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## E-government development, armed conflict, and government revenue: A cross-country panel analysis

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**Abstract.** The growing digitalisation of public administration and the increasing number of countries affected by armed conflicts raise important questions about the role of e-government in sustaining government revenue mobilisation under institutional stress. This study examines how the development of digital government influences different sources of public revenue and whether armed conflict moderates this relationship across countries. The analysis uses cross-country panel data for 2003–2024, combining indicators of e-government development from the UN EGDI database, fiscal indicators from the World Bank Open Data, and conflict information from the UCDP/PRIO Armed Conflict Dataset, estimated using two-way fixed effects models with robust clustered standard errors. The results show that economic development is the strongest determinant of revenue mobilisation, with GDP per capita coefficients

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ranging from 0.95 to 1.22 across models. The overall EGDI does not demonstrate a statistically significant direct effect on tax revenue or revenue excluding grants, although weak interaction effects suggest that armed conflict may reduce the fiscal effectiveness of digital governance ( $-0.238$ ;  $p \approx 0.10$ ). A significant negative relationship is observed for the telecommunications infrastructure component with tax revenue ( $-0.362$ ;  $p = 0.005$ ) and revenue excluding grants ( $-0.349$ ;  $p = 0.011$ ). For customs duties and social contributions, the results indicate no systematic relationship between e-government development and revenue performance, highlighting the dominant role of macroeconomic conditions in shaping fiscal capacity.

**Keywords:** e-government, digital governance, armed conflict, revenue mobilisation, tax revenue, fiscal capacity, panel data analysis.

**JEL Classification:** H11, H20, O33, F51

## 1. INTRODUCTION

The rapid expansion of digital technologies has significantly transformed the functioning of public administration and the mechanisms through which governments deliver services and mobilise fiscal resources. E-government systems, which integrate information and communication technologies into administrative processes, are increasingly recognised as an important tool for improving the efficiency, transparency, and accountability of public sector institutions. International organisations emphasise that digitalisation of government services can strengthen tax administration, reduce compliance costs, and enhance monitoring of economic activities, thereby supporting domestic revenue mobilisation (World Bank, 2021; Rivero del Paso et al., 2023). In the context of growing fiscal pressures, including rising public expenditures and global economic uncertainty, improving the efficiency of revenue collection has become a central priority for governments worldwide.

At the same time, the global political and economic environment has been increasingly characterised by rising armed conflicts and geopolitical instability. According to the Uppsala Conflict Data Program, the number of active armed conflicts has increased significantly over the past decade, affecting both developing and middle-income countries (Davies et al., 2025). Armed conflicts can severely disrupt economic activity and weaken state institutions, leading to reduced tax collection capacity, declining trade flows, and increasing fiscal pressures on governments. International financial institutions note that conflict-affected and fragile states often experience significant challenges in maintaining stable public revenues due to institutional fragility, infrastructure damage, and expansion of informal economic activities (World Bank, 2025; IMF, 2024).

In such conditions, digital government development may play a critical role in strengthening the resilience of public administration systems. Digital tax administration platforms, electronic customs systems, and online government services can help governments maintain administrative continuity and improve financial oversight even in environments characterised by institutional disruption. Reports from international organisations highlight that digital public infrastructure can improve governance quality, reduce corruption risks, and enhance the efficiency of fiscal management systems, particularly in fragile and conflict-affected contexts (United Nations, 2024; World Bank, 2021). These technologies may therefore support governments' ability to sustain revenue mobilisation during periods of political or economic instability.

Despite the increasing importance of digital governance reforms, empirical evidence on their fiscal implications remains limited, particularly in countries affected by armed conflict. Existing research primarily focuses on the role of digitalisation in improving administrative efficiency and service delivery. At the same time, relatively little attention has been paid to how digital government development interacts with conflict conditions in shaping government revenue mobilisation. Given the rising number of conflict-affected countries and the growing emphasis on digital transformation in public administration worldwide, analysing the relationship between e-government development, armed conflict, and fiscal capacity represents an important and timely research direction for international economic governance and public finance policy (European Commission, 2025; World Bank, 2024).

## 2. LITERATURE REVIEW

The transformation of public administration through digital technologies has become a central direction of institutional development in contemporary economies. Digital governance initiatives enable governments to modernise administrative processes, increase transparency, and improve the efficiency of public service delivery. The digitalisation of government institutions is increasingly associated with the development of new competencies among public managers, the adoption of innovative governance models, and the transformation of public-sector administrative decision-making processes (Androniceanu & Streimikiene, 2025; Stănescu, 2024). The growing importance of behavioural and institutional factors in supporting digital transformation has also been emphasised, as policy instruments and behavioural nudges can accelerate the adoption of e-government services and enhance public engagement with digital platforms (Crăciun et al., 2025). Moreover, digital governance strengthens the resilience of public institutions by enabling adaptive organisational responses to economic and institutional shocks (Bartuseviciene & Butkus, 2024; Kuanaliyev et al., 2024; Mishchuk et al., 2023).

The expansion of digital technologies in the public sector is closely linked to the broader development of the digital economy and the digitalisation of national economic systems. The diffusion of digital infrastructure, data analytics, and information platforms improves governance capacity and enhances the competitiveness of national economies (Jarzębowski et al., 2024; Kiseľáková et al., 2024). Empirical evidence also suggests that countries' digital readiness varies considerably across regions, driven by differences in institutional quality, digital infrastructure, and policy frameworks supporting technological development (Valaskova et al., 2025a; Paraschiv et al., 2024; Sibte-Ali et al., 2025). Analyses of digital transformation patterns reveal substantial heterogeneity in the speed and depth of digitalisation across European economies and other regions, highlighting the uneven diffusion of digital technologies in the public sector (Pakhnenko et al., 2025; Valaskova et al., 2025b). These disparities are further reinforced by the persistence of the digital divide, which limits some governments' ability to fully benefit from digital governance systems (Kovac et al., 2024).

The development of e-government systems is increasingly recognised as a key factor influencing governance quality, transparency, and institutional integrity. Digitalisation of administrative procedures can reduce corruption risks, increase accountability, and improve monitoring of public financial flows (Bilan et al., 2025; Guemmou, 2024; Yefimenko et al., 2025a). Technological innovations and digital tools also facilitate the strengthening of public integrity mechanisms by improving information accessibility and supporting transparency in public decision-making processes (Vasylieva et al., 2023; Ualtayev et al., 2024; Yefimenko et al., 2025b). Furthermore, integrating digital technologies into governance systems contributes to the development of more secure financial environments and supports efforts to combat illegal financial activities and money laundering (Krawczyk et al., 2025; Eriqat et al., 2025). The increasing use of artificial intelligence and machine learning further enhances governments' ability to detect financial irregularities and

strengthen financial monitoring systems (Lyeonov et al., 2024; Yarovenko et al., 2024). Emerging financial technologies, including cryptocurrencies, also create new challenges for financial regulation and governance systems, as they introduce additional channels for cross-border financial transactions and require advanced regulatory frameworks (Obeng & Attor, 2022).

