

# Tunisia's Economic Growth and Remittances: A Novel Approach Utilizing Instrumental Variables Method

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## Abstract:

This article examines the impact of remittances on economic growth in Tunisia, employing the instrumental variable (IV) approach to address the issue of endogeneity. Specifically, we introduce a novel instrumental variable to effectively mitigate biases and obtain robust estimates. We test two instrumental variables: the minimum national wage and tourism inflows. The empirical results reveal a positive and statistically significant effect of remittances on economic growth, underscoring the critical role that remittances play in Tunisia's economic dynamics.

**Keywords:** Economic Growth, Instrumental Variables, Remittances, Tunisia, Minimum National Wage, Tourism Inflows

## Résumé :

Cet article analyse l'impact des transferts de fonds sur la croissance économique en Tunisie, en utilisant la méthode des variables instrumentales pour résoudre le problème d'endogénéité. Plus précisément, nous proposons une nouvelle variable instrumentale permettant de traiter de manière optimale ces biais et d'obtenir des estimations robustes. Nous testons deux variables instrumentales : le salaire minimum national et les recettes touristiques. Les résultats empiriques montrent un effet positif et statistiquement significatif des transferts de fonds sur la croissance économique, confirmant l'importance des transferts dans l'économie tunisienne.

**Mots-clés :** Croissance économique, Variables instrumentales, Transferts de fonds, Tunisie, Salaire minimum national, Recettes touristiques

## I. Introduction

The Arab Maghreb nations have been confronting a number of challenges for more than a decade as a result of multiple shocks. North African countries have suffered greatly as a result of the 2008 financial crisis, the Arab Spring, COVID-19, and recently, the conflict in Ukraine. In light of these international and national conditions, remittances have garnered more attention because of their exceptional resilience to economic shocks. Currently, the money sent by Tunisian migrants to Tunisia are the main source of foreign currency, surpassing the volume of foreign direct investment and official development assistance. Furthermore, in 2021, despite the challenging conditions faced by Tunisia, the foreign exchange reserves have demonstrated remarkable resilience. In fact, the increase in foreign exchange reserves is explained by the increase in remittances from Tunisians migrants. According to the Central Bank of Tunisia, remittances reached a new record in 2021, totaling 8,600 million dinars.

In this context, remittances can form an alternative source of foreign currency for fragile nations, which do not have the capacity to attract more foreign direct investments. Therefore, the implementation of a new strategy and new objectives represent a crucial starting point for policymakers. To optimize the use of these resources, economists and researchers must pay more attention to these issues to better understand them. Despite a constant and impressive flow of remittances to developing countries, the effects of these migration flow on economic growth in these countries remain controversial among researchers. The results, whether national or transnational remain mixed. This may be explained by the difference in methodological approaches used to study the issue, as well as the difficulties in accessing reliable and credible data[1].

**Faini [2]** relied on a representative sample of 68 countries, with the dependent variable being the average annual growth rate of GDP per capita between 1980 and 2004. He discovered a positive and significant relationship between remittances and economic growth. However, the use of an instrumental variable approach with the distance between countries as a tool. The coefficient of total remittances has lost its significance but remained positive. In an international survey covering 84 recipient countries, **[3]**, estimated that remittances do not contribute positively to economic growth. Their study was different in two respects: First, they created a new instrument, which is the ration of remittances to the GDP of all other recipient countries. Secondly, a weighted average growth rate based on the trade of real GDP per capita of the 20 main trading partners of the remittance-receiving country was added as an explanatory variable.

Regarding Tunisia, there are no researchers who have used an instrumental variable to study the impact of remittances on economic growth. However, there are studies that have used other methods, which have improved the analysis. In this regard **[4]** concluded that before the Arab spring, remittances had a negative impact on the country's economic growth. Rather, they discovered that in the long term and after the 2011 revolution, the impact on growth and consumption becomes positive. This effect is justified by the fact that following the Arab Spring, the desire of migrant to support their families grows stronger. In the same context, **[5]**, using monthly data from 2000 to December 2016, suggest that remittances can help in alleviating the economic shock. Subsequently, they emphasized that governments could benefit from remittances to stimulate economic growth.

