

Tax Digitalization and Tax Evasion in MENA Countries: ICT and Human Capital as Moderators

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Abstract: This study investigates the impact of tax system digitalization on tax evasion, as well as the moderating roles of Information and Communication Technology (ICT) infrastructure and human capital. The analysis focuses on MENA countries using secondary data and employs regression analysis. The findings reveal that digitalization alone does not significantly reduce tax evasion. However, its effectiveness increases when supported by strong ICT infrastructure or a well-developed human capital base. Notably, the interaction between digitalization and ICT shows a statistically significant negative effect on tax evasion when using the Dynamic General Equilibrium (DGE) model. In contrast, the results from the Multiple Indicators Multiple Causes (MIMIC) model are weaker, showing only marginal significance.

Keywords: Tax Evasion; Tax System Digitalization; Information and Communication Technology; Human Capital; MENA Countries.

1. Introduction

Tax evasion is a crucial problem in both developed and developing countries (Herranz & Turino, 2023) that continues to capture the interest of researchers, likely persisting as long as taxes exist (Leenders et al., 2023). Understanding the determinants of tax evasion emerges as the first important step for the government to combat its detrimental effects, especially on economic growth, as it constrains the government's ability to provide essential public services. This comprehension empowers governments to adapt policies effectively, with the overarching goal of mitigating the prevalence of tax evasion (Khalil & Sidani, 2020; Abdixhiku, Krasniqi, Pugh, & Hashi, 2017).

Jackson and Milliron (1986) conducted one of the pioneering studies on tax evasion, wherein they introduced several determinants categorized into demographic, economic, and behavioral factors. Nevertheless, scholars have further explored tax evasion by adopting various approaches to explain this phenomenon. The classical approach was introduced by Allingham and Sandmo (1972), who argued that a rational taxpayer would engage in tax evasion as long as the gains from evading taxes surpass the costs associated with the risk of detection and penalties. While numerous subsequent studies have concentrated on the economic model to explain tax evasion

(as observed in works like Joulfaian, 2000, and Hoopes et al., 2012), some critics have challenged this purely economic approach. They argue that emphasizing economic deterrence alone overlooks non-economic motives that may offer a more comprehensive explanation for attitudes toward tax evasion.

Governments worldwide have transitioned into the digital era, implementing e-government systems to meet the rising demand for efficient services (Bounabat, 2017). Uyar et al. (2021) made it clear that the e-government literature has concentrated on the role of e-government in fighting corruption (e.g., Alm and Liu, 2017; Suhendi et al., 2020; Adam, 2020). Hence, this transition prompts a critical question: Do e-government initiatives contribute to reducing tax evasion? In addition, the significance of information and communication technologies (ICT), particularly their adoption by society and citizens, plays a crucial role in the efficiency of e-government (Adam, 2020). Hence, we inquire whether the relationship between the digitalization of government services and tax evasion is strengthened by the widespread integration of ICT by society. On the other hand, knowledge and education are required to use e-tax services and to ensure their efficiency; hence, studying their moderating effect on the relationship between tax evasion and the digitalization of the tax system is needed.

We concentrate on exploring technological changes that could significantly reduce levels of tax evasion. Our emphasis is on identifying solutions that policymakers can leverage to address and mitigate this issue effectively. We contribute to the tax evasion literature in four ways. First, in response to the scarcity of practical studies examining the impact of digitalization on tax evasion in MENA countries, our research aims to fill this critical gap. Second, we introduce a novel aspect to the MENA countries' tax evasion literature—the moderating role of ICT. Third, we study a novel approach which, to our knowledge, has not been discussed before: the moderating role of human capital as an indicator of knowledge and education in the relationship. Fourth, due to the sensitive nature of tax evasion and the challenges researchers face in measuring it accurately, we depend on the shadow economy as a proxy using two different measurement methods. Traditional survey questionnaires often yield questionable results, making the shadow economy a more reliable alternative for our research. Lastly, aligning with global trends in digitalization, our study delves into its effects on tax evasion, offering insights into a relatively new subject in the literature.

