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Research Article

The Effect of Foreign Direct Investment on Improving the Life Expectancy Index in Iran

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Abstract

Background: The health care sector is a key sector of every country. In the process of economic development, this sector is considered infrastructure since economic development directly affects the productivity of the labor force and, as a result, the increase in production and economic growth. Therefore, the quality of the health care system may be an important factor in attracting foreign direct investment (FDI), accompanied by infrastructure such as labor, education, and research and development costs. As the level of health care increases in a society, the average life expectancy increases as well. Therefore, the life expectancy index (LEI) is an indicator for measuring the progress or backwardness of countries, and thus, it is necessary to examine the factors affecting it.

Objectives: This study examined the effect of FDI on the LEI in Iran.

Methods: The autoregressive distributed lags (ARDL) method was applied from 1981 to 2020, given the time series nature of the data and to test the research hypotheses. The method shows a capacity to be applied to I(0) and I(1) data simultaneously. the following regression model estimation was utilized to investigate the effect of FDI on LEI in Iran:

HIt = c0 + c1 gross domestic product (GDP)t + c2 FDIt + c3 literacy rate (LR)t + c4 human immunodeficiency virus (HIV)t + c5 Urbent + c6 real exchange rate (EXR)t + c7 inflation rate (INF)t + c8 interest rate (IR)t + et.

Results: The outcomes indicated that FDI has favorable and substantial impacts on the health expenditure variable in Iran over short and extended periods. As a result, it can be anticipated that investing in the health care industry should influence society's economic advancement. Consequently, FDI becomes a significant macroeconomic factor in health care, acting as an extra investment source. With proper strategies, it holds the potential to serve as a crucial tool for the country's progress, especially in enhancing the health care sector. The results demonstrated that FDI has constructive and notable effects on enhancing the LEI in Iran, both in the immediate and prolonged durations.

Conclusions: Generally, the effects of FDI on health care can be described by direct and indirect channels. From the direct channel, FDI may affect health care outputs directly and indirectly, e.g., by providing a wider range of medical supplies and services (such as drugs and medical equipment), the expansion of FDI in the health care sector, and the presence of foreign firms producing medical or health care products that makes the supplies and services available at lower prices and consequently improves health care. From the indirect channel, FDI may influence the health care status of individuals in society indirectly by affecting other variables. Overall, based on the findings, life expectancy is likely to be improved in Iran by attracting more foreign investments in the health care sector.

Keywords: Life Expectancy Index; Health Care Sector; Foreign Direct Investment

1. Background

Health care is a basic need and plays an important role in improving the quality of life. Economic planners believe that if more households have health care facilities to increase health care, and if other conditions remain constant, fewer resources will be spent on their medical expenses in the future. Moreover, many great nations refer to health care in legal frameworks as a fundamental and sacred human right. From this point of view, every person has the right to benefit from suitable living standards, including food, clothing, housing, health care, essential social services, provision in times of disability, unemployment, old age, or other livelihood deficiencies for one's and his/her family's health and well-being. Accordingly, investment in the health care sector is likely to influence the economic growth of societies (1).

The health of the body brings about the health of

thoughts, the mind, and the business environment. The economic savings resulting from the lack of additional expenses will be the basis for increasing individual and group savings in society. The purpose of economic savings is the release of those additional costs to increase individual and social savings, which should be spent on medical expenses in the absence of health care (2).

The external outcomes arising from the improvement of the quality of the health care sector exert positive effects on the socioeconomic activities of society and ultimately increase the gross domestic product (GDP) and economic growth. Therefore, directing such savings towards the production of capital, such as the establishment and operation of medical service centers and hospitals, also contributes to the prosperity of economic activities, income generation, and employment (3).

From a theoretical perspective, given that an improved workforce has greater motivation and productivity, if the health of individuals in society is improved, health expenditure may increase production through enhancing productivity. People's health affects their well-being and economic growth from two aspects. If attention to health expenses increases life expectancy, it will also increase the supply of labor and, as a result, production. Extensive studies on the existence of a relationship between health, education, and economic growth of societies have always shown the importance of this factor in the national and international arenas (2).