Digital transformation also plays a critical role in shaping governments' fiscal capacity and improving revenue mobilisation mechanisms. The digitalisation of financial reporting systems, tax administration platforms, and payment infrastructures can significantly enhance the efficiency of revenue collection processes and improve fiscal sustainability (Darmawati et al., 2025; Damong, 2026). Digital financial technologies and electronic payment systems contribute to reducing tax evasion and increasing the transparency of financial transactions, thereby strengthening tax compliance and improving public revenue performance (Nghia & Hang, 2025; Shao & Chen, 2024). The effectiveness of fiscal systems also depends on the structure and progressivity of taxation systems, which influence revenue distribution and fiscal fairness within national economies (Kerimov, 2025). Empirical studies also demonstrate that improvements in tax administration systems and fiscal governance reforms can strengthen the balance of state budgets and enhance the stability of public finances (Nessipbay et al., 2024; Ntuli et al., 2025). At the same time, the transformation of digital economic ecosystems may create new challenges for taxation systems, including digital tax avoidance practices and evolving corporate ownership structures (Reswita et al., 2026).

The relationship between digital transformation and economic development has also been examined in the context of broader structural transformations of national economies. The diffusion of digital technologies stimulates entrepreneurial ecosystems, supports innovation, and drives the development of new business models across industries (Khatami et al., 2024). Digitalisation can also facilitate socio-economic inclusion and reduce structural inequalities by improving access to digital services and expanding opportunities for participation in economic activities (Ruthvika & Hedau, 2025). However, the digital transformation of economies is often accompanied by structural challenges, including the persistence of informal economic activities and unequal access to digital infrastructure, particularly in developing regions (Mtengwane, 2024). These dynamics highlight the importance of institutional frameworks and the quality of governance in shaping the outcomes of digital economic development (Samarkhanov et al., 2025). In addition, countries face various institutional and economic challenges when implementing digital economy strategies, including regulatory barriers, infrastructure limitations, and technological capability gaps (Huseynov et al., 2025).

Another important dimension of the literature relates to the role of technological development and digital innovation in strengthening economic security and institutional resilience. The development of digital ecosystems, intelligent automation, and advanced analytical technologies is increasingly viewed as a strategic factor supporting sustainable economic transformation and strategic decision-making in both the public and private sectors (Kuzior & Sira, 2025). The convergence of digital technologies, cybersecurity systems, and institutional transparency mechanisms strengthens global digital governance and improves the resilience of national economic systems (Kuzior et al., 2022). The growing digitalisation of critical sectors such as healthcare and public services has also increased the importance of cybersecurity leadership and digital risk management competencies within modern organisations (McCoy, 2025). Moreover, the acceleration of digital disruption during global crises, such as the COVID-19 pandemic, has demonstrated the capacity of digital technologies to rapidly transform service delivery models and administrative practices across sectors (Conley, 2025). At the same time, the rapid development of artificial intelligence technologies raises new governance challenges related to technological risks, institutional trust, and societal perceptions of technological change (Yarovenko et al., 2024).

In parallel with technological transformation, recent literature increasingly emphasises the influence of geopolitical instability and armed conflicts on economic governance and fiscal systems. Military conflicts

disrupt economic activity, weaken institutional structures, and create significant pressures on public financial systems. The Russian–Ukrainian war has generated substantial economic consequences, including disruptions in trade flows, agricultural markets, and global energy systems (Jareño et al., 2025). Conflicts also influence social structures and governance processes by creating new institutional challenges and economic vulnerabilities (Slyusarevskyy & Chunikhina, 2025). Economic security and foreign trade dynamics in wartime conditions further illustrate how conflicts reshape economic structures and fiscal capacity (Tsymbal & Demediuk, 2025). In addition, armed conflicts may contribute to institutional degradation, erosion of accountability mechanisms, and expansion of rent-seeking behaviour within public governance systems (Ugulava, 2026). The growing academic interest in the economic and financial consequences of conflicts is reflected in bibliometric studies that highlight the increasing volume of research on these issues (Zozulinskyy, 2024).

The intersection between digital transformation, governance quality, and national security has also attracted increasing scholarly attention. Digitalisation processes influence not only economic development but also the institutional capacity of states to maintain transparency, strengthen governance structures, and ensure national security in a rapidly evolving technological environment (Zámek & Zakharkina, 2024). Technological innovation can enhance public sector transparency, support anti-corruption mechanisms, and improve macroeconomic stability through strengthened governance frameworks (Makarenko et al., 2025; Yarovenko et al., 2025a). At the same time, digital transformation processes must be carefully managed to ensure that technological development contributes to institutional stability rather than generating new vulnerabilities in governance systems (Yarovenko et al., 2025b).

The existing literature demonstrates that digital governance, institutional transparency, and technological innovation are closely interconnected factors shaping modern public administration systems and economic development trajectories. However, previous studies have primarily examined these relationships in relatively stable institutional environments, while paying limited attention to how digital government development influences fiscal capacity in countries affected by armed conflict. Consequently, analysing the interaction between e-government development, conflict conditions, and government revenue mobilisation represents an important research direction that contributes to a deeper understanding of the institutional resilience of fiscal systems in contemporary geopolitical conditions.

This study aims to examine the impact of digital government development on public revenue mobilisation across countries and to assess whether armed conflict moderates the relationship between e-government development and different sources of government revenue.

### 3. METHODOLOGY

#### 2.1. Banks ownership and relationship lending

This study employs a cross-country panel data approach to examine the relationship between digital government development, armed conflict, and public revenue mobilisation. The empirical analysis focuses on four categories of fiscal revenues: tax revenue, government revenue excluding grants, social contributions, and customs and other import duties. The dataset combines information on digital governance, fiscal indicators, economic development, and armed conflict episodes across a large set of countries over the period 2003–2024. The panel structure allows the analysis to capture both cross-country differences and within-country changes over time.

Data on armed conflict are obtained from the Uppsala Conflict Data Program (UCDP), which provides internationally recognised datasets on organised violence. In particular, the study relies on the UCDP/PRIO Armed Conflict Dataset, which records conflicts involving at least one state actor and resulting in at least

25 battle-related deaths within a calendar year. The dataset was originally introduced by Gleditsch et al. (2002) and has been continuously updated to reflect new conflict episodes and methodological improvements. The most recent update covering the period up to 2024 is documented by Davies et al. (2025), which highlights challenges in identifying civilian victims and improving the measurement of organised violence. Following standard practice in empirical conflict research, a binary indicator of armed conflict is constructed for each country–year observation, taking the value of one when an armed conflict is recorded and zero otherwise.

The main explanatory variable capturing digital government development is the E-Government Development Index (EGDI), sourced from the World Bank's Data 360 platform (World Bank, n.d.-a). The United Nations originally compiled the EGDI and measures the capacity of governments to provide digital public services and digital administrative infrastructure. The index ranges from 0 to 1 and consists of three subcomponents: the Human Capital Index (HCI), the Online Services Index (OSI), and the Telecommunication Infrastructure Index (TII). The human capital component reflects educational attainment and digital skills within the population, the online services component measures the availability and sophistication of government digital services, and the telecommunications infrastructure component captures the availability of information and communication technology infrastructure supporting digital governance.

Fiscal variables and macroeconomic controls are obtained from the World Bank Open Data database (World Bank, n.d.-b). The dependent variables include tax revenue, government revenue excluding grants, social contributions, and customs and other import duties, all measured in current local currency units. These indicators capture different dimensions of fiscal capacity and allow the analysis to investigate whether digital governance and conflict conditions affect specific sources of government revenue differently. GDP per capita in current local currency units is sourced from the World Bank (n.d.-b) and included as a control variable representing the level of economic development, widely recognised as a key determinant of fiscal capacity.