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2. Literature review and hypothesis

2.1 Tax evasion

Tax evasion refers to the illicit strategies employed by taxpayers to reduce their tax liabilities. Despite being extensively discussed, it continues to pose significant challenges and remains an active area of research. Allingham and Sandmo (1972) made a significant contribution to the tax evasion literature. Their work is acknowledged as pioneering research that explored the factors influencing tax evasion, focusing on economic determinants to explain taxpayer behavior. These determinants are mainly deterrent measures used by governments, namely the tax rate, detection probabilities, and penalties, suggesting that taxpayers base their decisions on rational calculations. Many subsequent studies have supported and expanded upon this approach. For instance, Engel and Hines (1999) examined the idea that the likelihood of an audit in the United States is tied to the extent to which a taxpayer underreports income. Similarly, other researchers, including Andreoni et al. (1998) and Fischer et al. (1992), found a significant correlation between the exercise of authority through audits and fines and the incidence of tax evasion.

However, later studies focused on taxpayers' attitudes toward tax evasion, arguing that it is not only a matter of costs and benefits (Riahi-Belkaoui, 2004; Sidani, Ghanem, & Rawwas, 2014; Khalil & Sidani, 2020; Benkraiem, Uyar, Kilic, & Schneider, 2021). These studies employ diverse perspectives—economic, psychological, moral, religious, and cultural—to explain the phenomenon of tax evasion. For example, Mohdali and Pope (2014) and Benk et al. (2016) examined the influence of religiosity on tax evasion. Mohdali and Pope (2014) found that religiosity has a statistically significant negative impact on tax evasion and promotes voluntary compliance.

Some researchers have also explored external motivational factors that influence whether taxpayers choose to evade or comply with tax obligations—a concept commonly referred to as “tax morality.” This has been studied from various angles, including religion, particularly Islam (e.g., Al-Ttaffi & Abdul-Jabbar, 2015; Elgaroshi & Musa, 2013; McGee, 1997). Other research has examined how culture directly affects tax evasion (Ermasova et al., 2021; Hien, 2021; Hutchinson, 2019; Kountouris & Remoundou, 2013). Building on this, Allam et al. (2023) found that countries characterized by high levels of power distance, uncertainty avoidance, collectivism, and restraint tend to experience higher levels of tax evasion.

In addition, institutional factors have been studied. For instance, Yamen et al. (2018) examined the impact of Institutional Environment Quality (IEQ) on tax evasion in both older (pre-2004) and newer (post-2004) European Union member states, concluding that institutional quality significantly influences tax evasion levels.

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2.2 Tax evasion, digitalization of tax system, ICT, and human capital

Recently, the adoption of e-government has been recognized as a reflection of the efficiency of government operations, making it a crucial indicator for assessing the level of digitalization and administrative effectiveness in public services (Uyar et al., 2021). According to Bounabat (2017), due to rapid global changes, more governments with a long-term vision are adopting e-government practices in response to the widespread use of technology and the knowledge revolution.

The literature has emphasized the role of e-government in combating corruption. The argument is that by digitizing government services, there is an expected increase in government efficiency and effectiveness, leading to lower levels of corruption (e.g., Nam, 2018; Suhendi et al., 2020). In this vein, studies have offered empirical evidence supporting this relationship. Ojha and Palvia (2012) indicated that the level of corruption decreased following the implementation of e-government platforms.

Scholars repeatedly emphasize that corruption is one of the main driving factors behind tax evasion. In this context, Baum et al. (2017) stressed that implementing e-government systems is expected to reduce corruption, thereby contributing to a decline in tax evasion. Implementing an e-tax system as part of e-government practices requires regulatory reforms that make the system more flexible, simple, and efficient. Therefore, using an e-tax system that includes e-filing and e-payment components increases tax compliance (Uyar et al., 2021). Supporting this argument, Night and Bananuka (2020) demonstrated—through their research on small and medium-sized enterprises in Africa—that the adoption of an e-tax system plays a significant role in enhancing tax compliance. Additionally, Bhuasiri et al. (2016) found that incorporating e-tax and e-payment systems as integral components of e-government contributes to reducing tax evasion.