Based on the socioeconomic indicators affecting health, the following items are likely to be introduced to the total influencing indicators: Income versus basic expenses, the poverty threshold, high price and inflation, socioeconomic status, percentage of unwanted unemployment, addiction, housing situation, bureaucracy, corruption, percentage of those who require treatment and cannot afford, and so on (4). Moreover, drawing from theoretical principles, elevating the accumulation of human capital augments the yield on human resource investment, leading to an ultimate upsurge in the overall economic investment. Put differently, the escalation in economic investment resulting from enhanced resource utilization and prolonged life expectancy corresponds to a favorable societal return on investment. Consequently, a boost in life expectancy will foster savings and investment within the private sector, thereby enhancing the nation's economic state. This advancement sets in motion a cyclical process that further enhances health indicators (5). Because of the rise in the use of resources and life expectancy, the increase in investment in the economy is associated with a positive return on investment in society.

Foreign direct investment (FDI) is likely to have positive effects on the health of the population, primarily by increasing the demand and supply of health-related goods and services. "FDI generally holds a positive effect on both factor productivity and income growth in host countries, beyond what domestic investment normally does." Furthermore, FDI has the potential to enhance the efficiency of the health care domain by increasing the accessibility of medical goods and services at reduced costs (such as pharmaceuticals and medical devices). In conjunction with its direct supply impacts, FDI might also elevate the effectiveness of local health care suppliers in the host nation by facilitating the dissemination of advanced medical expertise and know-how (6).

However, contrary to the expected positive effects of the average increase in income, FDI may have negative impacts on the health care of the population by creating more inequality in the host countries. Furthermore, FDI stands as a significant force propelling globalization, contributing to a growing disparity in income levels among adept workers in developed and developing nations. In models such as the North and South classifications of vertical or efficient FDI, it is projected that premiums should rise in both the originating and recipient nations. In situations involving horizontal or market-oriented FDI, which is prevalent in advanced host countries, multinational corporations (MNCs) generally exhibit greater productivity, size, and skill compared to their indigenous counterparts. Moreover, FDI exacerbates wage inequality within host countries by primarily seeking skilled labor, thereby exerting upward pressure on local wages for proficient workers (6).

Heightened disparities in income have a pervasive detrimental impact on public well-being. Aligned with the absolute income theory, the effectiveness of the health care system displays diminishing incremental benefits; as a result, redistributing income from the less affluent to the more affluent segments should enhance overall health on a nationwide scale. Moreover, the relative income theory posits that people gauge their contentment in relation to their contemporaries, implying that income inequality fosters subpar health care outcomes by inducing distressing social contrasts. Besides, increased labor stress may result from more intense competitive pressure and economic insecurity related to FDI (6). British workers are more economically insecure in industries with greater FDI penetration. Additionally, several studies document that economic insecurity has detrimental effects on health care. The impacts of adverse health care due to increased economic insecurity may partially reduce the positive effects of FDI. However, incentive-based competition for FDI is unlikely to increase taxes and health and social service costs to compensate for the higher economic insecurity caused by FDI (7).

From an empirical point of view, the studied factors affect health care expenditure per capita in developing countries. For this purpose, data were collected from 1995 to 2014. The results showed that the impact of per capita income and life expectancy on health expenditure per capita was positive, while the impact of foreign aid and population was negative and significant. Furthermore, the spatial dependence on health care expenses in the studied drawers was confirmed, and the spatial model was selected.

A study (8) examined the effect of public and private health expenditures on the health status of individuals in Iran. The authors used time series data from 1995 to 2012. The results showed that total health expenditure has a positive effect on life expectancy at birth and the crude mortality rate and a negative effect on the child mortality rate. Moreover, private and public sector health care expenditures had a significant relationship with particular health care indicators, whereas public sector health care expenditures showed a relatively greater effect.

Another study (9) explored health care expenditures and FDI in Europe. The goal was to examine the role of different settings of national institutions in attracting FDI in 28 members of the European Union. Particularly, the study focused on the relationship between health expenditures and FDI, with the assumption that the percentage of public health expenditures in total health expenditures may be an indicator of institutional quality. For this purpose, the generalized least squares (GLS) panel method was adopted, and a dataset was used for 28 members of the European Union from 2000 to 2013. The connection between FDI and health care metrics was assessed using three indicators: The proportion of government health care expenditure to the overall health care expenditure, the portion of out-of-pocket payments (OOP) in total health care expenditures, and the percentage of health care coverage within the nation. The study incorporated several control factors, such as government oversight quality, market size, government commitment to research and development in higher education, and labor productivity. The outcomes revealed that across all the models, the link between the outcome variable and health expenditure-related factors remained consistently significant. Unexpectedly, a positive correlation was identified between FDI and the proportion of public health expenditure, whereas a negative correlation was noted between FDI and the percentage of OOP expenditures. Indicators that reflect the health of the populace exhibited a positive association with FDI consistently.

