



# Impact of Foreign Direct Investment, Human Capital, and Technology Transfer on Unemployment in Morocco: An Empirical Investigation

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## ABSTRACT

Previous studies have generally analyzed the impact of foreign direct investment (FDI), human capital and technology transfer on employment separately, without necessarily integrating them into a single model. This article aims to examine their combined effects on unemployment reduction in Morocco for the period between 1990 and 2023 within the same model. The empirical approach, based on a staggered lag autoregressive econometric model (ARDL), reveals that in the long term, human capital development and FDI will play a fundamental role in reducing unemployment in Morocco, while the impact of technology transfer is not significant. In the short term, improving human capital has the strongest, most immediate and significant effects on reducing unemployment, followed by FDI and then technology transfer. In light of our results, we recommend that the Moroccan authorities adopt integrated policies aimed at simultaneously strengthening human capital development, attracting FDI and promoting technology transfer. Such an approach would make it possible to sustainably reduce unemployment and improve inclusive, sustainable economic development in Morocco.

**Keywords:** Autoregressive Distributed Lag, Human Capital, Unemployment, Foreign Direct Investment, Morocco, Technology Transfer

**JEL Classifications:** C32, J24, J64, F21, O55, O33

## 1. INTRODUCTION

Unemployment is a major issue in developing economies, where high rates lead to economic challenges, income inequalities and social problems (Zhorzholiani, 2024). Reducing unemployment and creating jobs is therefore a central issue for economic and social development, particularly in emerging economies such as Morocco. The latter has made significant progress in its economic development policy, thanks in particular to the recommendations of the new development model (NMD). This strategic framework underlines the urgency of structural and strategic changes, including economic and digital transformation, as well as increased investment in human capital, in order to stimulate inclusive and sustainable development.

In this context, the adoption of framework law N° 03-22 instituting the new investment charter plays a crucial role in improving the business climate. This charter Strives to make Morocco a more attractive destination for foreign direct investment (FDI), which brings in the financial resources, skills and technologies essential to meeting the needs of growth sectors. By fostering innovation, improving productivity and creating jobs, FDI contributes directly to the improvement of socio-economic indicators, particularly youth employment. Indeed, they enable multinational companies to organize their production activities on a global scale when economic conditions and market prospects are favorable (Boushib et al., 2024).

These efforts are beginning to bear fruit, as evidenced by the establishment of global industrial leaders in strategic sectors

such as automotive and aeronautic, and the gradual improvement in labor market indicators. Among these indicators, reducing youth unemployment remains a priority, as it directly reflects the country's level of economic and social development.

FDI is perceived not only as a vector of economic growth, but also as a strategic tool enabling companies in host countries to access resources, skilled labor and advanced technologies (Arbia et al., 2023a; Arbia and Sobhi, 2024). One of the FDI's benefits is technology transfer. Locally established multinationals act as vectors of technological diffusion by training local staff and establishing partnerships with national firms (Findlay, 1978). This process encourages local innovation and generates positive externalities that boost the competitiveness of Moroccan companies.

However, the effectiveness of technology transfer depends largely on the level of human capital development in the host country. A skilled workforce plays a decisive role in the absorption and optimal uses of transferred technologies. According to (Blomström and Kokko, 1998), multinational firms prefer countries with high-quality human capital. Moreover, the quality of workers' education and skills directly influences the effectiveness of industrialization policies and the ability of local firms to exploit innovations Borensztein et al. (1998).

In an ever-changing global economic context, FDI, human capital development and technology transfer are emerging as strategic levers for accelerating economic development in emerging countries. A key question emerges for a country like Morocco, where the unemployment rate remains a major challenge, to what extent do foreign direct investment and technology transfer, in interaction with human capital, impact unemployment in the country?

First of all, the purpose of the present work is to make two essentials contributions to the existing literature and to similar studies based on the Moroccan case. Using a time series approach and data from reliable sources covering the period 1990-2023, we aim to examine in depth the combined influence of FDI, human capital development and technology transfer on unemployment in Morocco. Our approach stands out for its ability to capture the combined short- and long-term effects, while taking into account the specificities of the Moroccan context.

In addition, we seek to shed light on the mechanisms by which these three variables can contribute to reducing unemployment, a dimension that has received less attention in previous research. Political and economic decision-makers need this contribution to understand the levers they can activate to optimize the beneficial effects of FDI, human capital development and technology transfer on reducing unemployment in Morocco.

Finally, by identifying gaps in previous research and proposing a sound methodological approach, this article aims to enrich the academic debate on the contribution of FDI, human capital development and technology transfer to reducing unemployment, by providing empirical and theoretical evidences that can serve as a basis for future research.