To reduce skewness and mitigate the influence of extreme observations, monetary variables are transformed before estimation. Natural logarithmic transformations are applied to tax revenue, revenue excluding grants, social contributions, and GDP per capita. Since customs and import duties may include zero or negative observations, this variable is transformed using the inverse hyperbolic sine function, which behaves similarly to a logarithmic transformation for large values while allowing non-positive observations to remain in the sample. The armed conflict variable is specified as a binary indicator, originally collected from Gleditsch et al. (2002), Davies et al. (2025), and Uppsala University (n.d.). In contrast, the EGDI variables are used in their original scale and, in some specifications, mean-centred to facilitate the interpretation of interaction terms.

The empirical analysis is conducted using two-way fixed effects panel regressions estimated with the within estimator. This specification controls for unobserved time-invariant country characteristics, such as institutional quality, fiscal traditions, or structural economic features, as well as for common time effects that capture global shocks affecting all countries simultaneously. The baseline empirical model can be expressed as:

$$Y_{it} = \beta_1 EGDI_{it} + \beta_2 War_{it} + \beta_3 (EGDI_{it} \times War_{it}) + \beta_4 X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where  $Y_{it}$  represents the logarithm of the fiscal indicator for the country  $i$  in year  $t$ ,  $EGDI_{it}$  denotes the level of digital government development,  $War_{it}$  represents the armed conflict dummy, and  $X_{it}$  includes control variables such as GDP per capita. The terms  $\mu_i$  and  $\lambda_t$  denote country-specific and year-specific fixed effects, respectively, while  $\varepsilon_{it}$  is the error term.

In addition to the baseline specification, alternative models decompose the EGDI into its three components to examine whether specific dimensions of digital governance are associated with fiscal performance. Interaction terms between the EGDI indicators and the conflict dummy are included to assess whether armed conflict moderates the relationship between digital governance and revenue mobilisation. All regressions are estimated with heteroskedasticity-robust standard errors clustered at the country level to account for potential serial correlation and heteroskedasticity within panels.

This empirical strategy enables the study to isolate the roles of digital governance and conflict conditions in shaping fiscal outcomes, while controlling for structural country characteristics and global macroeconomic trends.

#### 4. EMPIRICAL RESULTS AND DISCUSSION

The descriptive statistics provide an overview of the main variables used in the empirical analysis across the panel datasets covering the period 2003–2024. The samples contain between 872 and 1,387 country–year observations depending on the availability of fiscal indicators. On average, the EGDI ranges from 0.50 to 0.63 across datasets, indicating a moderate level of digital government development globally. Among its components, the HCI shows the highest mean values (approximately 0.72–0.82), suggesting that human capital capacities related to education and digital skills tend to be relatively stronger than the technological infrastructure (TTI) or online service provision (OSI). The distributions of the EGDI variables appear relatively symmetric, with low skewness and kurtosis values close to zero, indicating a fairly balanced distribution across countries.

The fiscal variables display substantial heterogeneity across countries, reflecting the large differences in economic size and fiscal capacity within the sample. For instance, average tax revenue amounts to approximately 5.47 trillion in local currency units, while the mean value of government revenue excluding grants reaches approximately 9.99 trillion local currency units. However, the median values are considerably lower than the means, which indicates strong right-skewed distributions driven by large economies with substantial fiscal capacity. This pattern is further confirmed by very high skewness and kurtosis values for fiscal variables, particularly tax revenue and revenue excluding grants, suggesting the presence of extreme observations. Such characteristics are common in cross-country fiscal datasets and justify the use of logarithmic transformations or robust estimation techniques in subsequent econometric analysis.

The statistics related to social contributions and customs revenues reveal similar patterns of dispersion and asymmetry. The mean value of social contributions is approximately 2.4 trillion local currency units, whereas customs and import duties average 0.423 trillion local currency units. In both cases, the distributions exhibit substantial positive skewness and high kurtosis, indicating that a limited number of countries collect exceptionally large revenues from these sources. This reflects structural differences in fiscal systems and trade structures across countries, where customs revenues may be particularly important for some developing economies but relatively marginal for advanced economies with diversified tax bases.

Finally, the armed conflict dummy derived from the UCDP/PRIO Armed Conflict Dataset indicates that conflict conditions occur in approximately 14–16% of the country-year observations in the analysed samples. The median value of zero indicates that most observations correspond to peaceful periods. At the same time, the variable's positive skewness reflects the relatively limited but significant occurrence of conflict episodes in the global dataset. The presence of both conflict and non-conflict observations provides sufficient variation for examining how armed conflict moderates the relationship between digital governance and fiscal capacity in the subsequent econometric models.

The empirical analysis examines the relationship between digital government development and tax revenue performance while accounting for the moderating role of armed conflict. The dependent variable

is the natural logarithm of tax revenue in local currency units, which allows the coefficients to be interpreted approximately as semi-elasticities. All models (Table 1) are estimated using two-way fixed effects with robust standard errors clustered at the country level.

The results of the baseline interaction model indicate that the overall level of digital government development does not have a statistically significant effect on tax revenue mobilisation. The coefficient for the centred EGDI is negative ( $-0.198$ ) but not statistically significant ( $p = 0.152$ ), suggesting that variations in digital governance across countries are not systematically associated with changes in tax revenue when controlling for income levels and fixed country and time effects. However, the coefficient for the armed conflict dummy is positive and statistically significant at the 5 % level ( $0.078$ ;  $p = 0.034$ ). This finding suggests that, on average, tax revenue tends to increase during conflict years relative to peaceful periods when evaluated at the mean level of EGDI. Such a pattern may reflect wartime fiscal adjustments, including emergency taxation measures or increased fiscal mobilisation to finance military expenditures. The interaction term between EGDI and armed conflict is negative but statistically insignificant, indicating that the relationship between digital government development and tax revenue does not change significantly during conflict periods.

The second specification confirms these results when EGDI is included in its original scale rather than in centred form. The coefficient on EGDI remains negative and statistically insignificant, indicating that the general level of digital government development is not directly associated with higher tax revenue in the sample of countries analysed. The armed conflict dummy becomes only marginally significant at the 10 % level ( $p = 0.053$ ), suggesting weaker statistical evidence for a direct conflict-related increase in tax revenues once the EGDI variable is not centred. Importantly, the interaction term between EGDI and armed conflict remains statistically insignificant, implying that armed conflict does not significantly moderate the effect of digital governance on tax revenue mobilisation.

A more detailed specification decomposes the E-Government Development Index into three structural components: HCI, OSI, and TTI. The results reveal that only the telecommunication infrastructure component exhibits a statistically significant relationship with tax revenue. Specifically, the coefficient for EGDI\_TTI is negative and significant at the 1 % level ( $-0.362$ ;  $p = 0.005$ ), indicating that higher levels of telecommunication infrastructure development are associated with lower tax revenue over time within countries. Although this result may initially appear counterintuitive, it may reflect structural changes in economic activity accompanying digitalisation, such as the expansion of the digital or informal sectors, which are more difficult to tax under traditional fiscal systems. By contrast, the human capital and online service components of digital government do not display statistically significant effects on tax revenue mobilisation.