Muhammad Malik and Azam Syed (5) studied the socioeconomic factors affecting the OOPs of Pakistani households in the health care sector. In their modeling, they benefited from a multivariable linear regression estimated by ordinary least squares (OLS) regression. The results showed that the following are among the factors that directly affect payments: Non-foodstuff expenses, literacy of the head of the household and his/her spouse, urbanization, unsafe water source, inappropriate sanitary services, having at least one young and elderly child in the family, and having a physical distance (more than 30 minutes) from health care centers. Moreover, the employment of the head of the household in clerical occupations and household management by men showed an inverse relationship with the number of payments.

The long-term relationship between community health and FDI was studied in 46 developing economies over 15 years, from 1996 to 2011. The authors additionally approximated community health by measuring life expectancy. Their results indicated that an increase in life expectancy up to 1 year may cause a 7% growth in FDI. The factors affecting the health expenditure of households were also investigated in Chittagong Port, Bangladesh. In this study, the researchers utilized the multi-equation regression estimation method. The probability of being sick was estimated by using the binary logit model in the first step. In the second step, the possibility was supplemented by the independent variables, and the selection of health care providers was investigated by the logit model. Ultimately, OLS was applied to the parameters of the health expenditure model. The results indicated that income level has a significant effect on the choice of health care provider and the amount of health expenses spent. Moreover, smoking and low access to safe drinking water and proper sanitation services made households more vulnerable to diseases. The level of individual education, the level of education of the head of the household, and the presence of men in the family had less effect on the report of illness and health care expenses.

The FDI helps improve health in low- and middle-income countries by increasing community health indexed based on life expectancy at birth. The findings suggest that a 1-year increase in life expectancy requires a 9% increase in GDP.

2. Objectives

This study employed life expectancy index (LEI) to examine the health care index. The LEI expresses the quality of life and is affected by social programs, health care, mental peace, and healthy nutrition. The increase in this index is likely to indicate the quality of health expenditure in a country. This paper aimed to study the impact of FDI on improving the LEI in Iran. Based on the results, FDI showed a relationship with the LEI.

3. Methods

Consistent with (3) and (10), the following regression model estimation was applied to study the effect of FDI on LEI in Iran:

$$HIt = c0 + c1\,GDPt + c2\,FDIt + c3\,LRt + c4\,HIVt + c5\,Urbent + c6\,EXRt + c7\,INFt + c8\,IRt + et.$$

where

The dependent variable:

- Development of the health care sector (health index): LEI

The independent variables:

- Economic growth (GDP): GDP growth
- FDI: FDI in the health sector of the total GDP
- Literacy rate (LR): The number of literate individuals in the entire population aged 6 years and above
- Acquired immunodeficiency syndrome (AIDS) infection rate human immunodeficiency virus (HIV): The growth rate of individuals with AIDS
- Urbanization rate (URBEN): Urban population growth

rate

- Real exchange rate (EXR): The real exchange rate is the adjustment of the nominal exchange rate to the index of domestic and foreign prices, which is described by the following formula:

EXR = NER (Pd/Pm)

Where EXR is the real exchange rate, NER is the nominal exchange rate, Pd is the domestic price index, and Pm is the import price index.

- Inflation rate (INF): The annual rate of inflation in the country

- Interest rate (IR): The interest rate of 1-year deposits of state-owned banks

The desired data were collected from relevant authorities such as library sources and databases, including the Central Bank of Iran, the Statistical Center of Iran, the World Health Organization, and the World Bank, from 1981 to 2020. The data collection method was library-based, accessible through the collection of sources, references, and information available on well-known reference websites (e.g., the Central Bank of Iran, the Statistical Center of Iran, the World Health Organization, and the World Bank).

