

Taxation of the Digital Economy, Tax Revenues and Economic Growth in Morocco: An ARDL Analysis

Nouhaila EL HAJJAJI^{1*}, Zakariae BELMKADDEM², Imane Tesse³

¹ Doctoral Researcher, Laboratory for Studies and Research in Economics and Management, National School of Business and Management, El Jadida, Morocco.

² Professor of Taxation and Applied Economics, National School of Business and Management, El Jadida, Morocco.

³ Doctoral Researcher, Laboratory for Studies and Research in Economics and Management, National School of Business and Management, El Jadida, Morocco.

*Corresponding author: el-hajjaji.nouhaila@ucd.ac.ma

Abstract

Taxation of the digital economy is a crucial and increasingly debated issue worldwide, particularly in emerging economies such as Morocco, where the rapid growth of internet penetration and digital services has raised new challenges for tax administrations. Traditional tax systems, designed for physically anchored economic activities, struggle to capture value generated by dematerialized transactions, cross-border digital platforms, and location-independent business models. Against this background, understanding how the development of the digital economy interacts with tax revenue mobilization and economic growth becomes essential for designing appropriate fiscal policy. This study examines the effect of internet use, taken as a proxy for the penetration of the digital economy, together with tax revenues and research and development (R&D) expenditure, on economic growth in Morocco. An Autoregressive Distributed Lag (ARDL) approach is applied to annual data collected from the World Bank for the period 2003-2023, using Eviews v.10, given its suitability for examining both short-run and long-run relationships among variables with mixed orders of integration. The results show that, in the long run, internet use and tax revenues have a positive and statistically significant effect on Gross Domestic Product (GDP), whereas R&D expenditure exhibits a negative long-run effect, which may reflect the time lag typically required for research investments to translate into productivity gains. In the short run, tax revenues also exert a significant positive effect on GDP, while internet use shows a negative short-run relationship, consistent with the upfront costs of digital infrastructure investment preceding productivity returns. These findings suggest that digitalization and effective tax revenue



mobilization can jointly support economic growth in Morocco, provided that tax policy carefully balances revenue generation with incentives for innovation and continued investment in the digital economy, without discouraging businesses from adopting digital technologies.

Keywords: Digital economy; Gross Domestic Product; Tax revenues; ARDL cointegration; Research and development expenditure.

Classification JEL : H25, O33, O47, O55

1. Introduction

In the 1990s, economic changes were primarily linked to the emergence of the Internet, which remains the foundation of the digital economy's growth. But during the 2000s and 2010s, a succession of new information and communication technologies (ICT) drove and sustained economic change. These include the integration of connected sensors into a growing number of objects (the Internet of Things), new devices designed for end users (cell phones, smartphones, tablets, netbooks, laptops, 3D printers), new digital models (cloud computing, digital platforms, digital services), the increasing intensity of data use driven by the spread of big data, data analytics, and algorithmic decision-making, as well as new automation and robotics technologies. This evolution is primarily driven by the constant improvement of digital technologies. Digitization is a defining feature of societal progress, influencing how communities, economies, and governments function on a global scale (Shkuropadska et al., 2025). It has revolutionized the way economies and societies operate (Esses et al., 2021).

Advanced information and communication technologies have enabled broader access to information, services, and markets. As a result of the digitization of economic sectors, the collection of taxes and other fiscal resources has increased, while the digital revolution has fostered innovation and the development of new industries (Vărzaru et al., 2023). This transformation has improved economic efficiency and increased government revenue (Zhang et al., 2023). It is considered a key driver of growth in local tax revenue through structural optimization and improved production efficiency (Shuguang & Yifan, 2023). The development of the digital economy tends to stabilize tax sources, harness their potential, increase revenue, and help governments create new tax sources (Xu & Feng, 2024), while leveraging advances in digitization and information technology to ensure sound management and effective oversight of tax sources, thereby reducing tax revenue losses (Ren et al., 2021).

However, it is clear that digital technology has had a dramatic impact on the economy as a whole, and this trend is likely to accelerate in the future. Several authors have also pointed out that attempts to measure this impact have proven problematic (Boccia & Leonardi, 2016). The rapid integration of technologies gives rise to several challenges that jeopardize both security and equity (Shkuropadska et al., 2025).

Indeed, taxation is a fundamental pillar of national governance, and the remarkable changes in technology have a major impact on tax revenues (Casi et al., 2020). However, due to the unprecedented changes the world is undergoing, the rise of taxation on the digital economy now presents challenges related to its specific characteristics, such as the non-localization of economic activities, which makes it difficult to collect taxes using traditional methods.

The international tax landscape is adapting to the upheavals caused by the digitization of the economy, with various initiatives aimed at adjusting tax rules. At the same time, the crucial issue of digital taxation has become a priority for both governments and international organizations, reflecting the need to rethink tax frameworks in the digital age. In this context, the following research question arises: What is the effect of digital development, as measured by Internet usage rates, as well as tax revenues and research and development expenditures, on Morocco's economic growth?

More specifically, this study has three specific objectives: to assess the short-term and long-term effects of Internet use, tax revenue, and research and development spending on Morocco's Gross Domestic Product; to determine, using the ARDL model, whether a cointegration relationship exists among these variables over the 2003–2023 period; and to draw implications from these results for the design of a digital tax policy tailored to the Moroccan context.

It is important to clarify the scope of this study. In Morocco, there is no long-term, specific statistical series on digital taxation, as the country did not introduce VAT on dematerialized digital services until the 2025 Finance Act, which was enacted after the period covered by this study (2003–2023). This study uses the Internet usage rate as an indicator of digital economy penetration and total tax revenue as an indicator of the government's tax-raising capacity. The objective is therefore not to directly measure the revenue generated by a specific digital tax, but to examine how digital development, combined with tax revenue collection and research and development spending, is associated with economic growth in Morocco. Once established, this relationship provides valuable insight into the digital tax policy choices that Morocco must now make.