To this end, our paper is structured as follows: Section 2 presents a review of the literature, both theoretical and empirical. Section 3 presents the data and methodology used. The results obtained and the ensuing discussions are presented in section 4. Finally, the paper concludes by highlighting the main political and economic implications.

## 2. LITERATURE REVIEW

The link between foreign direct investment (FDI), human capital and technology transfer is a major issue for economic development, particularly in developing countries. Dunning (2000) argues that an economy can only take full advantage of FDI and technology transfer if it has adequate human capital to exploit these opportunities. This concept, based on the theory of complementarities, underlines the need for a global approach to optimize benefits in terms of growth and employment.

By integrating local economies into their global value chains, multinationals play a crucial role in generating employment. According to Gereffi et al. (2005), this integration is only beneficial if the local workforce possesses the skills needed to meet the technological and organizational requirements of value chains. The quality of the jobs thus created depends directly on the skills and technological capabilities of the host country. In this context, FDI can act as a catalyst for development, provided that local conditions allow its impact to be optimized.

Empirical research on the contribution of FDI, human capital development and technology transfer to improving employment faces several constraints, including the diversity of national contexts, methodological differences, the nature of the data collected and the public policies in place. Despite these difficulties, many studies have tackled this issue, although they have not systematically explored the combined impact of the three variables on unemployment.

Akinmulegun and Adekunle (2022) show that FDI contributed significantly to reducing unemployment in Nigeria between 1986 and 2018. Their analysis reveals a long-term relationship between FDI and unemployment, suggesting that FDI stimulates job creation through asset expansion, technology transfer and knowledge diffusion. Similarly, Mkuya and Ngaruko, (2021) examine the impact of FDI on youth unemployment within the East African Community (EAC) and highlight the importance of favorable economic policies to maximize their positive effects on employment.

In the case of Algeria, Dib et al. (2020) analyze the relationship between unemployment, growth, inflation and FDI over the period 1990-2018. Using the generalized method of moments (GMM) on panel data, they identify nine factors influencing unemployment, including FDI and human capital. Their results show a positive impact of FDI on job creation, although the effect of human capital is mixed across sectors. For their part, Jude and Silaghi (2016) study the impact of FDI on employment in 20 Central and Eastern European countries between 1995 and 2012. Their analysis highlights a phenomenon of creative destruction, with

an initial loss of jobs due to automation, followed by long-term job creation thanks to the integration of foreign subsidiaries into the local economy.

The mismatch between human capital accumulation and employability is also illustrated by Flayols (2015) in the cases of Morocco and Tunisia, where tertiary graduates encounter higher unemployment rates than those with lower levels of education. This finding underlines the importance of tailored policies to align qualifications with labor market needs. Similarly, Miningou and Vierstraete (2010) point out that a high human development index (HDI) does not automatically guarantee greater efficiency of human capital in terms of job creation or income growth.

In Morocco, few empirical studies have examined the joint influence of FDI, human capital and technology transfer on employment. Moujahid et al. (2022) confirm that FDI plays an important role in long-term job creation, while El Wazani and Souaf (2006) conclude that its effect remains limited. Arbia et al. (2023b) show that information and communication technologies (ICT) can amplify the impact of FDI on growth and, consequently, employment, by enhancing business efficiency and digital inclusion. Furthermore, Boushib et al. (2024) demonstrate that FDI contributes to the expansion of SMEs, thereby stimulating employment and reducing unemployment. Youness and Abderrahim (2023a) point out that technology transfer is an essential process in helping companies to innovate and remain competitive, which can indirectly boost employment and consequently reduce unemployment.

However, some studies nuance these observations. Idalfahim et al. (2023) find that while trade openness increases unemployment, FDI (foreign direct investment) plays a reducing role. In contrast, El Massaoudi and Baddih (2024) show a negative impact of FDI on employment in Morocco over the period 1991-2019, suggesting that the nature of the received FDI and its integration into the local economy are determining factors.

### 3. METHODOLOGICAL DATA AND EMPIRICAL MODEL SPECIFICATION

#### 3.1. Data

The variables selected in our study are crucial for assessing how FDI, human capital development and technology transfer influence the reduction of unemployment in the country. The unemployment rate, which refers to the share of the labor force that is unemployed but available for and seeking employment (World Bank). It's one of the world's development indicators FDI, expressed as a percentage of GDP, represents net FDI inflows and is considered a key driver of economic growth (Arbia et al., 2023a).

Technology transfer represents commissions linked to the use of intellectual property, and returns for transferred technologies as a percentage of GDP. This indicator is fundamental for measuring the impact of innovations on Moroccan economic growth and consequently on the job market (Youness and Abderrahim, 2023b).

The HDI assesses human capital development, taking into account criteria such as health, education and standard of living. A high HDI is often associated with a more skilled and productive workforce (UNDP, 2015). These factors were deemed relevant to capture the combined and individual contribution to reducing population unemployment based on previous studies conducted by Jude and Silaghi (2016); Obeng-Amponsah and Owusu (2023); Arbia et al. (2023) and Youness and Abderrahim (2023a).