The model was tested via autoregressive distributed lags (ARDL), introduced by (11) and (12). The method is described as an ARDL model test that includes explanatory variables, intervals of the dependent variable, and intervals of the simultaneous values of explanatory variables that estimate short- and long-term effects. The test allows for the presence of convergence without requiring that the regressions be self-accumulating at the data level, I(0), or with an I(1) lag. The following equation was applied for estimation purposes:

$$\Delta HE = \beta 0 + \beta 1t \ \Sigma \ \Delta HE\ t\text{-}1 + \beta 2t \ \Sigma \ \Delta GDP + \beta 2t \ \Sigma \ \Delta FDI + \beta 3t \ \Sigma \ \Delta LR + \beta 4t \ \Sigma \ \Delta HIV + \beta 5t \ \Sigma \ \Delta Urben + \beta 6t \ \Sigma \ \Delta EXR + \beta 7t \ \Sigma \ \Delta INF + \beta 8t \ \Sigma \ \Delta IR + \beta 9\ GDPt\text{-}1 + \beta 10\ FDI\ t\text{-}1 + \beta 11\ LR\ t\text{-}1 + \beta 12\ HIV\ t\text{-}1 + \beta 13\ Urben\ t\text{-}1 + \beta 14\ EXR\ t\text{-}1 + \beta 15\ INF\ t\text{-}1 + \beta 16\ IR\ t\text{-}1 + ut$$

Where β1, β2,..., β8 are short-term dynamic coefficients, and β9, β10, ... β16 are long-term coefficients, which is the random disturbance term.

The null hypothesis is the absence of a long-term relationship:

$\beta 9 = \beta 10 = \beta 11 = \beta 12 = \beta 13 = \beta 14 = \beta 15 = \beta 16 = 0$

The contradiction hypothesis is:

$\beta 9 = \beta 10 = \beta 11 = \beta 12 = \beta 13 = \beta 14 = \beta 15 = \beta 16 \neq 0$

And they were tested via the F statistic. The asymptotic distribution of the F statistic is nonstandard, regardless of whether the variables are correlated with degree 0 or 1. Proportional critical values are given; one of them assumes that the variables are I(1), and the other assumes that they are I(0). Furthermore, if the expressed F statistic is higher than the calculated level, then the null hypothesis of non-convergence is rejected. Before estimating the model, it is essential to test the significance of the required variables.

4. Results

4.1. The Significance of Variables

The significance of the variables is discussed below. The augmented Dickey-Fuller (ADF) test was applied for this purpose (Table 1).

Table 1. The Results for the Mean Test of the Variables

Result of Nonstationarity Assumption and the Level of Significance	Prob	*t*-Statistic	Variables
The stationary assumption is confirmed at a 5% level.	0.0432	-3.02	HI
The stationary assumption is confirmed at a 1% level.	0.0000	-6.55	GDP
The stationary assumption is rejected at a 5% level.	0.2052	-2.21	FDI
The stationary assumption is confirmed at a 1% level in the first difference of the data.	0.0000	-6.48	D(FDI)
The stationary assumption is confirmed at a 5% level.	0.0481	-2.96	LR
The stationary assumption is confirmed at a 1% level.	0.0000	-6.14	HIV
The stationary assumption is confirmed at a 5% level.	0.0221	-3.32	URBAN
The stationary assumption is rejected at a 5% level.	0.1052	-2.58	EXR
The stationary assumption is confirmed at a 1% level in the first difference of the data.	0.0006	-4.65	D(EXR)
The stationary assumption is confirmed at a 5% level.	0.0189	-3.36	INF
The stationary assumption is rejected at a 5% level.	0.5441	-1.45	IR
The stationary assumption is confirmed at a 1% level in the first difference of the data.	0.0019	-4.38	D(IR)

Abbreviations: GDP, gross domestic product; FDI, foreign direct investment; LR, literacy rate; HIV, human immunodeficiency virus; EXR, real exchange rate; INF, inflation rate; IR, interest rate.

Since the significance level of the test for foreign investment, exchange rate, and interest rate was more than 0.10, the assumption of the existence of a single root in the series was confirmed, and the data were non-signifi-

cant and normalized with 1 order of differentiation, while the other research variables were at non-significant.

Table 2 shows the comparison of the calculated F statistic with the critical values to check the existence of convergence in the model. The F statistic was equal to 4.623. According to the number of observations (12), the (13) was utilized to determine the lower and upper limit critical values.

Table 2. Comparison of the Calculated F Statistic with Narayan's Critical Values

Significance Level	Critical Value I(1)	Critical Value I(0)	Intervals	*t*-Statistic
95% level	**4.0727**	**2.6367**	**2** *	**14.7421**
90% level	**3.4637**	**2.2203**		

* The number of optimal intervals is selected using the Schwartz Bayesian (BS) criterion.