In light of the aforementioned arguments, we recommend that strengthening tax procedures—particularly the tax-filing system—is essential to improving the overall

efficiency of the tax system and is expected to help alleviate tax evasion (Night and Bananuka, 2020).

H1: The higher the level of digitalization of the tax system (with online services as an indicator) in a country, the lower the level of tax evasion.

Building upon the idea that e-government diminishes corruption, Elbahnasawy (2014) discusses that the adoption of information and communication technologies, such as Internet usage, significantly contributes to anti-corruption efforts.

To clarify, ICT encompasses a wide range of communication devices and applications, including but not limited to mobile phones, laptops, tablets, television, and satellite systems. These technologies collectively aid users in accessing, transmitting, and storing information (Sabri, 2012). However, the widespread adoption of ICTs for successful e-government initiatives necessitates robust technological infrastructure, reliable internet access, and widespread digital literacy among citizens. Governments globally are investing significantly in ICT to ensure accessible online public services (Rana et al., 2013). Therefore, ICT adoption reflects the extent to which citizens and society utilize information and communication technologies when interacting with public services (Sabri, 2012).

Accordingly, Adam (2020) investigated corruption in Africa, focusing on its relationship with e-government development. The study incorporated institutional quality and ICT development as mediators, revealing that both factors mediate the relationship between e-government and corruption.

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Empirically, Decman et al. (2010) analyzed the impact of ICT use on government efficiency and stressed that ICTs provide non-financial benefits such as reducing paper use in tax returns, diminishing formal control activities, and ensuring the instant availability of tax data. Therefore, we propose that ICTs play a positive moderating role in the relationship between the implementation of e-government initiatives and tax evasion.

H2: Information and communication technology plays a moderating role between the digitalization of the tax system and tax evasion.

Fundamentally, human capital theory is an economic concept emphasizing that education, knowledge, and skills constitute a form of capital. In the context of e-government, human capital refers to citizens' proficiency in utilizing e-government services (United Nations, 2012).

Building on the assertions of Burn and Robins (2003), who posit that learning and knowledge capability influence e-government development, we propose that individuals with elevated human capital—particularly in terms of digital literacy—are more likely to adeptly use e-government services, including online tax filing systems. This enhanced efficiency and accessibility may, in turn, foster increased tax compliance.

H3: Human capital plays a moderating role between the digitalization of the tax system and tax evasion.

3. Research methodology

3.1 Sample

The sample for this study (see Table 01) consists of 18 MENA countries, as defined by the United Nations High Commissioner for Refugees (UNHCR). It encompasses

both developed and developing nations, offering a mix of countries distinguished by language, culture, and geography within the MENA region. The selected countries represent a diverse spectrum of economic, social, and political landscapes. However, Iraq and Libya were excluded from the sample due to missing data, ensuring the reliability and completeness of the dataset for rigorous analysis.

Table .01. Sample List of MENA Countries

Morocco	Bahrain
Oman	Egypt
Palestine	Jordan
Qatar	Kuwait
Saudi Arabia	Lebanon
Syria	Mauritania
Tunisia	Yamen
UAE	Algeria

Source: made by researchers.

3.2 Variables definition

2.2.1 Independent variable: Recent studies, including those by Alm (2012) and Korndörfer et al. (2014), focus on evaluating tax evasion. Alm (2012) thoroughly investigates various methodologies for measuring tax evasion, classifying them into traditional methods like assessing the size of shadow economies and contemporary approaches such as consumption-based measures. Henderson et al. (2012) pursue an unconventional approach, relying on the comparison between real economic activity, evaluated using satellite-measured luminosity, and the official economic level. There is no universally accepted method for measuring tax evasion due to its sensitive nature, and all methods remain discretionary.

We utilized the size of the shadow economy as an indicator for tax evasion, as it represents the disparity between the official economic size and the informal economic level.