This study is of twofold interest. From an academic perspective, it contributes to the still-limited body of literature on the relationship between digitalization, tax revenue, and economic growth in the specific context of a North African country, as most existing research focuses on China, Europe, or sub-Saharan Africa. From an operational perspective, its findings provide useful insights for Moroccan policymakers at a time when the country is implementing, through the 2025 Finance Act, its first digital taxation measures and must strike a balance between generating revenue and preserving the attractiveness of the digital sector.

The remainder of this article is organized as follows: Section 2 presents a review of the literature on the digital economy and its taxation; Section 3 outlines the methodology and the ARDL model used; Section 4 presents the empirical results; Section 5 discusses these results in light of the existing literature; and finally, Section 6 concludes and offers public policy recommendations.

2. Literature review

2.1 Definition and Components of the Digital Economy

The digital economy is a constantly evolving phenomenon that transcends physical boundaries and is redefining the way businesses operate in the modern world. It has attracted global attention (Verhal, 2023). Nevertheless, there is no universally accepted definition of this type of economy; consequently, the definitions of the digital economy presented by various authors reveal the diversity and complexity of this rapidly expanding field.

Tapscott (1996) was the first to coin the term “digital economy.” He emphasized that this term highlights the relationship between the new economy, technological transitions, and new businesses, and how they mutually reinforce one another. According to the literature analyzed by Kraus et al. (2022), definitions of digital transformation range from the adoption and use of new technologies, to the improvement of processes, operations, customer relationships, and performance, to the creation of new business models, and to the potential outcomes and impacts on various stakeholders and environments. Becker (2021) added that the digital economy encompasses services supported by platforms such as Uber, online platforms such as Amazon, Facebook, and Google, as well as electronic services such as e-books, video games, and movies. Mpofu (2022) describes the economy in the digital age as a set of economic activities encompassing platform services, e-commerce services, and the provision of software and mobile technologies, all of which promote increased globalization. Cui and Hashimzade (2019) specify that it is based on digital technologies and the Internet, covering sectors such as e-

commerce, online advertising, and digital platforms. The digital economy, as defined by Shuguang & Yifan (2023), encompasses next-generation technologies, including 5G, the Industrial Internet, artificial intelligence, cloud computing, and big data. The authors emphasize that the digital economy plays a crucial role in promoting economic growth, especially during periods of structural adjustment and shifts in economic development. According to Philip et al. (2021), the digital economy can be defined as a value chain comprising companies operating within an ecosystem that provides content and applications to consumers and businesses. Mesenbourg (2001) also defines the digital economy by dividing it into two categories: the production of ICT infrastructure and the use of ICT for other economic processes, including e-commerce.

According to the definitions provided by various authors, none of them is limited solely to the digital sector. Thus, the digital economy must be defined as broader than just the digital sector (Bukht & Heeks, 2017). The authors therefore define the digital economy as the portion of economic output derived solely or primarily from digital technologies, with a business model based on goods or services in the digital market. It encompasses three levels of analysis:

- The Digital Sector: encompasses companies that produce digital technologies (computer hardware manufacturing, software development, telecommunications, and IT consulting).
- The Narrow Digital Economy: includes the digital market sector and innovative services based on digital platforms.
- The Digitalized Economy: encompasses all economic sectors that rely primarily on ICT to varying degrees and integrate it into all economic activities, including e-commerce, Industry 4.0, and economic algorithms.

This three-level distinction has direct implications for empirical measurement. Internet penetration, as used in the present study, captures access to digital infrastructure rather than digital economic activity per se; it therefore aligns more closely with what Bukht and Heeks (2017) describe as the broad "digitalized economy" than with the narrower "digital sector" that specific digital tax instruments typically target. This distinction matters for interpreting the results of this study: a rising internet usage rate reflects growing digital connectivity and potential exposure to the tax base, but does not by itself indicate the volume of value actually generated, or taxed, within the digital sector strictly defined.

2.2 Taxation of the Digital Economy

2.1.1 *Characteristics of the Digital Economy That Pose Challenges to Traditional Tax Systems*

By nature dematerialized and borderless, the digital economy puts considerable strain on the core principles underpinning traditional tax systems, which were originally built around physically anchored, territorially defined economic activity. Several of its structural features illustrate this tension. First, the growing shift toward paperless, digitized transactions, accelerated by the rise of FinTech, complicates the work of tax authorities. Although digitization improves the traceability of certain economic flows, it simultaneously makes fraud detection and tax-base broadening harder in a cross-border setting. Bourekkadi et al. (2023) note the particular difficulty of monitoring transactions carried out on digital platforms, cryptocurrencies among them. Payments made through cryptocurrencies, digital wallets, or microtransactions frequently escape conventional oversight mechanisms; NFTs offer a telling illustration, as they allow artists to collect income with no tax intermediary involved at all. Emerging tools, such as blockchain-based tax tracking (currently piloted in Estonia) or AI-driven analytics (used by the U.S. IRS), attempt to close this gap, though concerns over cost and data privacy still limit their broader adoption (Abkar & Chaihab, 2024). Second, many of the business models that digitalization has produced, platform work, subscription services, data-driven economies, sit awkwardly within existing tax frameworks. Three examples make this visible: the ambiguous employment status exploited by platforms such as Uber or Deliveroo, which blurs the line between independent contractor and employee to reduce social security contributions; the monetization of user data by major digital firms (the so-called GAFAM), which generates substantial value that nonetheless falls outside conventional tax bases (Brynjolfsson & McAfee, 2014); and the income earned through influencer activity or NFT sales, which largely goes unreported. Third, the digital economy undermines the principle of tax territoriality on which traditional systems rest. Firms such as Netflix or Google can generate substantial revenue in a given country without maintaining any physical presence there, making it difficult to establish where tax liability should even apply. This has motivated reform proposals such as Pillar 1, designed to reallocate part of taxing rights toward the jurisdictions where end users are actually located.