Across all model specifications, GDP per capita shows a strong, highly significant positive relationship with tax revenue. The coefficient on the logarithm of GDP per capita is approximately 0.95 in all regressions and is statistically significant at the 1 % level. This indicates that economic development remains the primary determinant of fiscal capacity across countries. A 1% increase in GDP per capita is associated with approximately a 0.95% increase in tax revenue, reflecting the strong structural link between economic growth and government revenue mobilisation. Taken together, the results suggest that while macroeconomic development strongly drives tax revenue, the direct contribution of digital government development appears limited in the short run.

Table 1  
E-government development, armed conflict, and tax revenue (two-way fixed effects models)

Variables	(1) Baseline Interaction (EGDI centred)	(2) Interaction (EGDI level)	(3) EGDI Components
EGDI / EGDI_c	-0.198 (0.138)	-0.198 (0.138)	–
War dummy	0.078* (0.037)	0.212† (0.109)	0.229 (0.148)
EGDI × War	-0.246 (0.160)	-0.246 (0.160)	–
EGDI_HCI	–	–	-0.002 (0.153)
EGDI_OSI	–	–	-0.040 (0.068)
EGDI_TTI	–	–	-0.362*** (0.130)
EGDI_HCI × War	–	–	-0.168 (0.170)
EGDI_OSI × War	–	–	-0.029 (0.148)
EGDI_TTI × War	–	–	-0.048 (0.153)
Log GDP per capita	0.947*** (0.035)	0.947*** (0.035)	0.957*** (0.036)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

*Notes:* Robust standard errors clustered at the country level are reported in parentheses. The dependent variable is the natural logarithm of tax revenue (current LCU). Significance code: †  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

The negative coefficient associated with the TTI may reflect structural transformations accompanying digitalisation rather than a direct negative effect of infrastructure development on fiscal capacity. Rapid expansion of telecommunications infrastructure can facilitate the growth of digital and platform-based economic activities that are often more difficult to capture within traditional tax systems, particularly in countries where tax administration and regulatory frameworks have not yet fully adapted to digital business models. As a result, the expansion of digital connectivity may temporarily widen gaps in tax compliance and enforcement, leading to weaker recorded tax revenue in the short run. In addition, improvements in telecommunications infrastructure frequently occur in economies undergoing broader economic restructuring, where shifts towards informal, service-based, or cross-border digital activities may reduce the immediate tax base measurable by conventional fiscal statistics. Consequently, the observed negative association likely reflects transitional institutional and regulatory adjustments rather than a detrimental role of digital infrastructure itself.

The second set of regressions examines the relationship between digital government development and government revenue excluding grants, again accounting for the moderating role of armed conflict. The dependent variable is the natural logarithm of revenue excluding grants, allowing the coefficients to be interpreted approximately as semi-elasticities. All models (Table 2) are estimated using two-way fixed effects, controlling for country-specific and time-specific heterogeneity, with robust standard errors clustered at the country level.

The baseline specification, including the centred EGDI, indicates that the overall level of digital government development does not exert a statistically significant direct effect on government revenue excluding grants. The coefficient of centred EGDI is very small and statistically insignificant ( $-0.027$ ;  $p = 0.843$ ), suggesting that within-country improvements in digital government development are not systematically associated with changes in domestic fiscal revenues once macroeconomic conditions and fixed effects are taken into account. Similarly, the coefficient of the armed conflict dummy is statistically insignificant ( $0.028$ ;  $p = 0.499$ ), indicating that conflict episodes do not independently affect revenue excluding grants in the baseline specification when EGDI is centred.

Table 2

E-government development, armed conflict, and revenue excluding grants (two-way fixed effects models)

Variables	(1) Baseline Interaction (EGDI centred)	(2) Interaction (EGDI level)	(3) EGDI Components
EGDI / EGDI_c	-0.027 (0.138)	-0.027 (0.138)	–
War dummy	0.028 (0.041)	0.158† (0.088)	0.182 (0.143)
EGDI × War	-0.238† (0.145)	-0.238† (0.145)	–
EGDI_HCI	–	–	0.103 (0.112)
EGDI_OSI	–	–	0.030 (0.060)
EGDI_TTI	–	–	-0.349** (0.136)
EGDI_HCI × War	–	–	-0.163 (0.190)
EGDI_OSI × War	–	–	-0.069 (0.107)
EGDI_TTI × War	–	–	-0.006 (0.121)
Log GDP per capita	0.991*** (0.035)	0.991*** (0.035)	1.003*** (0.037)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

*Notes:* Robust standard errors clustered at the country level are reported in parentheses. The dependent variable is the natural logarithm of government revenue excluding grants (current LCU). Significance code: †  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

However, the interaction term between EGDI and armed conflict exhibits a negative coefficient that is marginally significant at the 10 % level ( $-0.238$ ;  $p = 0.100$ ). This result suggests that the relationship between digital government development and domestic revenue mobilisation may weaken during conflict periods. In other words, while digital governance alone does not appear to significantly affect revenue performance, armed conflict may reduce the potential fiscal benefits of digital government development. Such an effect may reflect institutional disruptions during conflict, including damaged infrastructure, administrative fragmentation, and reduced state capacity, which may limit the effectiveness of digital public administration systems.

The alternative specification using the original EGDI variable rather than the centred version produces very similar results. The coefficient for EGDI remains statistically insignificant, confirming that improvements in digital government development are not directly associated with higher government revenue (excluding grants) in the sample analysed. The coefficient of the armed conflict dummy becomes marginally significant at the 10 % level ( $0.158$ ;  $p = 0.073$ ), suggesting weak evidence that government revenue excluding grants may increase during conflict periods, possibly reflecting wartime fiscal mobilisation or emergency taxation measures. The interaction term between EGDI and armed conflict again displays a negative coefficient. It remains marginally significant at the 10 % level, reinforcing the interpretation that conflict conditions may dampen the fiscal effectiveness of digital governance mechanisms.

The final specification decomposes the EGDI into its three constituent components: human capital, online services, and telecommunication infrastructure. The results reveal that neither the human capital component nor the online services component has a statistically significant relationship with government revenue excluding grants. By contrast, the telecommunications infrastructure component exhibits a negative, statistically significant coefficient ( $-0.349$ ;  $p = 0.011$ ). This suggests that improvements in telecommunications infrastructure are associated with lower government revenue, excluding grants, over time within countries. As discussed earlier, this pattern may reflect transitional dynamics of digitalisation,

including the expansion of digital economic activities that may not yet be fully captured within existing taxation systems. Importantly, none of the interaction terms between the EGDI components and armed conflict is statistically significant, indicating that the moderating role of conflict does not differ across the individual dimensions of digital government development.

Across all model specifications, GDP per capita remains a strong and highly significant determinant of government revenue. The coefficient on the logarithm of GDP per capita is approximately 1 and statistically significant at the 1% level in all regressions. This indicates that a 1% increase in GDP per capita is associated with an approximately 1% increase in government revenue excluding grants, highlighting the dominant role of economic development in shaping fiscal capacity across countries.