As Table 2 shows, the F statistic is outside the upper limit of the critical value of the Narayan table for data less than 80; therefore, the null hypothesis (i.e., there is no long-term relationship between the variables) was rejected. Consequently, there was a long-term equilibrium relationship at the 95% probability level. Interval 2 was considered the optimal interval to estimate the ARDL model based on the Schwartz Bayesian criterion (BS). The results of the ARDL test are reported in Table 3.

Table 3. Results of the Short-Term Effects, Autoregressive Distributed Lags (2,0,0,2,0,1,1,0,0)

Variables	Coefficient	t-Statistic and Significance Level
HI(-1)	1.7318	29.6215 (0.000)
HI(-2)	0.82379	14.7417 (0.000)
GDP	0.0082053	3.5709 (0.002)
FDI	0.070166	1.9323 (0.066)
LR	0.024739	1.1124 (0.277)
LR(-1)	0.0080672	0.37429 (0.712)
LR(-2)	0.061263	3.0847 (0.005)
HIV	-0.16091	-3.7042 (0.001)
URBEN	-0.25879	-1.3947 (0.176)
URBEN(-1)	0.51870	2.9366 (0.007)
EXR	-0.9829*E-3*	-2.6025 (0.016)
EXR(-1)	-0.0011864	-2.9489 (0.007)
INF	-0.0010914	-0.73257 (0.471)
IR	0.013165	1.6195 (0.119)
C	-2.1217	-2.1985 (0.038)

Abbreviations: GDP, gross domestic product; FDI, foreign direct investment; LR, literacy rate; HIV, human immunodeficiency virus; EXR, real exchange rate; INF, inflation rate; IR, interest rate.

As Table 3 exhibits, the variable of life expectancy and literacy rate holds two intervals, and the coefficient of determination is 0.99. However, examining the probability of the Durbin-Watson statistic shows no autocorrelation. The F statistic of the model is 31752.5, and its probability value is more than 99%; therefore, the LEI model was significant at the above probability level.

Table 4. Diagnostic Tests

Test Statistics	LM Version	F Version
Serial correlation CHSQ	2.4055 (0.121) F(1,22)	1.4868 (0.236)
Functional form CHSQ	2.2919 (0.130) F(1,22)	1.4121 (0.247)
Normality CHSQ	1.6813 (0.431)	
Heteroscedasticity CHSQ	1.2656 (0.261) F(1,36)	1.2403 (0.273)

Table 4 confirms the classical assumption of regression; particularly, it confirms the lack of autocorrelation of the error sentences, lack of variance heterogeneity, specification of the functional form, and normality of the error sentences.

Table 5 displays the results of the vector estimation of the long-term coefficients of the health care expenditure model.

Table 5. Results of the Long-Term Effects of the Model

Variables	Coefficient	t-Statistic and Significance Level
GDP	0.089229	1.9212 (0.067)
FDI	0.76302	1.9199 (0.067)
LR	1.0230	7.2005 (0.000)
HIV	-1.7498	-2.7302 (0.012)
URBEN	2.8264	2.4268 (0.023)
EXR	0.0022129	0.67318 (0.508)
INF	-0.011868	-0.75320 (0.459)
IR	0.14316	1.3731 (0.183)
C	-23.0722	-1.6581 (0.111)

Abbreviations: GDP, gross domestic product; FDI, foreign direct investment; LR, literacy rate; HIV, human immunodeficiency virus; EXR, real exchange rate; INF, inflation rate; IR, interest rate.

The long-term function of Iran's health care expenditure from 1980 to 2020 is as follows:

HI = -23.07 + 0.08 GDP + 0.76FDI + 1.02LR - 1.74HIV + 2.82URBEN +0.002EXR - 0.01INF + 0.14IR

The results of the long-term model showed that the variables of economic growth, FDI, literacy rate, urbanization rate, exchange rate, and interest rate had positive effects on the LEI. Nevertheless, the percentage of individuals suffering from AIDS and the inflation rate had negative effects on the LEI as an indicator of the development of the health care sector in Iran.

Foreign direct investment is probably an important macroeconomic factor in health care. Moreover, FDI and health care have a two-way relationship; on the one hand, health care is considered a factor along with other factors affecting the flow of FDI, and on the other hand, health care is affected by the flow of FDI. Generally, the effects of FDI on health care are likely to be described through direct and indirect channels. From the direct channel, FDI may affect health care outputs directly and indirectly, e.g., by providing a wider range of medical supplies and services (such as drugs and medical equipment), expansion of FDI in the health care sector, and the presence of foreign firms producing medical or health care products that make the supplies and services available at lower prices and, consequently, improve health care. From the indirect channel, FDI may affect the health care status of individuals in society indirectly by influencing other variables; e.g., the economic growth caused by the FDI flow may increase the average income, which leads to more demand for health services and ultimately increases the general health of the country.