2.1.2 *The Impact of Taxation on the Digital Economy*

Evidence on how taxation shapes the digital economy points in more than one direction. Abkar and Chaihab (2024) argue that taxing the digital economy can effectively raise revenue by

specifically targeting firms operating in the sector, while cautioning that policymakers must carefully balance taxation against the need to preserve innovation, since revenue maximization should not come at the cost of stifling growth. Along similar lines, Shuguang & Yifan (2023) report that taxing the digital economy has a positive and significant effect on tax revenue, though the reverse relationship, the effect of tax revenue on digital economy development, is not statistically significant. This asymmetry suggests that digital taxation mainly serves a revenue-generating function rather than actively shaping the pace of digital development itself. A further consideration is that as the digital economy expands, governments may be able to draw more revenue from cross-border digital transactions, which could in principle allow them to ease other tax burdens over time. This possibility, however, is not without criticism, since taxation can distort both economic behavior and consumer spending decisions (Bunn et al., 2020; Kelbesa, 2021). El Yamlahi et al. (2022) similarly describe the growth effects of digital taxation as mixed: on one hand, it provides governments with additional resources to invest in infrastructure, education, and other growth-supporting sectors, and helps level the playing field between traditional and digital businesses; on the other, taxing digital activity too heavily risks discouraging the innovation and technological progress that drive growth in the digital era.

Regional evidence adds further nuance. Ahmed and Gillwald (2020) stress that digital economy growth is a critical development lever for Africa, but warn that digital taxation could raise already-high internet costs in several African countries, potentially reducing the uptake of digital services. Becker (2020) reaches a comparable conclusion, arguing that higher internet access costs can hold back both the digital sector's expansion and its contribution to GDP. By contrast, Tyutyuryukov & Guseva (2021) find that the digital economy has a positive effect on local tax revenues by stabilizing revenue sources and improving the efficiency of tax administration through digitization, a result corroborated by Mao et al. (2023), who document a marked increase in tax revenue driven by the digital economy alongside gains in industrial competitiveness and greater foreign investment.

Beyond the direct revenue effects discussed above, the literature also identifies an administrative channel through which digitalization affects tax outcomes: ICT adoption strengthens the technical capacity of tax administrations themselves, independently of taxing digital economic activity as such. Adegboye et al. (2022) show that information and communication technology significantly improve tax revenue mobilization across Sub-Saharan African countries by facilitating taxpayer registration, filing, and compliance monitoring, an administrative transmission channel distinct from the direct taxation of digital transactions. This

dual pathway, digitalization as a tax base on one hand and as an administrative tool on the other, is particularly salient for developing and emerging economies, where enforcement capacity is often a greater constraint on revenue mobilization than the design of the tax instrument itself. Comparative evidence from other developing and emerging regions further situates the Moroccan case. In the MENA region specifically, Souguir et al. (2025) find, based on a panel of banks over 2011-2022, that digital transformation is associated with reduced corporate tax avoidance, suggesting that digitalization can strengthen tax compliance even in the absence of a dedicated digital tax. Comparable findings from Sub-Saharan Africa (Ahmed & Gillwald, 2020; Mpofu & Moloi, 2022) point to a common pattern across the two regions: the returns to digitalization for tax systems depend less on the existence of a specific digital tax than on complementary investments in administrative capacity and regulatory frameworks, a conclusion directly relevant to the case of Morocco examined in this study.

2.3 Tax Revenue and Economic Growth

The relationship between tax revenue mobilization and economic growth constitutes a second theoretical pillar of this study. Using panel data from 29 developing countries over 2000-2020, Ho et al. (2023) find that tax revenue positively affects economic growth in developing economies, and that this relationship is strengthened by moderate trade openness, though excessive openness tends to weaken it. This finding is particularly relevant for Morocco, an economy engaged in successive trade liberalization while seeking to expand its domestic revenue base. More directly relevant to the present context, Arbia et al. (2026) apply an ARDL bounds-testing approach, methodologically close to the one used in this study, to examine the relationship between foreign direct investment, taxation, and growth dynamics in Morocco, and report evidence of a long-run relationship between fiscal variables and GDP growth. Taken together, this literature supports the expectation that tax revenue, beyond financing public expenditure, can act as a structural driver of growth when it does not excessively burden economic activity, a balance that is central to the interpretation of the results presented in Section 4.

2.4 Research and Development Expenditure and Economic Growth

The third pillar of this study concerns the relationship between R&D expenditure and economic growth. Gumus and Celikay (2015), using dynamic panel data from 52 countries over 1996-2010, show that R&D expenditure has a positive and significant effect on economic growth in the long run, but that this effect is initially modest for less-developed economies and strengthens only progressively over time, a lag consistent with the time typically required for research

investment to translate into productivity gains. In the African context specifically, Kasongo and Makamu (2024) analyze 32 African countries over 2006-2017 and find a positive association between innovation, including R&D expenditure considered separately, and economic growth, alongside complementary drivers such as domestic investment and human capital. This literature suggests that the growth returns to R&D spending are neither immediate nor guaranteed, particularly in developing economies, which provides a direct theoretical anchor for interpreting the negative short- and long-run R&D coefficient obtained in this study's ARDL estimation.