**Juini [6]** explored the relation between economic growth and remittances in Tunisia over the period 1970 to 2010, specifically focusing on tow transmission channels: financial development and investment. Using the Autoregressive Distributed Lag model, the study assessed the long-term and short term causal links between the variables. The results showed a cointegrated relation between economic growth and remittances, suggesting that, although there is limited support for a long term causal connection, significant bidirectional causal links exist in the short term, particularly between remittances and economic growth.

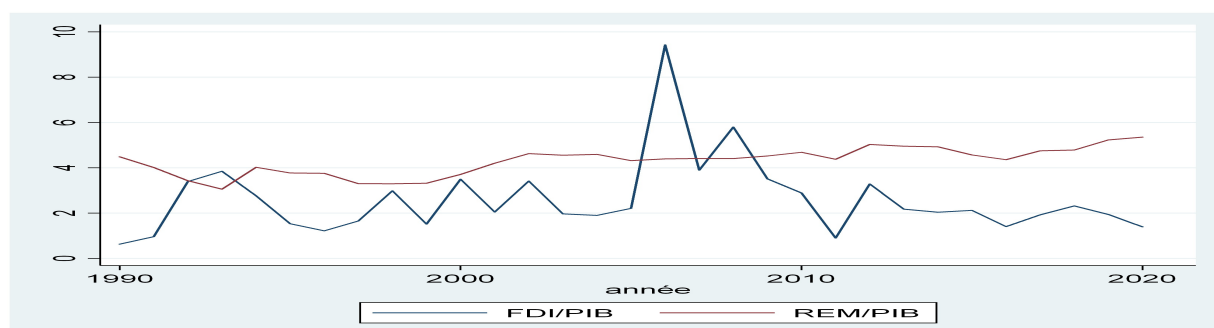
Given the importance of remittances, this article aims first to analyses some stylized facts related to these flows. In a second phase, an empirical analysis is conducted to examine whether these transfers have a significant effect on economic growth in Tunisia.

## II. Stylized Facts

In this section, we present stylized facts that illustrate the main trends and characteristics observed regarding remittances in the context of Tunisia.

Source : Minister of Foreign Affairs, 2018  
 Figure 1: Distribution of Tunisian Migrants by Country

The graphic shows that most Tunisians living abroad reside in France, with a number approaching 900,000 people. Germany follows with a significantly smaller number, but still notable, around 300000. Italy comes next with an even lower number. On the other hand, the Tunisian community's in Canada and Belgium are comparatively very small. These data show historical, cultural, economic and linguistic ties between Tunisia and these countries, particularly the influence of the French colonial history in North Africa.



Source: Authors' calculation  
 Graph 2: Comparative Analysis of the Two Main Sources of Foreign Currency for Tunisia

When comparing the percentages of remittances and foreign direct investments in Tunisian GDP, it appears that remittances have shown a more marked stability compared to foreign direct investments. Remittances represent a more stable and reliable source of foreign currency, particularly in volatile economic contexts. In Tunisia, the inflow of foreign direct investment is hindered by several structural challenges, including an unfavorable business climate, political instability, and excessive bureaucracy.

