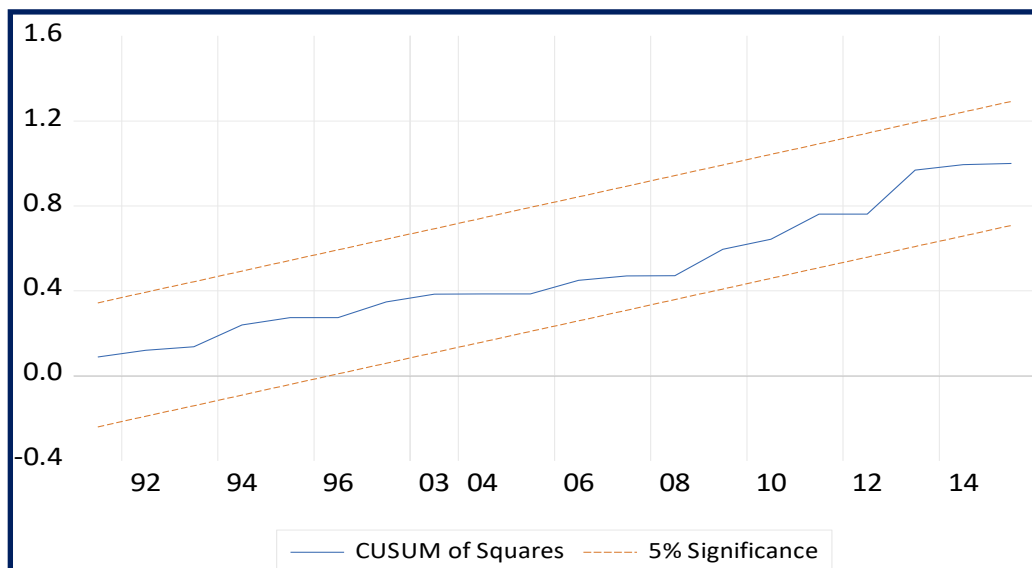


Figure 5: Cumulative of square of recursive residual (CUSUMQ) stability test



V. Discussion of the results:

The results of the ARDL-ECM approach, which were previously shown in the analysis of short and long run relationship between tax revenue and other explanatory variables, match several other studies. The study shows that the increase of FDI (-2) of one percent reduces tax revenue by 0.18 percent in the short run. The same result is found in the study of Jeza and others (2016). In their study, the researchers found a negative impact of FDI on aggregate tax revenue in both the short and long run in Ethiopia. ALshubiri (2024) also found a negative impact of FDI on tax revenue in developing countries in the short run. In addition, a 1 percent increase in GDP growth decreases tax revenue by 0.09 percent after one year. This result is consistent with the study of Muriithi (2013) that was applied to Kenya. Gross capital formation doesn't have a significant effect on tax revenue in the short run.

However, all variables have a significant impact on tax revenue in the long run except for inflation. The insignificant effect of inflation in the long run might be due to the modification in tax laws that could lessen the effect of inflation in the long run. Furthermore, the increase in inflation is usually accompanied by an increase in public expenditure which might offset gains in tax revenue and stabilize tax revenue to GDP over time (Mihaljek, 2023). FDI and tax revenue have a direct relationship in the long run. A one percent increase in FDI increases tax revenue by 0.18 percent in the long run. The same findings were found in ALshubiri (2024) when investigating the long run relationship in developing countries. Wijaya and Dewi (2022) reached the same results when explaining the relation between FDI and tax revenue in Indonesia. Furthermore, a 1 percent increase in GDP growth raises tax revenue by 0.2 percent. The positive correlation between GDP growth and tax revenue is detected in the work of Babatunde and others (2017) and Juliannisa and others (2023). On the other hand, the results show a negative effect of gross capital formation on tax revenue. Tax revenue decreases by 0.72 percent when gross capital formation increases by 1 percent. We didn't find similar studies that reached the same results due to the insufficient number of studies that investigate the impact of Gross capital formation on tax revenue. Furthermore, inflation doesn't seem to have a significant effect on tax revenue in the long-term.

While FDI is expected to have a positive effect on tax revenue in Egypt through boosting economic growth and hence tax revenue. The negative effect of FDI on tax revenue in Egypt in the short run could be explained by using tax incentives to attract FDI. Egypt used tax holidays, custom duties exemptions, value added tax refunds, and property tax exemption especially in Special Economic Zones (SEZ) (Ali, 2020). Investment Law 8/1997 included several FDI incentives offered by the government to attract FDI. These incentives include tax holidays, different tax exemptions, in addition to financial subsidies in case of foreign investments included in the privatization program. The study of Massoud (2003), which was conducted on a period from 1973-

2003, found that FDI incentives in Egypt didn't increase the flow of FDI in the country in a way that could justify the tax forgone and compensate the budgetary costs. Another reason that might interpret this negative relationship between tax revenue and FDI is profit shifting and repatriation. According to Garcia-Bernardo and Janský (2024), the estimated percentage of total profits shifted from Egypt is 27.2 percent. This practice affects the country's tax revenue negatively in the short run.