The third set of regressions investigates the relationship between digital government development and social contribution revenues, while accounting for the potential moderating effect of armed conflict. The dependent variable is the natural logarithm of social contributions collected by governments in local currency units. As in the previous specifications, all models are estimated using two-way fixed effects with robust standard errors clustered at the country level, controlling for both country-specific and time-specific unobserved heterogeneity.

The baseline specification, including the centred EGDI, suggests that overall digital government development does not exert a statistically significant effect on social contribution revenues. The coefficient for centred EGDI is very small and statistically insignificant (0.056;  $p = 0.930$ ), indicating that within-country improvements in digital governance are not systematically associated with changes in social contribution revenues, even after controlling for macroeconomic conditions and fixed effects. Similarly, the coefficient for the armed conflict dummy is negative but statistically insignificant ( $-0.153$ ;  $p = 0.202$ ), suggesting that armed conflict does not significantly affect the level of social contribution revenues in the analysed sample.

The second specification, which includes the EGDI variable in its original scale, confirms these findings. The coefficient of EGDI remains statistically insignificant and close to zero, reinforcing the conclusion that improvements in digital government development are not directly associated with higher social contribution revenues. The armed conflict variable also remains statistically insignificant, suggesting that conflict conditions do not significantly alter the collection of social contributions across countries. Importantly, the interaction term between EGDI and armed conflict is also statistically insignificant, indicating that armed conflict does not significantly moderate the relationship between digital government development and social contribution revenues.

The third specification decomposes the EGDI into its three structural components: the HCI, the OSI, and the TTI. The results indicate that none of the direct effects of these components is statistically significant. Although the coefficient of the human capital component is positive (1.101), suggesting that improvements in digital skills and education may be associated with higher social contribution revenues, this effect is not statistically significant at conventional levels. Similarly, the online services and telecommunications infrastructure components do not exhibit statistically significant relationships with social contribution revenues.

However, one interaction effect is marginally significant. The interaction between the online services component and armed conflict ( $EGDI\_OSI \times war$ ) displays a negative coefficient and is statistically significant at the 10 % level ( $-0.959$ ;  $p = 0.075$ ). This result suggests that expanding online government services may be less effective at supporting social contribution collection during conflict periods. One possible explanation is that armed conflict disrupts labour markets, employment structures, and administrative systems, thereby weakening the institutional channels through which digital government services facilitate the collection of payroll-based contributions. Consequently, the potential fiscal benefits of online government services may be partially offset under conflict conditions.

Across all specifications, GDP per capita remains a strong and highly significant determinant of social contribution revenues. The coefficient on the logarithm of GDP per capita is positive and statistically significant at the 1 % level in all models, with estimated values ranging from 1.12 to 1.22. This indicates that a 1% increase in GDP per capita is associated with an increase of approximately 1.1–1.2% in social contribution revenues. This finding highlights the central role of economic development and labour market expansion in shaping the fiscal capacity of social insurance systems across countries.

Table 3

E-government development, armed conflict, and social contributions (two-way fixed effects models)

Variables	(1) Baseline Interaction (EGDI centred)	(2) Interaction (EGDI level)	(3) EGDI Components
EGDI / EGDI_c	0.056 (0.639)	0.056 (0.639)	–
War dummy	-0.153 (0.120)	-0.138 (0.327)	-0.443 (0.701)
EGDI × War	-0.023 (0.476)	-0.023 (0.476)	–
EGDI_HCI	–	–	1.101 (0.748)
EGDI_OSI	–	–	0.073 (0.230)
EGDI_TTI	–	–	-0.749 (0.840)
EGDI_HCI × War	–	–	0.739 (0.869)
EGDI_OSI × War	–	–	-0.959† (0.537)
EGDI_TTI × War	–	–	0.673 (0.444)
Log GDP per capita	1.124*** (0.109)	1.124*** (0.109)	1.216*** (0.153)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

*Notes:* Robust standard errors clustered at the country level are reported in parentheses. The dependent variable is the natural logarithm of social contributions (current LCU). Significance code: †  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

The final set of regressions investigates the relationship between digital government development and customs and other import duties, while accounting for the moderating role of armed conflict. The dependent variable is transformed using the inverse hyperbolic sine (*asinh*), which allows the inclusion of zero and negative observations while preserving properties similar to those of logarithmic transformations for large values. As in the previous models, the estimations employ two-way fixed effects controlling for country-specific and time-specific heterogeneity, with robust standard errors clustered at the country level.

The baseline specification, including the centred EGDI, indicates that digital government development does not have a statistically significant direct effect on customs revenues. The coefficient of centred EGDI is negative but statistically insignificant ( $-1.273$ ;  $p = 0.349$ ), suggesting that within-country improvements in digital governance are not systematically associated with changes in customs and import duty revenues. Similarly, the armed conflict dummy does not show a statistically significant effect on customs revenues ( $p = 0.797$ ), suggesting that armed conflict does not significantly alter customs revenue levels after controlling for country and year effects. The interaction term between EGDI and armed conflict is also statistically insignificant, indicating that conflict conditions do not significantly moderate the relationship between digital government development and customs revenues.

The alternative specification using the original EGDI variable rather than the centred version produces nearly identical results. The coefficient for EGDI remains negative and statistically insignificant, confirming

that digital government development does not directly affect customs revenue mobilisation over time within countries. The coefficient for the armed conflict variable remains statistically insignificant, suggesting that customs revenue collection is relatively resilient to conflict conditions in the short run, possibly because customs duties are often collected at centralised border points that may remain operational even during periods of political instability. The interaction term between EGDI and armed conflict is again statistically insignificant, reinforcing the conclusion that the fiscal role of digital government development does not significantly change during conflict episodes in the context of customs revenues.

The third specification decomposes the EGDI into its three core components: human capital, online services, and telecommunication infrastructure. The results indicate that none of these components exhibits statistically significant direct effects on customs revenue collection. Although the coefficient for the human capital component is negative and relatively large in magnitude, it is not statistically significant at conventional levels. Similarly, the online services and telecommunication infrastructure components do not display statistically significant relationships with customs revenues. These findings suggest that improvements in digital governance structures may not directly translate into higher customs revenue collection, possibly because customs administration is more strongly influenced by trade volumes, border control capacity, and international trade regulations than by broader digital government indicators.

Across all specifications, GDP per capita remains the only consistently significant determinant of customs revenues. The coefficient of the logarithm of GDP per capita is positive and statistically significant at the 1 % level in all models, indicating that higher levels of economic development are associated with increased customs revenue collection. Specifically, the estimated coefficients suggest that a 1% increase in GDP per capita is associated with an approximately 1.11% increase in customs revenues. This finding highlights the importance of economic scale and trade intensity in shaping customs revenue performance across countries.

The results indicate that while economic development plays a central role in determining customs revenues, the direct contribution of digital government development and its interaction with armed conflict do not appear to significantly influence customs revenue mobilisation within the analysed sample.

Taken together, the results presented in Tables 1–4 reveal a consistent pattern regarding the relationship between digital government development, armed conflict, and different components of public revenue. Across all model specifications, GDP per capita emerges as the most robust and statistically significant determinant of fiscal capacity, indicating that economic development remains the primary structural driver of government revenue mobilisation. The coefficients of GDP per capita are positive and highly significant in all regressions, suggesting that higher levels of economic activity systematically translate into greater tax revenues, social contributions, customs duties, and overall revenue excluding grants. By contrast, the overall level of digital government development, as measured by the E-Government Development Index, does not exhibit a statistically significant direct effect on most fiscal indicators. This finding suggests that improvements in digital governance alone may not automatically translate into stronger fiscal performance, particularly in the short run.