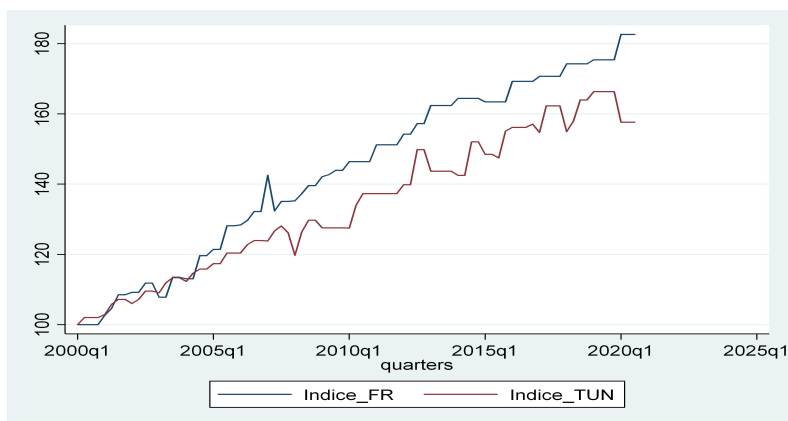
Since the Arab Spring, FDI has decreased, a trend that accelerated with the 2019 health crisis. In 2021, although the economy showed signs of recovery, foreign direct investment continued to decline. In a context marked by political uncertainty, the Covid-19 crisis, and the suspension of Parliament, it seems unlikely that investment will recover the levels observed before 2011. Even with imposed reforms and political stability, it will likely several years for FDI to return to their previous levels. However, in response to the health crisis related to Covid-19. Remittance show a notable increase in 2020. These follow mainly come from more than 1586669 Tunisians working abroad in 2020, especially in the European Union. The increase in remittances shows the support of Tunisian expatriates towards their families, who have been particularly affected by the post-revolution economic recession. In the recent years, Tunisia has become dependent on remittances due to the successive shocks it has experienced since 2011. Consequently, remittances are now the main source of foreign exchange currency.

Faced with these internal conditions and global crises, Tunisia has gone through difficult periods and continues to confront economic challenges at both the national and international levels. So, having a relatively stable source of foreign currency, such as remittances, could be one of the solutions to strengthen the countries resilience and ensure a certain level of economic security. To achieve this objective, it is crucial to better understand the mechanism and the economic impact of this remittances. The increase in the number of Tunisian migrants over the past few decades has contributed to the rise in remittances. The difference in remuneration and living conditions play a key role in this phenomenon. One of the main drivers of emigration is the search of better living conditions and the possibility of improving those of their family left behind in Tunisia. Also, due to the current condition in the origin country such as inflation, the health crisis, and political instability, many migrants have made more transfers to support their families during the economic recession.

## II. Minimum Wage, Purchasing Power, and remittances

Following the 2010 revolution, Tunisia has faced a series of challenges, including political instability, security threats, a decline in tourism, the Covid-19 and recently the unexpected war in Ukraine. These events have contributed to increasing the prices of most goods and services in Tunisia, in parallel, the national minimum wage has not increased sufficiently to adapt with this unexpected rise in prices. Given the depreciation of the exchange rate, the purchasing power of the average citizen deteriorates year after year, and for the poor class, their situation becomes increasingly critical. In these difficult condition, the need for other sources of financing becomes a necessity.

In 2020, the minimum wage was being around 400 dinars, about 125 euros, whereas the national minimum wage in France is around 1600 euro, with the gap between the two wages being around 84%. In light of the considerable wage disparity and the prevailing economic and political conditions in the county, the number of emigrants has been rising significantly. Also, an increase affected the category of qualified youth, according to the opinion of Tunisian doctors, 80 % of newly graduated left the country in 2020.



Source: Authors' calculation

Graph 3: Analysis of the Difference between the Minimum Wage in France and Tunisia (2000-2021) in Purchasing Power Parity

The graphic 3 shows a significant difference in the minimum wage index, this difference can explain the increase in remittances after the health crisis. Tunisian immigrants, mostly located in Europe specifically, 60% reside in France respond to these deteriorating situations with altruistic behavior.

### III. Empirical Approach and Model Specification

The empirical analysis highlights the need to address indigeneity issues related to remittances which pose a major challenge for economists aiming to analyses their effect on economic growth. Three main tools are often used in the literature to solve these problems who are the choice of an appropriate estimation technique, the selection of a relevant set of conditioning variables, and the use of instrumental variables. In our study, we test two variables as instrumental variables to examine the impact of remittances on Tunisia's economic growth.