By improving the per capita income of individuals, economic growth is one of the most important factors affecting health, and usually, there is a high and permanent correlation between low income and poor health. Moreover, access to sufficient income is a prerequisite for access to other determinants of health, such as nutrition and education. Furthermore, low-income societies have low living standards, low financial means to cover health expenses, insufficient nutrition, and low education, all of which may decrease health. Improving the income status of individuals is likely to improve their health and, as a result, increase their life expectancy. There is a claim that individuals who have higher education and literacy make the right decisions about adopting a healthy lifestyle and finding a suitable job, which may improve and develop the health sector and, thus, increase the LEI.

Concerning the positive effect of the urbanization rate, it is stated that socioeconomic status has a clear relationship with health in cases such as the mortality rate, diabetes, asthma, and similar diseases in individuals who have a low socioeconomic level. Those who have better socioeconomic conditions are in a more favorable situation due to their better ability and access; in contrast, individuals who belong to the lower strata of society suffer from unfavorable health care. Therefore, with the increase in the rate of urbanization and the expansion of the culture of urbanization, with people's attitude toward the higher socioeconomic status of urban dwellers compared to rural ones, the increase in the rate of urbanization is expected to improve the LEI and, thus, lead to further development of the health sector in the country.

Concerning the beneficial impact of lower interest rates, it can be argued that a decrease in interest rates fosters greater confidence in the potential returns of diverse investments, including those in the health care sector. This, in turn, can stimulate heightened investment activities, thereby contributing to the advancement of the health care industry.

Furthermore, the exchange rate emerges as a pivotal determinant potentially amplifying health care sector expenditures, primarily due to the pharmaceutical sector's reliance on imports. This reliance becomes particularly pronounced during periods of heightened economic sanctions, which might lower the overall well-being of society. Given that household expenditure encompasses a wide array of necessities such as food, clothing, shelter, education, and health care, any rise in inflation and any concurrent decline in individual incomes could dimin-

ish financial resources allocated to health care, making it lag behind other essential requisites such as sustenance. This could also translate to decreased OOPs for household and personal medical expenses.

Similarly, an elevation in the inflation rate, driven by factors such as instability, social disparity, and dwindling purchasing power, can unfavorably impact health care expenses and exert a detrimental influence on both economic growth and overall development within society.

Iran, like other developing countries, has always been involved with high inflation rates. Therefore, the effect of this variable has not been significant. Arguably, with the increase in the percentage of AIDS and the negative atmosphere that exists concerning this disease and its intractability, individuals' morale is weakened, and consequently, life expectancy is reduced.

Following the long-term, dynamic (short-term) function, the model may be expressed by exercising the error correction model (ECM), the results of which are given in Table 6.

Table 6. The Results of the Dynamic Error Correction Model (Short Term), Dependent on the Bayesian Schwartz Criterion Model (Autoregressive Distributed Lags (2,0,0,0,2,0,1,0,0))

Variables	Confidence	t-Statistic and Significance Level
dHI1	0.72936	34.6367 (0.000)
dGDP	0.0026793	2.3527 (0.027)
dFDI	0.036712	2.2819 (0.031)
dLR	0.102774	3.7765 (0.001)
dHIV	-0.046606	-3.98470 (0.000)
dHIV1	-0.20219	-4.1619 (0.000)
dURBEN	0.00783	2.1219 (0.046)
dEXR	0.8034	0.38507 (0.703)
dINF	-0.0015110	-2.2079 (0.037)
dIR	0.5978E-3	0.16308 (0.872)
dT	0.061390	12.2855 (0.000)
ecm(-1)	-0.16795	-10.5491 (0.000)

Abbreviations: GDP, gross domestic product; FDI, foreign direct investment; LR, literacy rate; HIV, human immunodeficiency virus; EXR, real exchange rate; INF, inflation rate; IR, interest rate.