3. Methodology

3.1 Data and Variables

The objective of this article is to analyze the impact of digital development, tax revenues, and research and development expenditures on economic growth in Morocco, using a quantitative approach supported by the Eviews v.10 software, for the period 2003–2023. To analyze this relationship, we opted for the ARDL (Autoregressive Distributed Lag) model. This choice is based on the model's ability to highlight both short- and long-term relationships between economic indicators, which is crucial in the context of our study. The data were collected from the World Bank. The variables selected for this study are:

Table 1. Variables in the econometric model

Variables	Description	Source
GDP	Gross Domestic Product	World Bank WDI
IU	Internet Use	World Bank WDI
TR	Tax Revenues	World Bank WDI
R&D	Research and development expenditure	World Bank WDI

Source: generated by the authors

3.2 The Empirical Model

3.2.1 The unit root test

We used a software package called EViews V.10 for all econometric analyses. We first conducted a stationarity analysis of the time series using the unit root test to determine the stability and stationarity of the data. To examine the stationarity of the variables selected for this study, we used the test that remains the most widely used in econometric research today: the augmented Dickey-Fuller (ADF) test.

3.2.2 Description of the ARDL Model

This study uses ARDL (Autoregressive Distributed Lag) cointegration techniques to examine the relationship between digital development, tax revenue, research and development spending, and economic growth. Cointegration techniques provide a robust approach for determining the existence of a stable, long-term relationship between the variables of interest, as developed by Pesaran et al. (2001). This differs from the Pooled Mean Group (PMG) estimator of Pesaran, Shin, and Smith (1999), designed for heterogeneous country panels; since this study relies on a single-country time series, the ARDL bounds-testing framework of Pesaran et al. (2001) is more appropriate. In our study, we use the ARDL model to examine this relationship, taking into account the available data.

For the present study, the following ARDL model is estimated:

$$(1) \quad GDP_t = \alpha + \sum_{i=1}^p \beta_i GDP_{t-i} + \sum_{j=0}^q \gamma_j IU_{t-j} + \sum_{k=0}^m \delta_k TR_{t-k} + \sum_{l=0}^n \theta_l R\&D_{t-l} + \varepsilon_t$$

Where GDP denotes Gross Domestic Product (GDP), IU denotes the Internet Use, TR denotes Tax Revenues, and R&D denotes Research and Development expenditure; p, q, m, and n are the respective lag orders of the endogenous and exogenous variables; α , β_i , γ_j , δ_k , and θ_l are the coefficients to be estimated; and ε_t is the error term.

To estimate the ARDL model and the short- and long-run relationships, the optimal number of lags (p, q, m, n) is determined using the Akaike Information Criterion (AIC).

4. Results

4.1 Descriptive Statistics

Table 2 presents a descriptive analysis summarizing the data on the variables studied in Morocco for the period 2003–2023. We observe that the GDP variable recorded an average growth rate of 4.26 over the defined period. The results suggest that the GDP data approximately follow a normal distribution according to the Jarque-Bera test (p-value = 0.795), with a moderately skewed distribution. With regard to the other variables, we find similar results: all follow a normal distribution (probability greater than 0.05), with a moderately left distribution for GDP and R&D, a more markedly left distribution for the IU, while the TR variable exhibits a distribution close to normal (kurtosis close to 3).

Table 2. Descriptive Statistics for the Variables

	GDP	IU	TR	R&D
Mean	4.261146	51.82001	20.48196	0.703323
Median	3.745769	56.00000	20.28612	0.669875
Maximum	7.790820	89.35426	24.06877	0.982752
Minimum	0.521186	3.353367	16.85825	0.549870

Std. Dev.	1.909120	26.74854	1.749962	0.132048
Skewness	0.299803	-0.202576	-0.077597	0.692447
Kurtosis	2.594267	2.025403	3.187548	2.543343
Jarque-Bera	0.458630	0.974739	0.051852	1.860658
Probability	0.795078	0.614240	0.974407	0.394424
Observations	21	21	21	21

Source: Generated by the authors based on the results from Eviews

4.2 Stationarity Test

Before applying the ARDL model, we used stationarity tests such as the augmented Dickey-Fuller (ADF) test to assess whether the time series were stationary. If they were not, appropriate transformations, such as differentiation, were applied to make the series more stationary before proceeding with ARDL modeling.

The augmented Dickey-Fuller test is the unit root test used in this paper:

Table 3. Stationarity Test Results

Variable	TR	GDP	IU	R&D
ADF test	I(1)	I(1)	I(1)	I(1)