The model relies on the standard Cobb-Douglas production function, specifying the Gross Domestic Product per capita as the dependent variable. The explanatory variables include remittances, foreign direct investment, fixed capital formation, export revenues. The model is specified as follows:

### IV. Estimation Results

- *Descriptive Statistics and Unit Root Test:*

Table I. Descriptive Statistics for Economic Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
pibhab	84	1.503	.53	.736	2.506
remitt	84	776.526	414.192	272	2215.2
expp	84	5819.823	2651.355	2244.18	11846.4
fbcff	84	3384.381	1032.259	1851	5264
idee	84	623.433	394.359	140.2	3361.3

Source: Authors' calculation

Table I presents the descriptive for key Tunisian economic variables, including GDP Per Capita, remittances, export, foreign direct investment, gross fixed capital formation. The table reports the number of observations, mean values, standard deviations, as well as the minimum and maximum values for each variable. The GDP per capita shows significant variability, with a mean of 1.503 and a wide range from .736 to 2.506. Remittances have a mean of 776,52.6 with a range from 272 to 2215,2 indicating substantial variation. Similar variability is observed in other variables such as exports and FDI, reflecting economic diversity across the sample.

Table II: Unit Root Test Results and Order of Integration

Variable	Level (Z(t))	First Difference (Z(t))	Order of Intgration (I(d))
GDP	0.248	-8.411 ***	I(1)
Remittances	-0.816	-11.052 ***	I(1)
Export (exp)	-0.483	-8.210 ***	I(1)
IDE	-6.476***	-11.054	I(0)
FBCF	-1.536	-6.346 ***	I(1)

Source: Authors' calculation

The unit root test show that GDP per Capita, remittances, exports, and Gross Fixed Capital Formation are non-stationary at level but become stationary after first differencing, meaning they are integrated of order I(1). In contrast, FDI are stationary at the level, indicating they are I (0).

- *The Minimum Wage as an Instrumental Variable in Remittances and Economic Growth:*

In our study, we used the difference between the minimum wage in Tunisia and France as an instrumental variable to examine the impact of remittances on economic growth. This approach is based on an empirical analysis using quarterly data from the Central Bank of Tunisia (BCT), the National Institute of Statistics (INS) and the World Bank for the period 2000 -2022.

Tableau III : 2SLS Regression Results

Variable	Coefficient	Erreur standard	Z-Score	P-value
d.remit	0.03099	0.03538	0.88	0.381
d.exp	0.00758	0.00225	3.36	0.001
d.ide	-0.00172	0.00135	-1.27	0.203
d.FBCF	0.00365	0.00191	1.91	0.056

Source: Authors' calculation

Table IV: Instrument Validation

Variable	R-squared ajusté	R-squared partiel	R-squared robuste	F(1,78)	Prob >F
D.remit	0.0801	0.0329	0.0103	0.356828	0.5520

Source: Authors' calculation

The results of the first stage of the regression show that the instrument used (the difference between the minimum wage in Tunisia and France to instrument remittances) is not particularly powerful in explaining the variations in remittances. Indeed, the values of adjusted R-squared (0.0801), partial R-squared (0.0329), and robust R-squared (0.0103) suggest that the instrument accounts for only a small proportion of the variation in the dependent variable. Moreover, the first-stage F-test ( $F(1,78)=0.3568$ ,  $p\text{-value}=0.5520$ ) indicates that the instrument is not significant, as the p-value is well above the 0.1 threshold, indicating a weakness in explaining the variation in remittances. Consequently, the research for another instrument therefore proves crucial in this case.

- *Tourisme Revenues as an Instrumental Variable for Remittances*

In this analysis, we choose to use tourism receipts as an instrumental variable to evaluate the impact of remittances on economic growth. Indeed, a close link can be established between remittances and tourism receipts, particularly through migratory behaviors. A significant portion of the remittances is made by Tunisian migrants residing abroad. These individuals, in addition to the regular remittance made through formal channels, often return to the country during holiday periods or religious festivities, thereby contributing to tourist revenues. During these stays, they bring with them financial resources, whether formally or informally. This phenomenon creates a link between remittances and tourism follow, as the expenditures made by these migrants during their stay are counted as part of the country's tourism receipts.