The shadow economy's size can be measured at both microeconomics level using surveys or questionnaires Yamen et al. (2018) and macroeconomics levels using several indicators such as Self-employment (% of total employment), informal employment Elgin et al. (2021). To enhance the reliability of our findings, we utilized two general proxy measures of tax evasion. The first measure is based on estimates output informality (Elgin et al. 2021) as a percentage of official GDP, derived from a Dynamic General Equilibrium (DGE) model. The second measure is based on the Multiple Indicators Multiple Causes (MIMIC) model at the macro level (Elgin et al. 2021), which considers various indicators directly influencing the development of shadow economies over time (Benkraiem, Uyar, Kilic, Schneider, 2021). While Schneider and Buehn (2012) acknowledge the absence of an exact measure for the size of the shadow economy and the potential error margin associated with the MIMIC method, they argue for its superiority over other approaches (Benkraiem, Uyar, Kilic, Schneider, 2021).

3.2.2 The dependent variables: We utilized the Online Services Index as an indicator for the digitization of the tax system, which evaluates a government's ability to improve its services by offering them electronically, thereby facilitating communication with its citizens (Nations, 2012). Additionally, for information and communication technology, we employed the Telecommunication Infrastructure

Index, which assesses the available infrastructure necessary for citizens' involvement in online services (United Nations, 2012). Whereas, education was assessed through the Human Capital Index, reflecting citizens' capability in utilizing online services (United Nations, 2012).

The data for the dependent variable were available for the period between 2003 to 2020, missing value for 2006,2007,2009,2011,2013,2015, 2017 and 2019. Hence we took data for the same specific countries for dependent and control variables.

3.2.3 Control variables: We added Income level (GDP per capita) and Population size as control variable in order to consider the variations in the demographic and economic structures of the nations

Table.02.Variables, Definitions, and Sources

<i>Variable</i>	Short Definition	Source
<i>Tax Evasion (DGE)</i>	Shadow economy size as a percentage of GDP, estimated using a Dynamic General Equilibrium model.	Elgin et al. (2021)
<i>Tax Evasion (MIMIC)</i>	Shadow economy size as a percentage of GDP, estimated using the Multiple Indicators Multiple Causes (MIMIC) model.	Elgin et al. (2021); Benkraiem et al. (2021)
<i>Digitalization (TSDG)</i>	Online Services Index measuring the extent of government services provided online.	United Nations (2012)
<i>ICT Infrastructure (ICT)</i>	Telecommunication Infrastructure Index indicating a country's digital capacity and network availability.	United Nations (2012)
<i>Human Capital (HCP)</i>	Human Capital Index reflecting citizens' education level and ability to use digital services.	United Nations (2012)
<i>GDP per capita</i>	Economic output per person, indicating the average income level of a country's residents.	World Economic Forum (2020)
<i>Population size (POP)</i>	Total number of inhabitants in a country.	World Economic Forum (2020)

Soource: ade by researchers

3.2 Correlation analysis

Table.03. Pearson correlation

	TSDG	DEG	HCP	ICT	GDP	POP	MIMI
TSDG	1	-.433	.753*	.880**	.673**	.225	-.394
DEG		1	-.556*	-.620*	-.446	-.099	.992**
HCP			1	.829**	.567*	.315	-.538*
ICT				1	.806**	.287	-.564*
GDP					1	.047	-.406
POP						1	-.102
MIMI							1
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Source: spss 25 output.

According to The Pearson correlation results (table 01) that both digitalization of tax system ($r = -0.488$) and the moderator variable information and communication technology infrastructure ($r = -0.626$) have a moderate to a strong negative correlations with tax evasion (DEG), suggesting that better digital systems—especially when supported by ICT—are associated with lower evasion.

Additionally, human capital ($r = -0.556$) also shows a moderate negative correlation with tax evasion, indicating that higher levels of education and skills among citizens contribute to reducing tax evasion, likely by enabling more effective use of digital tax systems.

While, MIMIC, as a measure of tax evasion, is strongly negatively correlated with digitalization of the tax system (TSDG) ($r = -0.394$), ICT infrastructure ($r = -0.564$), and human capital ($r = -0.538$), suggesting that greater digitalization, stronger technological infrastructure, and higher levels of education and skills are associated with lower tax evasion.