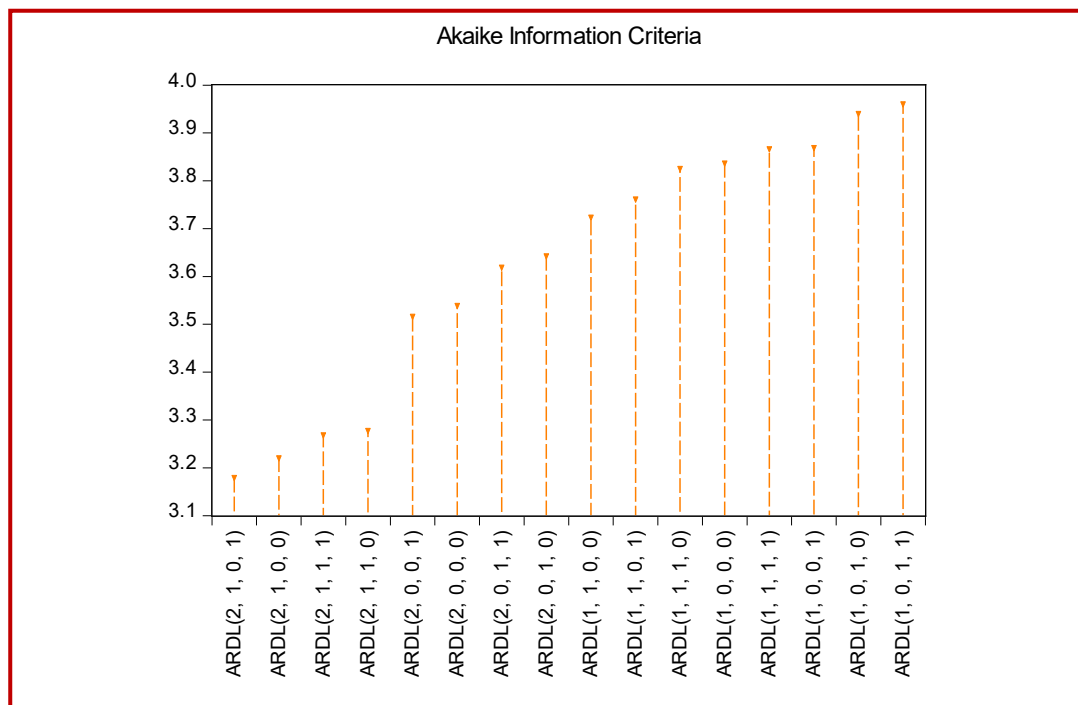
Source: Generated by the authors based on the results from Eviews

The results in Table 3 show that the variables in our study are all stationary at the first difference, which justifies the use of the ARDL model.

4.3 Model Selection

The Akaike Information Criterion (AIC) is used to determine the optimal number of lags.

Figure 1. Model Selection Table Based on AIC



Source: Generated by the authors based on the results from Eviews

This graph shows the best models based on the Akaike information criterion; the ARDL (2,1,0,1) model, which has the lowest AIC value, is the optimal model.

4.4 The ARDL Model

Based on the stationarity of the data for each variable, the objective of this study is to examine the existence of short- and long-term relationships between the dependent variable (GDP) and the independent variables (TR, R&D, and IU).

This study uses ARDL (Autoregressive Distributed Lag) cointegration techniques to examine the effect of digital development, tax revenue, and R&D spending on GDP growth. In this paper, we use the ARDL model to examine how digital development is associated with economic growth in Morocco, taking into account the available data. In our study, the ARDL model is specified as follows:

$$(2) \quad \Delta GDP = \alpha + \sum_{i=1}^p \phi_i \Delta GDP_{t-1} + \sum_{j=0}^q \gamma_j \Delta IU_{t-j} + \sum_{k=0}^m \delta_k \Delta TR_{t-1} + \sum_{l=0}^n \theta_l \Delta R\&D_{t-1} + \lambda_1 GDP_{t-1} + \lambda_2 IU_{t-1} + \lambda_3 TR_{t-1} + \lambda_4 R\&D_{t-1} + \varepsilon_t$$

The difference terms (Δ) capture short-term effects, and the coefficients λ_1 , λ_2 , λ_3 , and λ_4 represent long-term relationships.

The results of the econometric model are summarized in the following table:

Table 4. Long-run and short-run coefficients from the ARDL model (dependent variable: GDP)

<i>Long-term relationships</i>				
Variable	Coefficient	Std Error	T-statistic	Prob
IU	0.032438	0.016441	1.973038	0.0441
R&D	-10.83886	2.961819	-3.659527	0.0038
TR	0.407007	0.076796	5.299822	0.0003
C	1.915868	1.977807	0.968683	0.3535
<i>Short-term relationships</i>				
Variable	Coefficient	Std Error	T-statistic	Prob
D (GDP (-1))	0.604573	0.148365	4.074915	0.0018
D (IU)	-0.032312	0.030164	-1.071235	0.3070
D (TR)	0.728101	0.163130	4.463307	0.0010
CointEq(-1)	-2.619033	0.287930	-9.096087	0.0000

Source: Generated by the authors based on the results from Eviews

Based on the results obtained using Eviews regarding the long- and short-term relationships between the variables, we observe the following. In the long run, the coefficient of 0.032438 is statistically significant, with a p-value of 0.0441, indicating a positive long-run relationship between Internet usage and GDP growth—a result consistent with the expected positive effect of digital connectivity on economic activity. GDP growth and tax revenue exhibit a positive and highly significant long-term relationship, with a p-value of 0.0003, confirming the importance of tax revenue in economic development and growth. Research and development (R&D) spending, on the other hand, has a negative and significant long-term impact on GDP growth (coefficient of -10.839; $p = 0.0038$). This result, which at first glance may seem counterintuitive, is consistent with the literature on the lag in the payoff from R&D investments: the positive effects of R&D on productivity generally materialize with a time lag, so that in the short and medium term, these expenditures may weigh on growth before yielding results.

In the short term, the coefficient of 0.6045 reflects a positive and highly significant relationship, indicating that GDP in the previous period has a positive effect on GDP in the following period. There is an inverse relationship between the dependent variable (GDP) and Internet usage, which can be explained by the lack of short-term benefits. The investments needed to stimulate Internet use may entail immediate costs without immediate gains in productivity. In the short term, this could temporarily reduce economic growth, since these costs are incurred before

productivity gains materialize. The coefficient (0.7281), which is positive and significant, indicates that an increase in tax revenue leads to strong GDP growth. This can be explained by the fact that tax revenue helps finance public spending, which directly stimulates the economy in the short term.