It's important to emphasize that tourism follow are not necessarily correlated with GDP per capita in a direct or proportional relation. Indeed, tourism revenues mainly depend on other exogenous factors such as internal security, political stability, or the country's tourist attractiveness. These elements strongly influence the country's visitation by foreign tourists, regardless of internal economic performance. As a result, tourism follow can change a lot without directly matching changes in GDP per capita. Consequently, the use of tourism receipts as an instrumental variable for remittances is justified by their strong correlation with remittances, while being relatively exogenous to economic growth measured by GDP per Capita.

Table V: 2SLS Regression Results Using Tourism Revenues as an Instrumental Variable

Variable	Coefficient	Erreur standard	z	P> z
D.remit	2.01e-06	5.24e-07	3.83	0.000
D.exp	5.84e-07	1.97e-07	2.97	0.003
D.ide	-9.76e-08	7.84e-08	-1.25	0.213
D.FBCF	3.48e-07	1.21e-07	2.88	0.004

Constante	0.0163095	0.0082565	1.98	0.048
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Source: Authors' calculation

Table VI: First Stage Results

Variable	R-sq. ajusté	R-sq. partiel	R-sq. robuste	F(1, 78)	Prob >F
D.remit	0.7418	0.7285	0.7222	74.4461	0.0000

Source: Authors' calculation

The high R-squared values indicate that the instrument explains a significant portion of the variation in remittances. The F-statistic and the p-value confirm the statistical significance of the instrument used in the first stage.

The results of the model estimation with tourism follow as an instrumental variable reveal significant relation between remittances and GDP per capita, as well as positive links with exports and gross capital formation. More specifically, exports have a significant and positive effect of 5.84e-07 and a p-value of 0.003, showing that the increase in exports positively contributes to the economic growth. Similarly, the coefficient of remittance is positive and statistically significant. Suggesting that the increase in remittances has positive and direct impact in economic growth. These finding are in agreement with those of [7], who demonstrated that remittances can have an important impact in GDP per capita, and [8] Who demonstrated that remittances can have a significant effect on economic growth, and highlighted the positive impact on the economic growth of Tunisian economic. Also, juni [9], confirmed the positive impact of remittances in short run in the case of Tunisia. This positive effect of remittances can be attributed to their crucial role in enhancing consumption, healthcare, and education in the countries of origin, consequently, contributing to the overall well-being and economic stability of households.

Furthermore, the effect of gross fixed capital formation is also statistically significant, confirming economic theories that associate capital accumulation with economic growth. However, FDI does not show statistical significance in this model, with a p-value of 0.213. The non-significant impact of foreign direct investment can be explained by the Tunisian instability and its inability to attract foreign investors, which are hindered by factors such as political uncertainty, inadequate infrastructure, and a challenging business. This issues limit the effectiveness of foreign direct investment in driving economic growth.

## V. Conclusion

The empirical analysis conducted in this article demonstrates that remittances have a significant impact on economic growth, particularly in Tunisia. Using the instrumental variable method and a new variable, we were able to overcome endogeneity issues and obtain more robust estimates of the relation between remittances and GDP per capita. The results show that remittances, as a stable source of external currency, play crucial role in stimulating domestic demand and improving living conditions, which in turn fosters economic growth. Moreover, remittances are particularly important in the context of countries in transition or facing economic crisis, where they can offset deficits in FDI. However, public policies must be adapted to maximize the impact of transfers, particularly through measures that promote their productivity and channel them towards strategic sectors of the economy. The results suggest that optimal management of transfers could provide an additional pathway to support sustainable economic growth in Tunisia.