While the impact of FDI on tax revenue in the short run can have a negative effect due to tax incentives and profit shifting, our findings found that FDI affects tax revenue positively in the long run. The positive impact is negligible, which refers to the fact that FDI doesn't effectively contribute to the increase of tax revenue in Egypt. This slight increase might be interpreted by the end of different tax incentive periods from one side and the expansion of FDI, which creates more jobs and hence increases income and corporate profit taxes from the other side (Farooq et al., 2024). However, the limited effect in the long run could be also explained by profit shifting, tax avoidance, and inefficiency of tax collection (Saleh et., al (2020); Zahran, (2024)).

The preceding results open the door for further future research that measures the effect of FDI on specific types of tax revenue that are related to FDI, in addition to investigating the effect of the different types of tax incentives on tax revenues, but this kind of research requires a detailed data series.

VI. Policy recommendations:

Having a negative effect of FDI on tax revenue in the short run in Egypt, and a positive, minor impact in the long run, stresses the importance of suggesting some policy recommendations to maximize revenue collection in the short and long run without harming the investment climate in Egypt:

- 1. Reforming tax incentives:** Some studies explained that the use of tax incentives sometimes does not have a significant effect on attracting FDI in some developing countries, but lowers tax revenues (Linus & Enekwe, 2024). As a result, the government should build an institutional capacity to analyze tax incentives by looking at all dimensions of policy, legal, and administrative to balance between tax collection and the flow of FDI, in addition to regularly estimating revenue forgone from tax incentives (Pecho et al., 2024).
- 2. Controlling profit shifting:** Some practices could be implemented to increase the frequency of audits on multinational corporations and apply stricter penalties for not complying with established regulations. Furthermore, we can implement a real-time reporting system through digital platforms where companies should record their transactions once they occur to reduce potential manipulation.

3. **Diversify the source of investment:** It is important not to rely extensively on FDI for development. The government should be selective when it comes to the type of investment needed to allow room for the role of local investment as the basic sector for development and the main financier of taxes. By looking at the long-run effect of FDI on tax revenue in our study, it is noticed that the positive effect in the long run is weak, which implies that tax revenue is mainly financed through domestic firms. In the same context, we should encourage FDI in export-oriented sectors as an important sector that may need the finance of FDI through applying differentiated tax policies.
4. **Encourage linkage between FDI and local sourcing:** To maximize tax revenues originating from FDI, it is important to encourage FDI investors to create linkages with local industries. Not only will these linkages create new employment opportunities, but they will also increase tax revenues. These linkages could be enhanced through creating platforms or databases to connect the two parties. In addition, the government could provide subsidies to domestic producers to meet the requirements of foreign producers. The government could also establish a certification program for local producers that meets international quality standards. It is also recommended to shift from blanket tax exemptions to performance-based incentives, such as taxes from technology transfer and domestic employment and creating a link between the labor market and FDI is important to ensure the contribution of FDI to local employment.
5. **Encourage reinvesting of profits:** Before providing more tax incentives for the reinvestment of profits, we should first build institutional capacities which can analyze the main reasons behind profit shifting and repatriation. This analysis will give an overview of the types of incentives we need to adopt to encourage profit reinvestment.
6. **Enhancing international tax cooperation:** Developing countries, including Egypt, should enhance cooperation with other countries to commit to an international tax convention that ends profit shifting and repatriation. This cooperation could include sharing experiences and enforcing best practices through strengthening partnerships with international organizations such as the OECD and the African Tax Administration Forum (ATAF).

Conclusion:

The study investigated the long and short run effects of FDI on tax revenue in Egypt using the ARDL-ECM approach to detect the long and short run relationship between the variables from 1975 to 2023. The ADF and PP unit root tests were applied to figure out the level of integration of the series. Consequently, the results show cointegration among variables ensuring the existence of long run relationships. The study found a

negative effect of FDI and GDP growth on tax revenue in the short run and a positive effect on the long run. Furthermore, there is a positive long run impact of gross capital formation on tax revenue while the effect of inflation is insignificant. The independent variables succeeded in explaining 64 percent of the variations in tax revenue after adjusting for the number of predictors. The negative effect of FDI on tax revenue in the long run is explained by the excessiveness of tax incentives to attract FDI through the period of study. The study recommended some policies to enhance the positive impact of FDI on tax revenue and eliminate the negative effect in the long run. The suggested policies include reforming tax incentives, encouraging linkage between FDI and domestic firms, encouraging reinvesting of profits, enhancing international tax cooperation, and diversifying sources of investment.

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