By incorporating these variables into our analysis, we hope to better understand the combined and individual synergy underlying the contribution of FDI, technology transfer and human capital development to reducing unemployment in Morocco. Furthermore, the choice of these variables is based on previous research, such cited in table 1, which demonstrates their relevance in the analysis of a country's economic performance.

#### 3.2. Methodology

Our study claims to examine the impact of FDI, human capital development and technology transfer on reducing unemployment in Morocco, using the ARDL model. We analyze data covering the period 1990-2023 in order to understand how these three variables influence unemployment among the Moroccan population.

First, we will assess the stationarity of the variables included in our model. This step is essential to determine whether the variables are integrated of order 0 ( $I(0)$ ), order 1 ( $I(1)$ ), or a mixture of the two, a necessary condition before applying the ARDL model. Then, we determine the ARDL model by identifying the appropriate delays to capture the temporal relationships between the variables. This step guarantees the accuracy and robustness of our analysis.

Next, we will test for the existence of a long-run relationship between the variables using the bounds test. This test will identify the co-integration links between FDI, human capital, technology transfer and employment.

If the bounds test confirms the presence of a long-run relationship, we will proceed to estimate the ARDL model, taking into account optimal lags. This will enable us to assess the short- and long-term links between unemployment and the explanatory variables (FDI, evolution of human capital, technology transfer). Finally, we will validate our model by examining statistical indicators and performing appropriate diagnostic tests.

In the light of the results obtained, we will conclude on the contribution of FDI, the evolution of human capital development and technology transfer to reducing unemployment in Morocco. We will also formulate proposals for more effective management of these main variables, with the aim of promoting sustainable and equitable employment in the country.

The choice of the ARDL model is particularly relevant to this study. This model is suitable for analyzing dynamic relationships between economic variables with different orders of integration ( $I(0)$  or  $I(1)$ ). It can be used to simultaneously estimate short- and long-term relationships, providing a comprehensive view of economic dynamics. Moreover, thanks to limit testing, it facilitates

the identification of co-integration relationships, while modeling adjustments towards long-term equilibrium. This approach is essential for understanding not only the immediate impact of the variables studied, but also their lasting effects on unemployment in Morocco (Pesaran et al., 2001).

### 3.3. Model Specification

The model to be estimated to quantify the influence of FDI, human capital development and technology transfer on the reduction in unemployment of the Moroccan population over the period 1990-2023 is formulated as follows:

$$UER = f(FDI, HDI, TT) \quad (1)$$

Parameter selection is influenced by economic theory, and is also based on aspects associated with the study data. Once the economic model has been determined, it is crucial to transform it into an econometric model. The resulting formula is as follows:

$$UER = \beta_0 + \beta_1 FDI + \beta_2 HDI + \beta_3 TT + \varepsilon_t \quad (2)$$

### 3.4. The ARDL Model

Our econometric analysis of time series will use the ARDL (autoregressive distributed lag) model, originally developed by Pesaran and Shin (1995) and Natsiopoulou and Tzeremes (2022). This model is particularly well-suited to studying the short-term dynamics of variables, while taking account of the time dimension. It combines the features of autoregressive (AR) and distributed lag (DL) models.

The ARDL model combines the features of autoregressive (AR) and distributed lag (DL) models. In this context, we include the lagged dependent variable ( $X_{t-p}$ ) as well as the past values of the independent variable ( $X_{t-q}$ ) among the explanatory variables ( $X_t$ ).

If we wish to take into account both the short-term and long-term effects of the explanatory variables mentioned, the ARDL representation of function (2) can be written as follows:

$$\begin{aligned} \Delta UER_t = & \varnothing (UER_{t-1} - \beta_0 - \beta_1 FDI_{t-1} - \beta_2 HDI_{t-1} - \beta_3 TT_{t-1}) \\ & + \sum_{i=1}^p \alpha_i \Delta UER_{t-i} + \sum_{j=0}^q \gamma_j \Delta FDI_{t-j} + \sum_{k=0}^r \delta_k \Delta HDI_{t-k} \\ & + \sum_{m=0}^s \theta_m \Delta TT_{t-m} + \varepsilon_t \end{aligned} \quad (3)$$

## 4. RESULTS AND DISCUSSIONS

### 4.1. Augmented Dickey-Fuller (ADF) Test

To determine the order of integration of the different variables, we used the Dickey and Fuller (1979) test. The results of this test, presented in the table 3 below, show that the variables UER and FDI are integrated of order 0, while the variables TT and HDI are integrated of order 1. Given that the integration orders of the variables are mixed, this confirms that our study meets the prerequisites for applying the ARDL model, which is more suitable

than Johansen's cointegration model.