Table 4

E-government development, armed conflict, and customs revenues (two-way fixed effects models)

Variables	(1) Baseline Interaction (EGDI centred)	(2) Interaction (EGDI level)	(3) EGDI Components
EGDI / EGDI_c	-1.273 (1.360)	-1.273 (1.360)	–
War dummy	0.026 (0.103)	0.320 (0.271)	0.817† (0.503)
EGDI × War	-0.585 (0.544)	-0.585 (0.544)	–
EGDI_HCI	–	–	-0.464 (0.440)
EGDI_OSI	–	–	-0.097 (1.064)
EGDI_TTI	–	–	-1.131 (1.051)
EGDI_HCI × War	–	–	-0.994 (0.741)
EGDI_OSI × War	–	–	-0.739 (0.667)
EGDI_TTI × War	–	–	0.759 (0.648)
Log GDP per capita	1.108*** (0.316)	1.108*** (0.316)	1.116*** (0.328)
Country fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

*Notes:* Robust standard errors clustered at the country level are reported in parentheses. The dependent variable is the inverse hyperbolic sine transformation of customs and import duties (current LCU). Significance code: †  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

The role of armed conflict also appears limited in most specifications. While some models show weak evidence that conflict periods may be associated with increases in tax revenues or revenues excluding grants, possibly reflecting wartime fiscal mobilisation, these effects are generally not robust across different fiscal categories. In particular, conflict does not significantly affect the collection of social contributions or customs revenues, once country- and time-specific factors are controlled for. Furthermore, the interaction terms between digital government indicators and armed conflict are largely statistically insignificant across the models, indicating that conflict conditions do not systematically alter the relationship between digital governance and fiscal outcomes. Only limited evidence suggests that conflict may weaken the potential fiscal effects of digital government in certain cases.

A more nuanced picture emerges when the E-Government Development Index is decomposed into its constituent components. In the case of tax revenue and revenue excluding grants, the telecommunication infrastructure component displays a statistically significant negative relationship with fiscal outcomes, suggesting that rapid digitalisation of infrastructure may initially coincide with structural economic transformations that challenge traditional tax collection mechanisms. Similarly, in the analysis of social contributions, the interaction between online government services and armed conflict appears marginally significant, suggesting that conflict conditions may weaken the effectiveness of digital administrative tools in labour-market-related revenue collection. However, these effects remain relatively limited and do not appear consistently across all revenue categories.

The results indicate that while digital government development is often considered a key instrument for improving administrative efficiency and transparency, its direct impact on fiscal revenue mobilisation appears to be modest within the analysed sample. Instead, fiscal outcomes remain strongly shaped by broader structural factors, particularly economic development and the underlying scale of economic activity. These findings suggest that digital governance reforms alone may not be sufficient to enhance fiscal capacity unless they are accompanied by complementary institutional reforms, modernised tax administration systems, and regulatory frameworks capable of effectively capturing emerging digital economic activities.

The estimated country fixed effects (Table 5 and Table B1, Appendix B) reveal substantial cross-country heterogeneity in the structural capacity to generate government revenue after controlling for economic development, digital governance, armed conflict, and common time effects. These coefficients represent the average country-specific deviations from the overall intercept in the two-way fixed-effects model, reflecting persistent institutional and structural characteristics that are not explicitly captured by the explanatory variables. Higher values indicate countries where government revenue tends to be systematically higher than the model predicts. In contrast, lower values suggest relatively weaker revenue mobilisation after accounting for differences in GDP per capita, digital governance indicators, and conflict conditions.

Several countries exhibit particularly high positive fixed effects, indicating stronger structural fiscal capacity. For example, countries such as China (18.96), India (18.74), Brazil (17.80), the United States (17.82), the Russian Federation (17.48), and Indonesia (17.63) rank among the highest in the sample. These results suggest that these economies tend to collect significantly higher levels of revenue than predicted by the model variables alone. Such outcomes may reflect broader institutional factors, including well-developed fiscal administrations, diversified tax bases, strong central government capacity, or large domestic markets that support more efficient revenue mobilisation mechanisms beyond what is captured by GDP per capita and digital governance indicators.

Conversely, several small island states and fragile or conflict-affected countries exhibit relatively low fixed effects, indicating weaker structural capacity for revenue mobilisation. For example, Somalia (2.86), Palau (8.37), Nauru (9.50), and San Marino (9.39) appear among the lowest values in the distribution. These low coefficients may reflect structural constraints, such as limited economic diversification, small domestic markets, limited administrative capacity, or institutional fragility, that reduce governments' ability to mobilise domestic fiscal resources. In fragile states, these challenges may be further amplified by political instability, weak governance institutions, and limited tax enforcement capacity.

Table 5

## Countries with the highest and lowest estimated fixed effects

Highest Country Effects	Value	Lowest Country Effects	Value
China	18.96	Somalia	2.86
India	18.74	Palau	8.37
United States	17.82	San Marino	9.39
Brazil	17.80	Nauru	9.50
Indonesia	17.63	Marshall Islands	9.45
Russian Federation	17.48	St. Kitts and Nevis	9.40
France	17.12	Bahamas	10.80
Turkiye	17.03	Micronesia	10.13
Mexico	16.99	Tonga	10.22
Germany	16.93	St. Vincent and the Grenadines	10.16

*Notes:* Country effects represent the estimated country-specific intercepts ( $\mu_i$ ) from the fixed effects model. Higher values indicate systematically stronger fiscal capacity relative to the model predictions. In comparison, lower values indicate relatively weaker revenue mobilisation after controlling for GDP per capita, digital governance indicators, and conflict conditions.

The distribution of country effects highlights the importance of country-specific institutional and structural factors in shaping fiscal performance. While the econometric model controls for key observable determinants such as economic development, digital governance, and armed conflict, the remaining heterogeneity captured by the fixed effects suggests that broader institutional characteristics, including tax

administration efficiency, governance quality, the size of the informal economy, and historical fiscal traditions, continue to play a crucial role in explaining cross-country differences in revenue mobilisation. These findings underscore the importance of considering institutional context when evaluating the fiscal implications of digital governance reforms and conflict conditions.

The empirical results provide several important insights into the relationship between digital government development and fiscal capacity across countries, particularly in the context of armed conflict. First, the analysis confirms that macroeconomic development remains the dominant determinant of government revenue mobilisation. The coefficient on GDP per capita is consistently positive and statistically significant across all models, ranging from approximately 0.95 to 1.22, indicating that higher levels of economic development substantially strengthen governments' ability to generate fiscal revenues. This finding is consistent with previous research emphasising the strong connection between economic development, governance quality, and fiscal capacity, as more developed economies tend to possess more efficient administrative systems and broader tax bases (Makarenko et al., 2025; Nessipbay et al., 2024; Ntuli et al., 2025). The results therefore support the broader argument in the literature that structural economic conditions remain the fundamental driver of public revenue performance, while institutional and technological factors often play a complementary role.