As the results show, all the coefficients took the expected signs. Consistent with the coefficients, the greatest impact in the short term was on life expectancy and literacy rate, and the least impact was on the percentage of individuals with AIDS. The ECM coefficient in the model was statistically significant and indicated the speed of model adjustment. However, the rate was relatively low, and the adjustment toward balance was performed within a short interval. Furthermore, the amount of error correction in each period was approximately 16%, showing that the adjustment of the deviation from the long-term equilibrium relationship is within 7 periods. A cumulative sum of residuals (CUSUM) was applied to test the stability of the parameters and the variance of the model. The CUSUM test was based on the following statistics:

$$W_t = \sum \frac{W_i}{S}, t = k+1, \ldots, n$$

Where S is the error or residual of the regression criterion fitted for n members, and W is the cumulative sum and is plotted against t. If vector B remains constant from period to period, E(Wt) is - 0, and if it changes, Wt moves away from the 0-mean line. Moreover, the importance of any deviation from the 0-line concerns a pair of straight lines whose distance increases with increasing t. The mentioned test draws a graph of Wt versus t and shows the critical lines of 5%. The movement of Wt outside the critical lines indicates the instability of the parameters. Figure 1 displays the results of the CUSUM test. Since the movement path of return residuals or St is not out of the range of two lines, the hypothesis of parameter instability is rejected at the probability level of 95%. Consequently, long-term permanent stability for model parameters during the period under review is acceptable, i.e., no structural failure is observed in the model.

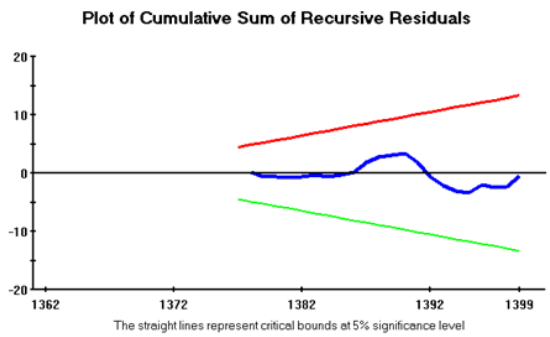

Figure 1. Results of the cumulative sum of residuals (CUSUM) test

5. Discussion

The results revealed that FDI exerts positive and significant effects on the life expectancy variable as an LEI in Iran. Theoretically, impact investments are likely to complement the health care ecosystem in several aspects, which may include physical infrastructure, financial solutions, emergency response, and the development of medicine, vaccines, and diagnostic services. Direct investment in medical and pharmaceutical firms allows access to the targeted opportunities. Besides, investing in the health care sector may be beneficial for expanding and strengthening the physical infrastructure of hospitals and clinics. Empirically, numerous studies show that health care is a part of human capital; therefore, the quality of the health system may be an important factor attracting investment, along with infrastructure such as education, labor, and research and development costs. The FDI may have positive effects on the health of the population, primarily by increasing the demand for health-related goods and services and improving the supply of these goods and services. "FDI generally holds a positive effect on both factor productivity and income growth in host countries, beyond what domestic investment normally does." Moreover, FDI is likely to improve health care sector performance by making more medical supplies and services available at lower prices (e.g., drugs and medical equipment). In addition to the effects of direct supply, FDI may increase the productivity of domestic suppliers in the health care sector of the country by expanding medical technical knowledge, which is consistent with the findings of Ogundari and Awokuse (1), Herzer and Nunnenkamp (6), and Motaghi et al. (10). Consistent with the results, it is suggested that macroeconomic policymakers in Iran increase the amount of domestic investment to develop the health care sector and lay the ground for more FDI in the sector. Therefore, while improving health indicators in the country, including life expectancy, by fostering a spirit of vitality and more effort in individuals, they should support the improvement of economic growth and development in numerous economic, cultural, and social arenas.

5.1. Conclusions

The findings indicated that FDI had favorable and noteworthy effects on the life expectancy measure, serving as an indicator of longevity in Iran. From a theoretical standpoint, investments hold the potential to complement various aspects of the health care framework. This could encompass enhancements in physical infrastructure, financial mechanisms, swift emergency responses, and advancements in medical technology, vaccines, and diagnostic services. Furthermore, direct investment channeled into medical and pharmaceutical enterprises offers avenues to tap into targeted opportunities. Additionally, allocating investments to the health care domain could prove advantageous for the expansion and fortification of the physical infrastructure of hospitals and clinics. As evidenced by the results, an augmented influx of foreign investments into the health care sector can potentially contribute to the enhancement of the nation's life expectancy.

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