### 4.2. Limit Test

The existence of a long-term relationship between variables can be determined by examining the results of the F-Bounds test, as shown in the table below. This test assesses the significance of the coefficients of the lagged variables in the ARDL model. The following criteria are generally used to determine the existence of a long-term relationship: In Table 3, the reported F-statistic is 5.643048, which is greater than both the upper bound (I(1)) and the lower bound (I(0)) at the 5% significance level. This suggests the presence of a significant long-term relationship between the variables. Therefore, based on the information provided, the fact that the F-statistic value of 5.643048 exceeds both the upper and lower bounds at the 5% significance level indicates the existence of a long-term relationship between the variables in the ARDL model.

### 4.3. Determining the Optimum Number of Delays for the ARDL Model

The following graph in Figure 1 presents the results of the 20 models estimated and selected according to Akaike's information criterion (AIC) for delays. It can be seen that the most appropriate model for our study is the ARDL model (2, 4, 4, 2).

In the table 4 below, we can see that this ARDL (2, 4, 4, 2) model is the most efficient in terms of number of delays, as it reduces the Akaike criterion.

### 4.4. Short- and Long-Term Estimates

The results of the long-term estimation, presented in the table 5 below, show that the effect of technology transfer on unemployment is positive but not significant. This means that, although technology transfer is expected to boost employment by modernizing industries and increasing productivity, its impact on reducing unemployment in Morocco does not appear to be statistically proven in the long term.

Indeed, the development of human capital has a significant negative effect on unemployment, indicating that an improvement in human capital makes a significant contribution to its reduction. In the long term, a one-unit increase in the HDI leads to a 13,637 drop in the unemployment rate. This result can be explained by the fact that higher levels of education, health and living conditions improve employability and encourage the absorption of skilled labor by the labor market.

A better match between the skills developed and market requirements facilitates the professional integration of graduates and stimulates innovation within companies. What's more,

**Table 1: Variable descriptions and sources**

Variables	Descriptions	Source
UER	Unemployment rate	World Bank
FDI	Foreign direct investment	World Bank
TT	Technology transfer	World Bank
HDI	Human development index	United Nations Development Programme



**Table 2: Results of the augmented Dickey-Fuller stationarity test**

Variables	Level		1 St		Decision
	T stat	Specification	T stat	Specification	
UER	-4.958045 (0.0018) *	Trend+Intercept	-	-	I (0)
FDI	-6.049538 (0.0000) *	Intercept	-	-	I (0)
TT	-2.314400 (0.4150)	Trend+Intercept	-7.308235 (0.0000) *	Trend+Intercept	I (1)
HDI	-1.051614 (0.7227)	Intercept	-4.897841 (0.0004) *	Intercept	I (1)

P-values in brackets, \*significant at 1% level. Source: Compiled by us from EViews 13 software

**Table 3: Bound test results**

Calculated F-stat	5.643048
Critical value at 5% of bound test	3.272 (lower) 4.306 (superior)

Source: Compiled by us from EViews 13

retaining talent and reducing the emigration of skilled workers strengthens the local economic dynamic.

What's more, a healthier population is generally better able to work and contribute effectively to the economy. A well-performing healthcare system reduces absenteeism, improves productivity and promotes the inclusion of vulnerable groups, such as the elderly and those with chronic illnesses. This ensures longer, more stable employability for the entire population.

In addition, improved living conditions promote the well-being of the population, which translates into higher productivity and more active participation in the labor market. Better access to housing, education, health and basic infrastructure enables people to focus on their professional development and access more qualified jobs.

Finally, a better quality of life reduces stress and social inequalities, thus contributing to a more stable social climate, conducive to investment and economic growth. Populations benefiting from favorable living conditions are generally more motivated, committed and in better health, which reinforces the efficiency of the labor market and supports a sustainable development dynamic.

FDI in turn exerts a negative and significant effect at the 5% threshold. A one-unit increase in FDI is associated with a 0,0055 decrease in the unemployment rate. This result is in line with policymakers' expectations, as FDI can stimulate job creation by strengthening the productive capacity of local companies, fostering innovation and integrating Morocco into global value chains. This reflects the country's ongoing efforts to optimize its public policies, notably by improving the business climate and simplifying administrative procedures, in order to enhance the attractiveness of FDI. These initiatives are aimed at improving labor market indicators, notably reducing youth unemployment, and fostering inclusive economic development.