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Annex:

Variable	Niveau/Diff.	Stat ADF	Critère 1%	Critère 5%	Critère 10%	p-value
PIBHABI	Niveau	0.248	-3.535	-2.904	-2.587	0.9748
remit	Niveau	-0.816	-3.535	-2.904	-2.587	0.8145
exp	Niveau	-0.483	-3.535	-2.904	-2.587	0.8953
ide	Niveau	-6.476	-3.535	-2.904	-2.587	0.0000
FBCF	Niveau	-1.536	-3.535	-2.904	-2.587	0.5155
PIBHABI	1ère diff.	-8.411	-3.537	-2.905	-2.588	0.0000
remit	1ère diff.	-11.052	-3.537	-2.905	-2.588	0.0000
exp	1ère diff.	-8.210	-3.537	-2.905	-2.588	0.0000
ide	1ère diff.	-11.054	-3.537	-2.905	-2.588	0.0000
FBCF	1ère diff.	-6.346	-3.537	-2.905	-2.588	0.0000

ivregress 2sls d.PIBauxprix $\sim$ é (d.remit= smigendinar ) d.exp ide d.FBCF , robust

Instrumental variables 2SLS regression      Number of obs =      83  
    Wald chi2(4) =      47.11  
    Prob > chi2 =      0.0000  
    R-squared =      0.6238  
    Root MSE =      508.3

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-----+-----
D.      |      Robust
PIBauxprix~é | Coefficient std. err.   z   P>|z|   [95% conf. interval]
-----+-----
remit |
D1. | .0309895 .0353778   0.88  0.381   -.0383497   .1003288
|
exp |
D1. | .0075811 .0022545   3.36  0.001   .0031624   .0119999
|
ide | -.0017199 .0013521  -1.27  0.203   -.0043699   .0009301
|
FBCF |
D1. | .0036452 .0019073   1.91  0.056   -.000093   .0073834
|
_cons | 225.5296 81.45051   2.77  0.006   65.88956  385.1697
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Instrumented: D.remit  
 Instruments: D.exp ide D.FBCF smigendinar

. estat firststage

First-stage regression summary statistics

Variable	Adjusted R-sq.	Partial R-sq.	Robust R-sq.	F(1,78)	Prob > F
D.remit	0.0801	0.0329	0.0103	.356828	0.5520

. ivregress 2sls d.PIBHABI (d.remit= d.tou ) d.exp ide d.FBCF , robust

Instrumental variables 2SLS regression      Number of obs =      83  
    Wald chi2(4) =      39.66  
    Prob > chi2 =      0.0000  
    R-squared =      0.6427  
    Root MSE =      .04238

D.PIBHABI	Robust Coefficient	std. err.	z	P> z	[95% conf. interval]
remit					
D1.	2.01e-06	5.24e-07	3.83	0.000	9.82e-07 3.04e-06
exp					
D1.	5.84e-07	1.97e-07	2.97	0.003	1.98e-07 9.70e-07
ide	-9.76e-08	7.84e-08	-1.25	0.213	-2.51e-07 5.60e-08
FBCF					
D1.	3.48e-07	1.21e-07	2.88	0.004	1.11e-07 5.84e-07
_cons	.0163095	.0082565	1.98	0.048	.0001269 .032492

Instrumented: D.remit

Instruments: D.exp ide D.FBCF D.tou

. estat firststage

First-stage regression summary statistics

Variable	Adjusted R-sq.	Partial R-sq.	Robust R-sq.	F(1,78)	Prob > F
D.remit	0.7418	0.7285	0.7222	74.4461	0.0000

Tableau : Matrice de Corrélation des Variables Économiques :

	D.PIBauxprix dumarché	D.remit	D.exp	ide	D.FBCF	D.tou
D.PIBauxprix dumarché	1.0000					



<b>D.remit</b>	0.5239	1.0000				
<b>D.exp</b>	0.4433	-0.2598	1.0000			
<b>ide</b>	-0.0356	0.0285	0.0384	1.0000		
<b>D.FBCF</b>	0.1648	0.0155	0.0825	-0.0379	1.0000	
<b>D.tou</b>	0.3706	0.8610	-0.2870	0.0208	0.0034	1.0000