The existence of a cointegration relationship between the variables is further confirmed by the coefficient of the lagged error correction term, $CointEq(-1)$, which is negative and highly significant (-2.619033 ; $t = -9.096087$; $p = 0.0000$). According to the t-test approach applied to the error correction term (Banerjee, Dolado, & Mestre, 1998; Kremers, Ericsson, & Dolado, 1992), a negative and statistically significant error correction coefficient alone constitutes robust evidence of a long-run equilibrium relationship between the variables, reinforcing the bounds-based approach of Pesaran, Shin, and Smith (2001) on which the specification of the chosen ARDL model is based.

5. Discussion

The results presented in Table 4 suggest, first, that tax revenues have a positive and highly significant impact on economic growth, in both the long and short term. These results are consistent with those of previous studies, notably El Yamlahi et al. (2022), which confirm the effect of tax collection on GDP in Morocco: taxation of economic activities, including digital ones, generates additional revenue that the government can invest in growth-driving sectors. The rise of digital platforms such as Facebook, which generate a significant portion of their revenue and profits outside their country of origin, can nevertheless lead to tax base erosion and profit shifting, which negatively affects tax revenue collection, a finding shared by other studies (Collet, 2021; Cui & Hashimzade, 2019; Mao et al., 2023; Mpofu, 2022; Mpofu & Moloi, 2022).

Second, the relationship between GDP growth and Internet use shows a positive effect in the long term, but this is not the case in the short term. There are several possible explanations for this. As El Yamlahi et al. (2022), the lack of specific regulations and frameworks in Morocco for taxing the digital economy limits the country's ability to generate additional revenue that could stimulate its economic development. This finding was also confirmed by Shuguang & Yifan (2023), who showed that taxing the digital economy has a positive and significant effect on tax revenue in the long term. They note, however, that the increase in revenue resulting from taxing the digital economy has a limited impact on GDP growth and may not directly boost growth in the digital sector in the short term. By effectively utilizing digital technologies such

as the Internet, artificial intelligence, blockchain, and big data, governments can nevertheless improve tax data collection, compliance, and the overall efficiency of tax administration.

Third, as the results have shown, spending on research and development (R&D) has a negative impact on GDP growth, which can be explained by several factors. As Krieger (2021) pointed out, fiscal policies for the digital economy should strive to maintain a balance so as not to hinder economic growth and innovation—a finding also confirmed by Noonan and Plekhanova (2020). Other reasons may explain this impact: R&D spending does not necessarily lead to successful projects or relevant innovations, which hinders GDP growth. The high costs of R&D spending can also slow growth by concentrating resources in this sector, to the detriment of other sectors that contribute to economic growth. R&D investments can indeed absorb a very significant portion of the financial resources of firms or governments; concentrating resources in this sector alone could thus lead to sectoral imbalances and productivity losses in less innovative sectors, thereby affecting short-term growth.

In short, the development of the digital economy, combined with effective tax revenue collection, has the potential to positively impact economic growth in Morocco. However, it is essential to carefully examine the implications of taxing the digital economy, seeking a balance between revenue generation and innovation in this sector, without discouraging businesses from investing in the digital economy. It is therefore important to strike the right balance in taxation so that the impact on GDP growth remains positive, both in the short and long term. Morocco does not yet have specific regulations and frameworks in place to effectively tax digital transactions. Given the continued growth of digital services, the Moroccan government is therefore encouraged to participate in multilateral discussions on international tax reform.

These three findings point to a common underlying pattern rather than three unrelated results. Tax revenue mobilization operates as an immediately available growth lever, exerting a significant positive effect on GDP in both the short and long run, because it finances public spending that supports the economy without delay. Internet use and R&D spending, by contrast, share a similar sequencing logic: both require upfront investment, whether in infrastructure or in research, whose productivity payoff materializes only progressively, which explains their negative or muted short-term association with growth despite a positive long-run effect for internet use. This suggests that digital transformation in Morocco follows a two-speed dynamic: tax policy can generate growth-supporting resources relatively quickly, while the returns to digital and innovation investment are inherently deferred. The practical implication is that tax revenue mobilized today can, and arguably should, be viewed as a bridge-financing mechanism

for the digital and R&D investments whose growth dividend will only appear over a longer horizon.

Conclusion

This article examined the effect of digital development as measured by the Internet usage rate tax revenue, and research and development (R&D) spending on economic growth in Morocco, using an ARDL model applied to annual data covering the period 2003–2023. The results show that Internet usage and tax revenue have a positive and statistically significant effect on GDP in the long run, while R&D spending exhibits a negative effect in the long run, consistent with the lag typically observed for this type of investment. In the short term, tax revenue retains a positive and significant effect, while the relationship with Internet usage temporarily reverses, reflecting the adoption costs that precede productivity gains.

These results confirm that tax revenue mobilization, combined with digital development, can be a major driver of Morocco's economic growth, provided that tax policy is carefully calibrated so as not to discourage innovation and investment in the digital sector. From an operational standpoint, they reinforce the relevance of the policy directions set forth in the 2025 Finance Act, which introduced a digital VAT applicable to digital services and requires non-resident service providers (Booking, Netflix, Airbnb, etc.) to report their revenue generated in Morocco on a quarterly basis. They also urge Morocco to prioritize large multinational corporations operating without a physical presence in the country, to avoid a tax burden that would penalize consumers and small local businesses, and to reinvest the revenue generated in digital infrastructure, technology training, and support for startups. Morocco is also encouraged to actively participate in multilateral discussions on international tax reform, taking into account challenges that differ from those faced by developed countries.