#### 4.5. Short-Term Results

The results presented in the table 6 below show that the CointEq coefficient is negative (-0.495). Furthermore, the P-value associated with this coefficient is 0.0000, which is below the 1% significance level. This indicates that the cointegrating equation (CointEq) in the ECM results has a negative coefficient and is

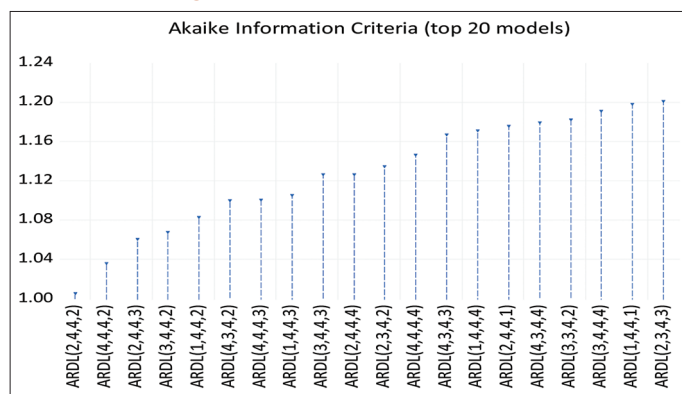
highly significant. This means that there is a dynamic adjustment between the short and long term: The gap between the current situation and the long-term equilibrium is corrected by 49.53% per period. In other words, it takes around two periods ( $\approx 2$  years) for a shock to the explanatory variables to have a full impact on the reduction in unemployment.

Furthermore, our model explains 86.67% of unemployment variations, indicating very good goodness of fit. The overall model is highly significant, confirming the relevance of the explanatory variables.

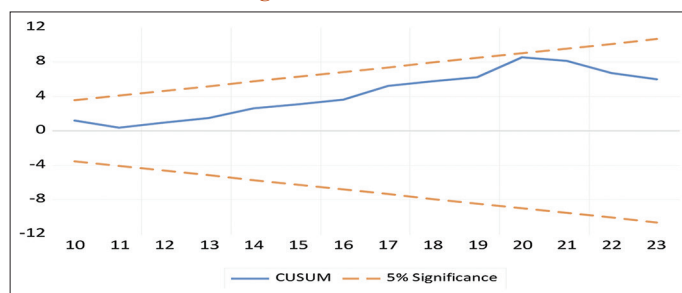
With regard to the effects of the various variables, the empirical results reveal that, unlike the long-term effects, in the short term technology transfer has a significant negative impact on unemployment. This could be explained by the fact that, at the start of the introduction of new technologies, employment opportunities are immediately generated. Indeed, a one-unit increase in technology transfer leads to a reduction in unemployment of 2.510 units, reinforcing the idea that rapid adoption of technological innovations stimulates hiring and improves employment prospects in the short term.

The effect of human capital on reducing unemployment is particularly strong and immediate. A one-unit increase in the level of human capital development leads to a rapid and significant reduction in unemployment of 85.007 units. This result highlights the importance of investment in human capital, particularly through education, vocational training, health and improved living conditions. Several factors explain this dynamic. On the one hand, a better match between the qualifications acquired and the needs of the job market encourages effective professional integration. Secondly, a high-performance healthcare system helps to improve workers' quality of life, reducing absenteeism, boosting productivity and facilitating the integration of vulnerable groups. These results underline the fact that human capital development is a key lever for economic progress, with immediate and positive effects on employment, provided it is accompanied by appropriate policies.

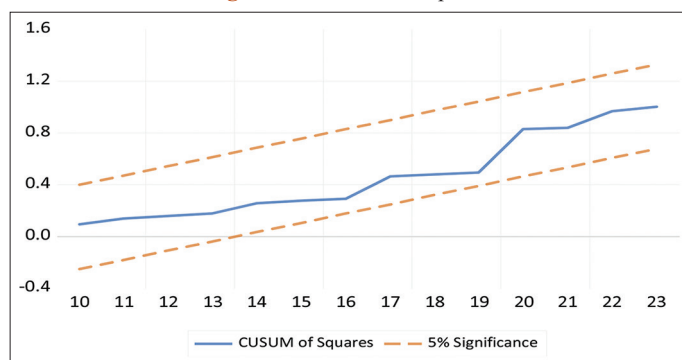
Thus, FDI also contributes to reducing unemployment in the short term, although its effect is more limited than in the long term. This suggests that the impact of FDI on employment takes time to fully materialize, due to the processes involved in setting up and adapting foreign companies. In the short term, a one-unit increase in FDI reduces unemployment by 0.407 units. This result testifies to the efforts made by public decision-makers to attract FDI in order to stimulate sustainable economic development.

**Figure 1:** Akaike information criteria

Source: Compiled by us from EViews 13

**Figure 2:** CUSUM test

Source: Compiled by us from EViews 13

**Figure 3:** CUSUM of squares

Source: Compiled by us from EViews 13

Our findings concur with those of (Moujahid et al., 2022), who highlight the crucial role of foreign direct investment (FDI) in long-term job generation, showing a negative and significant effect of FDI on long-term unemployment in Morocco. Nevertheless, they dispute the findings of El Wazani and Souaf (2006) and El Massaoudi and Baddih (2024), who highlight the limited impact of FDI on employment, arguing that these investments do not contribute significantly to reducing unemployment in Morocco, notably due to their weak integration into the local economy.