4. Findings

Given that tax evasion (TE) is influenced by technological factors, a multiple regression analysis was carried out to assess the impact of tax system digitalization and ICT development on tax evasion across countries. The dependent variable in the model is tax evasion (TE), we utilized two general proxy measuring tax evasion (DGE, MIMIC). The analysis includes Tax System Digitalization (TSDG) as the main independent variable, while TSDGbyICT, an interaction term between digitalization and ICT infrastructure, TSDGbyHCP, an interaction term between human capital and ICT infrastructure, serves as moderator variables. To control the national differences, GDP per capita (as a proxy for income level) and population size were introduced as control variables.

4.1 Dynamic General Equilibrium (DGE) as an indicator of tax evasion

4.1.1 The Moderating Role of Information and Communication Technology in the Relationship Between Tax Evasion (DGE as an Indicator) and the Digitalization of the Tax System:

The model is structured as follows:

$$TE_i(DGE) = \alpha + \beta_1 \cdot TSDG_i + \beta_2 \cdot TSDGbyICT_i + \beta_3 \cdot GDP_i + \beta_4 \cdot POP_i + \varepsilon_i$$

While:

$TE_i(DGE)$: Level of tax evasion in country i using DGE as predictor

$TSDG_i$: Tax system digitalization in country i

$TSDGbyICT_i$: Interaction between digitalization and ICT development

GDP_i : Income level (GDP per capita)

POP_i : Population size

ε_i : Error term

Table .04. Model Summary and ANOVA

(Correlation Coefficient)	R ² (Coefficient of Determination)	Adjusted R ²	Standard Error of Estimate	F-Statistic	Sig. (p-value)
0.719	0.517	0.324	7.80166	2.680	0.094

Source: spss 25 output.

Table .05. Coefficients

Predictor (Constant)	B	Beta	Sig.
<i>TSDG</i>	40.084	1.064	0.139
<i>TSDGbyICT</i>	-75.108	-1.822	0.050
<i>GDP</i>	0.000	0.251	0.535
<i>POPOLA</i>	1.157	0.020	0.931

Source: spss 25 output.

According to table (04) The regression analysis shows an R value of 0.719, indicating a strong positive correlation between the independent variables and the dependent variable tax evasion (coded as DEG). In addition, R² is 0.517, which means that approximately 51.7% of the variance in tax evasion is explained by the combination of predictors.

While table (05) shows that the F-statistic for the model is 2.680 with a significance level of 0.094 (< 10%).

the moderator variable $ICTbyDGTZ$, which represents the interaction between digital tax services and ICT infrastructure — has a marginally significant relationship ($B = -75.108$, $\beta = -1.822$, $p = 0.050$). The main independent variable, tax system digitalization (coded as $DGTZ$), has a positive but not significant relationship with tax evasion ($B = 40.084$, $p = 0.139$). The control variables, Income level of countries (GDP) and population, show no statistically significant influence, with p-values of 0.535 and 0.931 respectively.

4.2.1 The Moderating Role of Human Capital in the Relationship Between Tax Evasion (DGE as an Indicator) and the Digitalization of the Tax System

The model is structured as follows:

$$TE_i = \alpha + \beta_1 \cdot TSDG_i + \beta_2 \cdot TSDGbyHCP_i + \beta_3 \cdot GDP_i + \beta_4 \cdot POP_i + \varepsilon_i$$

Where:

TE_i : Level of tax evasion in country i

TSDG_i: Tax system digitalization in country i
 TSDGbyHCP_i: Interaction between digitalization and human capital development
 GDP_i: Income level (GDP per capita)
 POP_i: Population size
 ε_i: Error term

Table .06. Model Summary and ANOVA

<i>R</i> (Correlation Coefficient)	<i>R</i> ² (Coefficient of Determination)	Adjusted <i>R</i> ²	Standard Error of Estimate	F-Statistic	Sig. (p-value)
0.713 ^a	0.509	0.312	7.87254	2.587	0.102 ^b

Source: spss 25 output

Table .07. Coefficients

	B	Beta	sig
(Constan)	27.508		0.003
TSDG	56.835	1.508	0.112
GDP	-6.081	-.116	0.718
POP	-.018	-0.002	0.992
TSDGbyHCP	-870.888	-1.966	0.055

Source: spss 25 output.