Translating this bridge-financing logic into concrete policy design suggests several complementary mechanisms. First, a graduated compliance regime, exempting small and purely domestic digital businesses below a defined revenue threshold from the reporting obligations introduced by the 2025 Finance Act, would concentrate the administrative and financial burden on large non-resident platforms while protecting local digital entrepreneurship from disproportionate compliance costs. Second, a share of digital VAT revenue could be earmarked, through a dedicated fund, to co-finance digital infrastructure projects and R&D tax credits for domestic firms, directly addressing the upfront-cost barrier identified in the short-run results rather than treating tax collection and innovation support as separate policy tracks. Third, a

phased or sunset-clause implementation, gradually tightening reporting and payment requirements over two to three fiscal years, would give both non-resident platforms and local intermediaries time to adapt their compliance systems, reducing the risk of abrupt disruption to digital service availability. Finally, regulatory sandboxes for early-stage digital startups, offering temporary and conditional relief from certain tax obligations, would allow Morocco to support innovation in nascent digital business models while preserving the broader revenue base captured from established digital activity. Together, these mechanisms illustrate how the trade-off between revenue generation and innovation incentives, rather than being resolved by a single instrument, can be managed through a differentiated policy architecture tailored to firm size, investment stage, and the pace of digital adoption.

This study has several limitations that should be highlighted. First, the sample consists of 21 annual observations (2003–2023), a small sample size that, while compatible with the properties of the ARDL model in small samples, limits the statistical power of the tests and calls for caution in interpreting the results. Second, in the absence of a long-term time series specific to digital taxation in Morocco, the study uses Internet usage rates and overall tax revenue as proxy indicators of digital penetration and the government's tax-raising capacity; it therefore does not directly measure the revenue generated by a specific digital tax. Finally, the study period (2003–2023) predates the entry into force of the new tax measures introduced by the 2025 Finance Act (digital VAT, reporting requirements for non-resident service providers); their effects on tax revenue and growth therefore cannot yet be empirically assessed.

Several avenues for research arise from these limitations. A first approach would be to use as soon as the data becomes available specific digital taxation indicators, such as digital VAT revenue, the number of non-resident businesses filing returns, and the share of digital taxation in total revenue, in order to measure more directly the impact of the new measures introduced by the 2025 Finance Act. A second approach could extend the analysis to a comparative perspective by comparing Morocco's trajectory with that of other countries in North Africa or the Middle East engaged in similar reforms, in order to identify common contextual factors. A third avenue would be to explore, using regional or sectoral panel data, the heterogeneity of the impact of digitalization and taxation on growth across different sectors of activity or regions of Morocco. Finally, future research could delve deeper into the transmission mechanism between R&D spending and growth for example, by testing longer lags or nonlinear effects to better understand the timeframe after which these investments begin to benefit the Moroccan economy.

References

- Abkar, Y., & Chaihab, S. (2024). Optimization of smart taxation using artificial intelligence: Risks and opportunities. *Journal of Theoretical and Applied Information Technology*, 15(5). <http://www.jatit.org>
- Adegboye, A., Uwuigbe, U., Ojeka, S., Uwuigbe, O., Dahunsi, O., & Adegboye, K. (2022). Driving information communication technology for tax revenue mobilization in Sub-Saharan Africa. *Telecommunications Policy*, 46(7), Article 102329. <https://doi.org/10.1016/j.telpol.2022.102329>
- Ahmed, S., & Gillwald, A. (2020). *Digital taxation challenges in Africa: A multifaceted perspective*. Research ICT Africa.
- Arbia, A., Ayass, H., Belarbi, F. Z., Ghrara, S., & Bouzid, A. (2026). Foreign direct investment, taxation, and growth dynamics in Morocco: An ARDL bounds-testing analysis. *Economies*, 14(9), Article 387. <https://doi.org/10.3390/economies14090387>
- Banerjee, A., Dolado, J., & Mestre, R. (1998). Error-correction mechanism tests for cointegration in a single-equation framework. *Journal of Time Series Analysis*, 19(3), 267–283. <https://doi.org/10.1111/1467-9892.00091>
- Becker, C. (2020). Tax policies and developments affecting foreign portfolio investment in sub-Saharan Africa. *Journal of Securities Operations & Custody*, 13(1), 88–96.
- Becker, C. (2021). *Taxing the digital economy in sub-Saharan Africa*. ENSAfrica. Retrieved March 22, 2022, from <https://www.ibanet.org>
- Boccia, F., & Leonardi, R. (2016). *The challenge of the digital economy: Markets, taxation and appropriate economic models*. Springer. <https://doi.org/10.1007/978-3-319-43690-6>
- Bourekadi, S., Hmamouchi, S., El Asri, L., El Amrani, O., & Moslih, A. (2023). The philosophy of energy consumption in North Africa, contribution of artificial intelligence. *E3S Web of Conferences*, 412, Article 01107. <https://doi.org/10.1051/e3sconf/202341201107>
- Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W. W. Norton & Company.