Our results are also in line with the research of Boushib et al. (2024). Although this work does not directly address the effect of FDI on unemployment, it does indicate that such investment stimulates entrepreneurial growth, a key factor in job creation

**Table 4:** ARDL (2, 4, 4, 2) model

Variable	Coefficient	Standard error	t-statistic	Prob.
UER(-1)	0.754879	0.197742	3.817503	0.0019
UER(-2)	-0.250172	0.169950	-1.472038	0.1631
TT	-2.510788	1.309496	-1.917371	0.0758
TT(-1)	0.136657	1.666276	0.082013	0.9358
TT(-2)	3.428475	1.771630	1.935209	0.0734
HDI	-85.00797	25.41667	-3.344576	0.0048
HDI(-1)	106.9069	37.72187	2.834084	0.0133
HDI(-2)	-20.06068	50.33026	-0.398581	0.6962
HDI(-3)	161.4787	46.43070	3.477843	0.0037
HDI(-4)	-170.0715	38.77536	-4.386073	0.0006
FDI	-0.407614	0.130980	-3.112028	0.0076
FDI(-1)	-0.179036	0.097000	-1.845723	0.0862
FDI(-2)	0.064647	0.089528	0.722089	0.4821
FDI(-3)	-0.435528	0.100961	-4.313837	0.0007
FDI(-4)	-0.152111	0.087438	-1.739644	0.1038
C	10.52670	2.534581	4.153231	0.0010

R<sup>2</sup>=0.98; F-statistic=57.94165; Prob (F-statistic) =0.0000 ; AIC=1.005497. Source:

Compiled by us from EViews 13

**Table 5:** Long-term results

Variable	Coefficient	Standard error	t-statistic	Prob.
TT	2.128727	3.398252	0.626418	0.5365
HDI	-13.63754	2.799680	-4.871108	0.0000*
FDI	-2.240375	0.740624	-3.024982	0.0055*
C	21.25349	2.598884	8.177927	0.0000*

Source: Compiled by us from EViews 13. \*, \*\*, \*\*\*denotes statistical significance at 1%

and unemployment reduction in Morocco. Similarly, Idalfahim et al. (2023) confirm that, although trade openness can increase unemployment, FDI is an important lever for mitigating its effects.

Furthermore, our findings concur with (Flayols, 2015), who highlights an imbalance between graduates' skills and labor market requirements in Morocco and Tunisia. Similarly, Traoré and Mariko (2021) corroborate, in their research, that the progression of human capital in Mali has not led to a notable increase in skilled jobs, despite significant efforts by the authorities to improve the education system.

With regard to technology transfer, our observations are in line with the work of Jude and Silaghi (2016), who highlight a long-term dynamic of job creation and unemployment reduction thanks to the integration of foreign subsidiaries into the local economy. This process is accompanied by technological improvement which, to generate lasting beneficial effects on employment, requires highly qualified personnel. Thus, our results confirm those of Youness and Abderrahim (2023b), who emphasize that technology transfer is an essential lever enabling companies to innovate and remain competitive, thus indirectly contributing to the reduction of unemployment.

#### 4.6. Model Validation Test

In order to validate our previously estimated model, several diagnostic tests were performed to validate and confirm the optimal model. Table 7 shows the results of the diagnostic tests. We observe that for our model, there is no autocorrelation of errors and no heteroscedasticity of errors and no heteroscedasticity.

**Table 6: Short-term results**

Variable	Coefficient	Standard error	t-statistic	Prob.
COINTEQ*	-0.495293	0.082233	-6.023017	0.0000*
Δ (TT)	-2.510788	0.925064	-2.714177	0.0142**
Δ (HDI)	-85.00797	18.87112	-4.504660	0.0003*
Δ (FDI)	-0.407614	0.100502	-4.055770	0.0007*
R-squared	0.866651	Mean dependent var		-0.165400
Adjusted R-squared	0.785161	S.D. dependent var		0.653653
S.E. of regression	0.302973	Akaike info criterion		0.738830
Sum squared resid	1.652271	Schwarz criterion		1.299309
Log likelihood	0.917544	Hannan-Quinn criter		0.918132
F-statistic	10.63495	Durbin-Watson stat		2.279439
Prob (F-statistic)	0.000009*			

Source: Compiled by us from EViews 13. \*,\*\*denotes statistical significance at 1%, 5% respectively

**Table 7: Summary of different validation tests**

Tests	Values (Probability)
Autocorrelation of errors:	1.395351 (0.3039)
Breusch-Godfrey LM	
Heteroskedasticity:	0.428576 (0.9425)
Breusch-Pagan-Godfrey	
Heteroskedasticity: Arch-test	0.066923 (0.7978)
Normality of residues: Jarque-Bera	0.094097 (0.9540)
Ramsey Reset	0.514349 (0.6156)

() indicates the probability associated with each test. Source: Compiled by us from EViews 13

The errors are normally distributed and the models are correctly specified.