The regression analysis yielded an *R* value of 0.713, indicating a moderate to strong correlation between the independent variables and the dependent variable tax evasion (coded as DEG). The *R*² value of 0.509 implies that approximately 50.9% of the variation in DEG is explained by the model. The table shows that the overall model is not statistically significant at the 0.05 level (*F* = 2.587, *p* = 0.102).

However, the individual coefficients indicate that the effect of the moderator variable TSDGbyHCP is marginally significant, with a *p*-value of 0.055. Meanwhile, the tax system digitalization variable does not show a significant contribution to the model, with *p*-values well above 0.05, similar to the control variables.

4.1 The Multiple Indicators Multiple Causes (MIMIC) as an indicator of tax evasion

4.2.1 The Moderating Role of Information and Communication Technology in the Relationship Between Tax Evasion (MIMIC as an Indicator) and the Digitalization of the Tax System:

The model is structured as follows:

$$TE_i(\text{MIMI}) = \alpha + \beta_1 \cdot \text{TSDG}_i + \beta_2 \cdot \text{TSDGbyICT}_i + \beta_3 \cdot \text{GDP}_i + \beta_4 \cdot \text{POP}_i + \varepsilon_i$$

Where:

TE_i (MIMI) : Level of tax evasion in country i using MIMI as predictor

TSDG_i: Tax system digitalization in country i

TSDGbyICT_i: Interaction between digitalization and ICT development

GDP_i: Income level (GDP per capita)

POP_i: Population size

ε_i: Error term

Table.08. Model Summary and ANOVA

<i>R</i> (Correlation Coefficient)	<i>R</i> ² (Coefficient of Determination)	Adjusted <i>R</i> ²	Standard Error of Estimate	F- Statistic	Sig. (p-value)
0.650 ^a	0.422	0.191	8.8948	1.825	0.201 ^b

Source: spss 25 output

Table.09. Coefficients

	B	Beta	sig
(Constant)	25.763		0.016
TSDGT	36.245	0.923	.231
GDP	0.000	.201	0.648
POPOLA	.046	0.006	0.983
TSDGTbyICT	-680.513	-1.595	.105

Source: spss 25 output.

According to Table (08), the regression model shows a correlation coefficient (R) of 0.650, indicating a moderate to strong relationship between the combined predictors and the dependent variable (tax evasion, coded as DEG). The R^2 value is 0.422, meaning that approximately 42.2% of the variation in tax evasion across countries is explained by the model,

The F-statistic is 1.825 with a p-value of 0.201, meaning that the model is not statistically significant at conventional levels ($p > 0.10$). This indicates that the overall model does not significantly improve prediction over a model with no predictors. According to table 9 no significant relationship was found between any of the variables included in the model ($p \text{ value} > 0.05$).

4.2.2 The Moderating Role of Human Capital in the Relationship Between Tax Evasion (MIMI as an Indicator) and the Digitalization of the Tax System

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$$TE_i(\text{MIMI}) = \alpha + \beta_1 \cdot \text{TSDG}_i + \beta_2 \cdot \text{TSDGbyHCP}_i + \beta_3 \cdot \text{GDP}_i + \beta_4 \cdot \text{POP}_i + \varepsilon_i$$

Where:

TE_i (MIMI): Level of tax evasion in country i (using MIMI as an indicator)

TSDG_i : Tax system digitalization in country i

TSDGbyHCP_i : Interaction between digitalization and human capital development
 GDP_i : Income level (GDP per capita)

POP_i : Population size

ε_i : Error term

Table .10. Model Summary and ANOVA

R (Correlation Coefficient)	R^2 (Coefficient of Determination)	Adjusted R^2	Standard Error of Estimate	F-Statistic	Sig.(p-value)
0.680a	0.463	0.248	8.5749	2.154	0.148b

Source: spss 25 output.