Second, the empirical models show that the overall E-Government Development Index does not demonstrate a statistically significant direct effect on tax revenue or revenue excluding grants, suggesting that digital government development alone does not automatically translate into higher fiscal performance. This finding partly contrasts with theoretical expectations that digitalisation should improve tax administration efficiency and reduce tax evasion. However, similar conclusions have been reported in studies showing that digital transformation primarily enhances administrative capacity and governance transparency rather than immediately increasing fiscal revenues (Guemmou, 2024; Vasylieva et al., 2023; Yarovenko et al., 2025a). In addition, the results reveal weak interaction effects between armed conflict and digital governance development (approximately  $-0.238$ ;  $p \approx 0.10$ ), suggesting that conflict conditions may reduce the fiscal effectiveness of digital governance reforms. This outcome aligns with research highlighting that armed conflicts disrupt economic activity, weaken institutions, and reduce governments' ability to fully exploit technological governance tools (Slyusarevskyy & Chunikhina, 2025; Tsymbal & Demediuk, 2025; Ugulava, 2026).

Third, an unexpected but statistically significant negative relationship is observed between the telecommunications infrastructure component of the EGDI and government revenue indicators, particularly tax revenue ( $-0.362$ ;  $p = 0.005$ ) and revenue excluding grants ( $-0.349$ ;  $p = 0.011$ ). One possible explanation is that improvements in telecommunications infrastructure often occur in parallel with structural economic changes such as the expansion of digital platforms, cross-border digital services, and informal digital economic activities, which may temporarily reduce the effectiveness of traditional tax administration mechanisms. Similar challenges have been discussed in the literature on digital economy governance, where rapid technological development may create new channels for tax avoidance, regulatory gaps, or difficulties in monitoring digital transactions (Nghia & Hang, 2025; Reswita et al., 2026; Obeng & Attor, 2022). Moreover, countries with rapidly expanding digital infrastructure may still face institutional or regulatory limitations that prevent them from fully translating digital capacity into improved fiscal performance. Overall, these results suggest that while digital government development contributes to improving governance quality and institutional transparency, its fiscal effects depend strongly on broader economic conditions, institutional capacity, and the stability of the political environment.

Despite providing new cross-country evidence on the relationship between digital government development, armed conflict, and public revenue mobilisation, this study has several limitations. First, the analysis relies on aggregated national-level indicators, which may conceal important heterogeneity across

regions, sectors, and specific tax instruments within countries. Second, although the panel dataset covers a relatively large number of countries and years, the availability of fiscal data varies across revenue categories, leading to different sample sizes across the estimated models. Third, the empirical framework captures statistical associations rather than strictly causal relationships, as fiscal performance may also be influenced by institutional quality, governance structures, tax administration capacity, or the size of the informal economy, which are not explicitly included in the model. Fourth, the binary armed conflict indicator derived from the UCDP/PRIO dataset reflects the presence of conflict but does not fully capture its intensity, duration, or geographical concentration, which may influence fiscal outcomes in different ways. Finally, the EGDI represents a composite indicator of digital government development and may not fully reflect the effectiveness of specific digital public administration reforms, such as e-taxation systems or digital customs platforms. Future research could therefore extend the analysis by incorporating more granular institutional indicators, alternative measures of digital governance implementation, and more detailed measures of conflict intensity or subnational fiscal performance.

## 5. CONCLUSION

This study aimed to investigate whether the development of digital government contributes to public revenue mobilisation across countries and to assess whether armed conflict conditions modify this relationship. In particular, the research examined how the EGDI and its structural components influence different categories of government revenue, including tax revenue, revenue excluding grants, social contributions, and customs duties, while accounting for the institutional disruptions associated with armed conflict. By focusing on multiple fiscal indicators, the study sought to provide a more comprehensive understanding of how digital governance interacts with fiscal capacity under different political and economic conditions.

The empirical analysis relied on cross-country panel data covering the period 2003–2024. Data on armed conflict were obtained from the UCDP/PRIO Armed Conflict Dataset, while indicators of digital government development were derived from the EGDI and its sub-indices (HCI, OSI, and TTI). Fiscal indicators and macroeconomic controls were collected from the World Bank Open Data database. The relationships were estimated using two-way fixed effects panel models with robust standard errors clustered at the country level, allowing the analysis to control for both country-specific structural characteristics and global time effects.

The results reveal several important patterns. First, economic development emerges as the strongest determinant of fiscal capacity, with the coefficient on GDP per capita ranging from 0.95 to 1.22 across models, indicating that a 1% increase in GDP per capita is associated with approximately a 0.95–1.22% increase in government revenues, depending on the revenue category. Second, the overall level of digital government development (EGDI) does not show a statistically significant direct effect on tax revenues or other fiscal indicators in most specifications. Third, the telecommunications infrastructure component displays a significant negative relationship with tax revenue ( $-0.362$ ;  $p = 0.005$ ) and revenue excluding grants ( $-0.349$ ;  $p = 0.011$ ), suggesting transitional fiscal effects associated with rapid digitalisation. Fourth, armed conflict shows limited direct effects, although weak evidence suggests that tax revenues may increase slightly during conflict periods ( $0.078$ ;  $p = 0.034$ ), potentially reflecting wartime fiscal mobilisation. Finally, some interaction effects indicate that conflict may weaken the fiscal effectiveness of digital governance, particularly in the case of revenue excluding grants ( $-0.238$ ;  $p \approx 0.10$ ) and online government services in social contribution systems ( $-0.959$ ;  $p \approx 0.075$ ).

These findings carry several important policy implications. First, digital government reforms should not be viewed as a standalone instrument for improving fiscal capacity. While digitalisation can enhance

administrative efficiency and transparency, its fiscal benefits depend on complementary institutional reforms, including modernised tax administration systems, improved regulatory frameworks for digital economic activities, and strengthened enforcement mechanisms. Second, governments should prioritise integrating digital infrastructure development with tax policy adaptation, particularly in response to the expansion of digital platforms, cross-border digital services, and new forms of economic activity that may escape traditional tax mechanisms. Third, in conflict-affected environments, the effectiveness of digital public administration may be constrained by institutional disruptions, damaged infrastructure, and weakened state capacity. Therefore, digital governance reforms in fragile contexts should be accompanied by targeted investments in institutional resilience, administrative continuity, and secure digital infrastructure. Finally, international cooperation and knowledge sharing remain crucial for strengthening fiscal institutions in the digital era, particularly for developing economies seeking to modernise public administration while maintaining stable revenue mobilisation.