When the diagnostic tests of an ARDL model, such as the normality test (e.g., Jarque-Bera test), the serial correlation test (e.g., Breusch-Godfrey test) and the heteroscedasticity test (e.g., Breusch-Pagan or White test), have probabilities (P-values) >5%, this indicates that the model satisfies classical ordinary least squares (OLS) assumptions. More specifically, these results mean that: Residuals follow a normal distribution, there is no significant serial correlation between residuals, and residual variances are constant (homoscedasticity).

Thus, following the model validation tests, the results of which are presented and summarized in the table below, it emerges that the Jarque-Bera test confirms the normality of the residuals. In addition, the heteroscedasticity and serial correlation tests respectively reveal that the residuals are homoscedastic and that there is no significant serial correlation. All in all, the ARDL model is statistically valid, and the results obtained can be considered reliable.

Again, the graphs below, Figures 2 and 3 confirm the estimated stability of the ARDL model at the 5% significance level, as the CUSMUS lines lie within the limits.

## 5. CONCLUSION

The purpose of this article is to examine the combined impact of foreign direct investment (FDI), human capital and technology transfer on unemployment in Morocco over the period 1990-2023. Through an in-depth econometric analysis, our results show that, in the long term, the development of human capital

and the attractiveness of FDI play a fundamental role in reducing unemployment in Morocco, while the effect of technology transfer remains uncertain.

In the short term, improving human capital has the strongest and most immediate impact on reducing unemployment, followed by FDI and, to a lesser extent, technology transfer. These results underline the need for an integrated strategy combining human capital development, FDI attractiveness and the promotion of technology transfer in order to sustainably reduce unemployment.

This study provides new perspectives on the effectiveness of FDI, technology transfer and investment in human capital, the latter being the main lever for promoting inclusive and sustainable development. In this sense, it contributes to the literature by highlighting the importance of a more effective policy of FDI attractiveness, technology transfer and human capital development to improve labor market indicators, particularly youth unemployment, which is a major brake on the country's economic development.

The practical implications of this study suggest the need for public decision-makers to adopt coordinated policies aimed at maximizing the benefits of FDI, human capital and technology transfer. It is essential to invest in training programs tailored to labor market requirements, strengthen research and innovation infrastructures, and foster partnerships between local and multinational companies to facilitate know-how transfer and improve the skills of the national workforce. Furthermore, the ongoing alignment of education policies with the needs of the labor market is a strategic lever for facilitating the transition to a knowledge-based economy and guaranteeing sustainable and inclusive professional integration.

However, this study has a number of limitations. On the one hand, its generalist approach does not take into account sectoral disparities in the impact of FDI and technology transfer, as these effects can vary considerably between sectors such as agriculture, industry or services. Furthermore, although the study evaluates human capital through the human development index (HDI), which integrates criteria such as health, education and standard of living, it does not precisely identify the components with the most decisive impact on the labor market. A more in-depth analysis of these aspects would therefore be relevant.



These limitations do, however, open up interesting prospects for future research. A detailed sectoral study would enable us to refine the analysis by identifying the specific impacts of FDI, human capital and technology transfer on different sectors of activity. Such an approach would facilitate the development of more targeted recommendations tailored to sectoral realities. Finally, the integration of more specific and multidimensional data, such as literacy rates, continuing education indicators, the number of patents filed or the import of information and communication technologies, would deepen our understanding of the dynamics linked to technology transfer and human capital development.