Table .11. Coefficients

	B	Std. Error	Beta	sig
(Constant)	28.418	7.871		0.005
TSDG	59.157	35.537	1.507	0.127
GDP	-5.310	0.000	-0.097	0.772
POPOLA	-0.091	1.954	-0.011	0.964
TSDGbyHCP	-90.297	44.141	-1.939	0.068

Source: spss 25 output.

According to Table (10), the regression model shows a correlation coefficient (R) of 0.680, indicating a moderate to strong relationship between the dependent's variables and the dependent variable (tax evasion, measured using MIMI). The R^2 value is 0.463, meaning that approximately 46.3% of the variation in tax evasion across countries is explained by the model. However, the F-statistic is 2.154 with a p-value of 0.148, indicating that the overall model is not statistically significant at conventional levels ($p > 0.10$).

According to Table (11), no statistically significant relationship was found between most of the individual predictors and tax evasion, as their p-values are all greater than 0.05, with the exception of the interaction term (TSDGbyHCP), which shows a marginal effect ($p = 0.068$). This suggests a potential moderating role of the interaction between digitalization and human capital development in reducing tax evasion.

5. Discussion

Unlike previous research (i.e., Baum et al., 2017; Bananuka, 2020), The results show that digitalizing the tax system alone does not have a strong or clear impact on reducing tax evasion (DEG), as its effect was not statistically significant in any of the models. However, when digitalization is combined with strong ICT infrastructure, it does help reduce tax evasion. The interaction term between digitalization and ICT (TSDGbyICT) had a negative and marginally significant effect, meaning that digital tools are more effective in countries with better ICT systems. So, for digital tax systems to work well, they need to be supported by strong technology and communication networks. Similarly, when we look at the role of human capital, we find that the interaction between digitalization and human capital development also has a negative and negative and marginally significant effect. This means that for digital tax systems to really work, countries also need strong technology and well-trained people.

Similarly, when tax evasion is measured using MIMI, digitalization alone has no significant effect, but its interaction with ICT or human capital shows a marginal negative effect, suggesting a possible moderating role.

When we use DGE to measure tax evasion, the results show that digital tax systems supported by good ICT infrastructure, help reduce tax evasion. The effect of the interaction between digitalization and ICT was significant. But when we use MIMIC to measure tax evasion, the relationship becomes weaker. The interaction with human capital was only marginally significant

6. Conclusion

This study aimed to explore the role of tax system digitalization in reducing tax evasion in MENA countries, while considering the moderating effects of ICT infrastructure and human capital. Our findings reveal that digitalization alone does not significantly reduce tax evasion. However, when supported by strong ICT infrastructure or a well-developed human capital base, its effect becomes more noticeable, suggesting that these elements enhance the effectiveness of digital tax systems. This highlights the importance of not only adopting digital tools but also ensuring that societies are equipped with the necessary technological environment and skilled individuals to use them effectively.

Moreover, the results varied depending on the method used to measure tax evasion. When using the DGE-based measure, the interaction between digitalization and ICT

was statistically significant, showing a clearer reduction in tax evasion. In contrast, the MIMIC-based measure showed weaker relationships, with only marginal significance for the interaction terms. This suggests that the perceived impact of digitalization may differ depending on how tax evasion is measured.

Overall, our study emphasizes that digital reforms alone are not enough. Policymakers should invest equally in ICT infrastructure and education to fully leverage the benefits of digitalization in the fight against tax evasion.

Finally, it is important to acknowledge that some of the reported effects are only marginally significant. This may be due to the fact that ICT and human capital do not operate in isolation as moderating factors. Their impact on the relationship between tax digitalization and tax evasion may depend on the presence of other contextual factors, such as institutional quality, governance, or financial development. Future research could therefore explore broader frameworks that include additional moderating or mediating variables, alongside larger datasets and alternative methodologies, to provide a more comprehensive understanding of these dynamics.

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