- Bukht, R., & Heeks, R. (2017). Defining, conceptualising and measuring the digital economy. *International Organisations Research Journal*, 13, 143–172. <https://doi.org/10.17323/1996-7845-2018-02-07>
- Bunn, D., Asen, E., & Enache, C. (2020). *Digital taxation around the world*. Tax Foundation. <https://taxfoundation.org/research/all/global/digital-taxation/>
- Casi, E., Spengel, C., & Stage, B. (2020). Cross-border tax evasion after the common reporting standard: Game over? *Journal of Public Economics*, 190, Article 104240. <https://doi.org/10.1016/j.jpubeco.2020.104240>
- Collet, M. (2021). La fiscalité de l'économie numérique : enjeu global, réponses locales ? *Revue européenne du droit*, (2), 148–152. <https://doi.org/10.3917/red.002.0148>
- Cui, W., & Hashimzade, N. (2019). The digital services tax as a tax on location-specific rent. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3488812>
- El Yamlaoui, I., El Ghazlani, H., Bouayad, A. N., & Rouggani, K. (2022). Révolution fiscale à l'ère du BEPS : Enjeux et défis de la taxation de l'économie numérique. *Revue Française d'Economie et de Gestion*, 3(5). <https://www.revuefreg.fr/index.php/home/article/view/665>
- Esses, D., Csete, M. S., & Németh, B. (2021). Sustainability and digital transformation in the Visegrad group of Central European countries. *Sustainability*, 13(11), Article 5833. <https://doi.org/10.3390/su13115833>
- Gumus, E., & Celikay, F. (2015). R&D expenditure and economic growth: New empirical evidence. *Margin: The Journal of Applied Economic Research*, 9(3), 205–221. <https://doi.org/10.1177/0973801015579753>
- Ho, T. T., Tran, X. H., & Nguyen, Q. K. (2023). Tax revenue-economic growth relationship and the role of trade openness in developing countries. *Cogent Business & Management*, 10(2), Article 2213959. <https://doi.org/10.1080/23311975.2023.2213959>
- Kasongo, A., & Makamu, T. (2024). Innovation and economic growth: An empirical analysis for African countries. *African Journal of Science, Technology, Innovation and Development*, 16(6), 751–760. <https://doi.org/10.1080/20421338.2024.2382612>
- Kelbesa, M. (2021). *Digital service taxes and their application* (K4D Helpdesk Report). Institute of Development Studies. <https://doi.org/10.19088/K4D.2021.135>

- Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International Journal of Information Management*, 63, Article 102466. <https://doi.org/10.1016/j.ijinfomgt.2021.102466>
- Kremers, J. J. M., Ericsson, N. R., & Dolado, J. J. (1992). The power of cointegration tests. *Oxford Bulletin of Economics and Statistics*, 54(3), 325–348. <https://doi.org/10.1111/j.1468-0084.1992.tb00005.x>
- Krieger, T. (2021). Current state of research on the interaction of theory on tax evasion and the developments in the field of digital tax administration. *Science International Empirical Review*, 1(1).
- Mao, J., Liu, J., & Liu, Z. (2023). Tax effect of digital economy development in China: The policy effect and transmission mechanism. *Journal of Information Economics*. <https://doi.org/10.58567/jie01010004>
- Mesenbourg, T. L. (2001). *Measuring the digital economy*. U.S. Census Bureau.
- Mpofu, F. Y. (2022). Taxation of the digital economy and direct digital service taxes: Opportunities, challenges, and implications for African countries. *Economies*, 10(9), Article 219. <https://doi.org/10.3390/economies10090219>
- Mpofu, F. Y., & Moloi, T. (2022). Direct digital services taxes in Africa and the canons of taxation. *Laws*, 11(4), Article 57. <https://doi.org/10.3390/laws11040057>
- Noonan, C., & Plekhanova, V. (2020). Taxation of digital services under trade agreements. *Journal of International Economic Law*, 23(4), 1015–1039. <https://doi.org/10.1093/jiel/jgaa031>
- Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94(446), 621–634. <https://doi.org/10.1080/01621459.1999.10474156>
- 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. <https://doi.org/10.1002/jae.616>
- Philip, K., Muthee, I., Ngala, B., Musa, N., Wanyeri, A., & Gathoni, E. (2021). Enforcement of the digital economy taxation. *African Tax and Customs Review*, 4(1), 23. <https://atcr.kra.go.ke/index.php/atcr/article/view/72>

Ren, S., Hao, Y., Xu, L., Wu, H., & Ba, N. (2021). Digitalization and energy: How does internet development affect China's energy consumption? *Energy Economics*, 98, Article 105220. <https://doi.org/10.1016/j.eneco.2021.105220>

Shkuropadska, D., Tokar, V., Purdenko, O., Lotariiev, A., & Savchuk, K. (2025). Digital resilience of the Bucharest Nine and Ukraine. *International Journal of Economics and Financial Issues*, 15(1). <https://doi.org/10.32479/ijefi.17233>

Shuguang, W., & Yifan, S. (2023). Research on the impact of digital economy on local tax revenue—PVAR model analysis based on Chinese provincial panel data. In *International Conference on 5G for Future Wireless Networks* (Vol. 504, pp. 290–296). Springer. https://doi.org/10.1007/978-3-031-36011-4_26

Souguir, Z., Lassoued, N., Khanchel, I., & Bejaoui, E. (2025). Behind the screens: Digital transformation and tax policy. *Journal of Risk and Financial Management*, 18(7), Article 390. <https://doi.org/10.3390/jrfm18070390>

Tapscott, D. (1996). *The digital economy: Promise and peril in the age of networked intelligence*. McGraw-Hill.

Tyutyuryukov, V., & Guseva, N. (2021). From remote work to digital nomads: Tax issues and tax opportunities of digital lifestyle. *IFAC-PapersOnLine*, 54(13). <https://www.sciencedirect.com/science/article/pii/S2405896321018802>

Vărzaru, A. A., Bocean, C. G., Simion, D., Berceanu, D., & Mangra, M. G. (2023). Digital revolution, sustainability, and government revenues: A transversal analysis of how digital transformation and sustainable practices impact sustainable government revenues. *Systems*, 11(11), Article 546. <https://doi.org/10.3390/systems11110546>

Verhal, K. (2023). Digital economy as a driver of business development [Conference paper]. 390–394. <https://doi.org/10.53486/icspm2022.61>

Xu, Y., & Feng, Q. (2024). The effect of tax enforcement digitalization on corporate digital transformation: Evidence from China's listed companies. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4794055>

Zhang, W. L., Song, L. Y., & Ilyas, M. (2023). Can the digital economy promote fiscal effort? Empirical evidence from Chinese cities. *Economic Change and Restructuring*, 56(5), 3501–3525. <https://doi.org/10.1007/s10644-023-09540-6>