## REFERENCES

- Akinmulegun, S.O., Adekunle, O.E. (2022), Insight on the linkage between foreign direct investment and unemployment : Evidence from Nigerian data. *Journal of Accounting Research Organization and Economics*, 5(1), 68-81.
- Arbia, A., Sobhi, K. (2024), Foreign direct investment, information and communication technology, and economic growth: The case of North African countries. *Scientific African*, 24, e02234.
- Arbia, A., Sobhi, K., Karim, M. (2023a), Factors of FDI and their impact on the Moroccan economy: An empirical investigation using the ARDL approach. *International Journal of Economics and Finance*, 15(10), 32.
- Arbia, A., Sobhi, K., Karim, M., Edda, M. (2023b), FDI, information and communication technology, and economic growth: Empirical evidence from Morocco. *Advances in Management and Applied Economics*, 13(6), 1-10.
- Blomström, M., Kokko, A. (1998), Foreign investment as a vehicle for international technology transfer. In: Navaretti G.B., Dasgupta P., Mäler K.G., Siniscalco D., éditeurs. *Creation and Transfer of Knowledge*. Berlin, Heidelberg: Springer. p279-311.
- Borensztein, E., De Gregorio, J., Lee, J.W. (1998), Comment l'investissement direct étranger affecte-t-il la croissance économique? *Journal of International Economics*, 45(1), 115-135.
- Boushib, K., Moujahid, M., Hajji, M. (2024), Impact of foreign direct investment on the emergence of SMEs in Morocco: Analysis and strategic perspectives. *Asian Economic and Financial Review*, 14(11), 882-894.
- Dib, L., Amin, B.M.E., Aicha, A. (2020), Relation entre Chômage, croissance, inflation et IDE en Algérie. *Journal d'études économiques contemporaines*. 5(1), 168-183.
- Dickey, D.A., Fuller, W.A. (1979), Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, 74(366a), 427-431.
- Dunning, J.H. (2000), The eclectic paradigm as an envelope for economic and business theories of MNE activity. *International Business Review*, 9(2), 163-190.
- El Massaoudi, E.M., Baddih, H. (2024), L'impact des IDE sur le chômage au Maroc. *Internationale des Sciences de Gestion*, 7(2), 605-621.
- El Wazani, Y., Souaf, M. (2006), La création d'emplois par les investissements directs étrangers au Maroc : Un apport limité à la réduction du chômage et des flux migratoires. *Autrepart*, 37(1), 19-35.
- Findlay, R. (1978), Relative backwardness, direct foreign investment, and the transfer of technology: A simple dynamic model. *The Quarterly Journal of Economics*, 92(1), 1-16.
- Flayols, A. (2015), Accumulation Du Capital Humain Et Employabilité : Une Mise En Perspective Empirique. Available from: <https://theses.hal.science/tel-01294334v1>
- Gereffi, G., Humphrey, J., Sturgeon, T. (2005), The governance of global value chains. *Review of International Political Economy*, 12(1), 78-104.
- Idalfahim, M., Assouih, I., El Ouardirhi, S., Echaoui, A. (2023), L'ouverture économique et le chômage au Maroc : Une evidence empirique. *Revue Française d'Economie et de Gestion*, 4(5), 389-401.
- Jude, C., Silaghi, M.I.P. (2016), Employment effects of foreign direct investment: New evidence from central and Eastern European countries. *International Economics*, 145, 32-49.
- Miningou, É.W., Vierstraete, V. (2010), L'efficience du développement humain dans les pays de l'Afrique subsaharienne. *Groupe de Recherche en Économie et Développement International*, 10-17.
- Mkuya, S.M., Ngaruko, D.D. (2021), Impact of foreign direct investment on unemployment rates in east African community founding members: Who benefits the most? *Pan-African Journal of Business Management*, 5(1), 1002.
- Moujahid, M., Khariss, M., Assabane, I. (2022), Impact des investissements directs étrangers sur la création d'emploi : Cas du Maroc. *Repères et Perspectives Economiques*, 6(1), 31552.
- Natsiopoulou, K., Tzeremes, N.G. (2022). ARDL bounds test for cointegration: Replicating the Pesaran et al. (2001) Results for the UK earnings equation using R. *Journal of Applied Econometrics*, 37(5), 1079-1090.
- Obeng-Amponsah, W., Owusu, E.L. (2023), Foreign direct investment, technological transfer, employment generation and economic growth: New evidence from Ghana. *International Journal of Emerging Markets*, 20, 2088-2109.
- Pesaran, M.H., Shin, Y. (1995), An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. Vol. 9514. Cambridge, UK: Department of Applied Economics, University of Cambridge.
- Pesaran, M. H., Shin, Y., Smith, R. J. (2001), Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.
- Traoré, S.S.L., Mariko, O. (2021), Le rôle du capital humain dans l'accès à l'emploi dans le contexte malien: Une analyse empirique. *Revue Française d'Economie et de Gestion*, 2(11), 385-404.
- United Nations Development Programme (UNDP). (2015), Human Development Report 2015: Work for Human Development. New York: UNDP.
- Youness, D., Abderrahim, F. (2023a), L'Impact de l'IDE et du transfert de technologie sur la croissance économique : Étude theorique et validation empirique dans le cas du Maroc. *International Journal of Applied Management and Economics*, 2(4), 50-86.
- Youness, D., Abderrahim, F. (2023b), L'Impact de l'IDE et du transfert de technologie sur la croissance économique : Étude theorique et validation empirique dans le cas du Maroc. *International Journal of Applied Management and Economics*, 2(04), 50-86.
- Zhorzholiani, T. (2024), The impact of an employment on economic development: Georgia's example. *European Scientific Journal*, 20(37), 235.