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## REFERENCES

- Androniceanu, A., & Streimikiene, D. (2025). Reinventing public managers in the digital age: competencies and innovative governance models across the European Union. *Administratie si Management Public*, 45, 69-90. <https://doi.org/10.24818/amp/2025.45-04>
- Bartuseviciene, I., & Butkus, M. (2024). The effect of digital governance on the antifragile capabilities of public sector organisations. *Economics and Sociology*, 17(3), 41-61. doi:10.14254/2071-789X.2024/17-3/3
- Bilan, Y., Yurchyk, H., Samoliuk, N., & Mishchuk, H. (2025). Evaluating the effectiveness of public finance used for social protection of internally displaced persons. *Public and Municipal Finance*, 14(1), 23-40. doi:10.21511/pmf.14(1).2025.03
- Conley, L. (2025). Bridging Analog and Digital: A Case Study on Pandemic Accelerated Digital Disruption in Healthcare Retail. *Health Economics and Management Review*, 6(4), 11-27. <https://doi.org/10.61093/hem.2025.4-02>
- Crăciun, M.A., Dudian, M., and Lazăr, D.A. (2025). Nudging digital transformation: behavioral economics approaches to e-government adoption in the European Union with implications for Romania. *Administratie si Management Public*, 44, 60-74. <https://doi.org/10.24818/amp/2025.44-04>
- Damong, G. C. (2026). Revenue generation, collection efficiency, and fiscal sustainability: Evidence from a Philippine municipality. *Public and Municipal Finance*, 15(1), 14–26. doi:10.21511/pmf.15(1).2026.02
- Darmawati, D., Mediawati, E., & Dewi, A. R. S. (2025). Bibliometric analysis of digital financial reporting: a comprehensive review of research trends and emerging topics. *Journal of Business Economics and Management*, 26(1), 49–68. <https://doi.org/10.3846/jbem.2025.23054>
- Davies, S., Pettersson, T., Sollenberg, M., & Öberg, M. (2025). Organized violence 1989–2024, and the challenges of identifying civilian victims. *Journal of Peace Research*, 62(4). URL: <https://ucdp.uu.se/downloads/#armedconflict>
- Eriqat, I. O. A., Khatib, S. F. A., Abbas, A. F., & Fayad, A. A. S. (2025). Does digital payments reduce the risk of money laundering? The role of financial sector development. *Journal of Business Economics and Management*, 26(4), 860–879. <https://doi.org/10.3846/jbem.2025.24402>
- European Commission. (2025). *2025 State of the Digital Decade package*. Shaping Europe’s digital future. <https://digital-strategy.ec.europa.eu/en/policies/2025-state-digital-decade-package>
- Gleditsch, N. P., Wallensteen, P., Eriksson, M., Sollenberg, M., & Strand, H. (2002). Armed conflict 1946–2001: A new dataset. *Journal of Peace Research*, 39(5), 615–637. URL: <https://ucdp.uu.se/downloads/#armedconflict>

- Guemou, A. (2024). The Significance of Digital Transformation in Enhancing the Battle Versus Corruption. *Business Ethics and Leadership*, 8(4), 1-15. [https://doi.org/10.61093/bel.8\(4\).1-15.2024](https://doi.org/10.61093/bel.8(4).1-15.2024)
- Huseynov, A., Balsalobre-Lorente, D., Hamidova, L., & Samedova, E. (2025). Challenges and opportunities of digital economy development: Case of Azerbaijan. *Problems and Perspectives in Management*, 23(2), 265–276. [https://doi.org/10.21511/ppm.23\(2\).2025.18](https://doi.org/10.21511/ppm.23(2).2025.18)
- International Monetary Fund (IMF). (2024). Fiscal Monitor: Putting a Lid on Public Debt. Washington, DC: IMF, October. URL: <https://www.imf.org/-/media/files/publications/fiscal-monitor/2024/october/english/text.pdf>
- Jareño, F., Tolentino, M., & Fernández, M. del V. (2025). Energy-agriculture market linkages: Asymmetric effects in the context of the Russia-Ukraine conflict. *Oeconomia Copernicana*, 16(1), 163–196. <https://doi.org/10.24136/oc.3313>
- Jarzębowski, S., Bozhenko, V., Didorenko, K., Tkachenko, O., Blyznyukov, A., Melnyk, M., & Cieslik, J. (2024). The Impact of Digitalisation on the Competitiveness of European Countries. *SocioEconomic Challenges*, 8(3), 238–261. [https://doi.org/10.61093/sec.8\(3\).238-261.2024](https://doi.org/10.61093/sec.8(3).238-261.2024)
- Kerimov, P. (2025). Assessing the progressivity of the Ukrainian tax system. *Public and Municipal Finance*, 14(4), 94–107. doi:10.21511/pmf.14(4).2025.07
- Khatami, F., Ferraris, A., Palmucci, D. N., & Dabić, M. (2024). Impact Analysis of the Digital Entrepreneurial Ecosystem to Improve the Tourism Industry and Social Sustainability. *Journal of Tourism and Services*, 15(29), 176–205. <https://doi.org/10.29036/jots.v15i29.831>
- Kisefáková, D., Košíková, M., Miškuřová, M., & Loumová, V. (2024). Driving factors of the digital economy – how countries can manage their digital development. *Polish Journal of Management Studies*, 29(2), 311–327. <https://doi.org/10.17512/pjms.2024.29.2.16>
- Kovac, N., Žmija, K., Roy, J. K., Kusa, R., & Duda, J. (2024). Digital divide and digitalization in Europe: A bibliometric analysis. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 19(2), 463–520. <https://doi.org/10.24136/eq.2899>
- Krawczyk, D., Zhanseitova, G., Zakharkin, O., Zhytar, M., Dotsenko, T., Vovk, I., & Vasylieva, T. (2025). Determinants of anti-money laundering system's effectiveness in Ukraine: Insights from factorial and regression analysis. *Public and Municipal Finance*, 14(2), 146–170. [https://doi.org/10.21511/pmf.14\(2\).2025.13](https://doi.org/10.21511/pmf.14(2).2025.13)
- Kuanaliyev, A., Taubayev, A., Kunyazov, Y., Ernazarov, T., Mussipova, L., & Saduakassova, A. (2024). Digital and economic transformation in the public administration system. *Montenegrin Journal of Economics*, 20(3), 63–78. <https://doi.org/10.14254/1800-5845/2024.20-3.5>
- Kuzior, A., & Sira, M. (2025). Sustainable Digital Economy Transformation Through Intelligent Automation: A Multi-Environmental Framework for Strategic Decision-Making. *Sustainability*, 17(17), 7723. <https://doi.org/10.3390/su17177723>
- Kuzior, A., Vasylieva, T., Kuzmenko, O., Koibichuk, V., & Brožek, P. (2022). Global Digital Convergence: Impact of Cybersecurity, Business Transparency, Economic Transformation, and AML Efficiency. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(4), 195. <https://doi.org/10.3390/joitmc8040195>
- Lyeonov, S., Draskovic, V., Kubaščíková, Z., & Fenyves, V. (2024). Artificial intelligence and machine learning in combating illegal financial operations: Bibliometric analysis. *Human Technology*, 20(2), 325–360. <https://doi.org/10.14254/1795-6889.2024.20-2.5>
- Makarenko, I., Steiner, B., Yuhai, K., & Makarovych, V. (2025). The role of sector-specific SDG policies, governance quality and finance for SDG progress. *Economics and Sociology*, 18(4), 11–39. doi:10.14254/2071-789X.2025/18-4/1
- McCoy, E. (2025). How Cybersecurity Leadership Became the New Critical Managerial Competency in Healthcare Administration. *Health Economics and Management Review*, 6(2), 50–59. <https://doi.org/10.61093/hem.2025.2-04>
- Mishchuk, H., Czarkowski, J. J., Neverkovets, A., & Lukács, E. (2023). Ensuring Sustainable Development in Light of Pandemic “New Normal” Influence. *Sustainability*, 15(18), 13979. <https://doi.org/10.3390/su151813979>
- Mtengwane, G. (2024). Experiences and challenges of digital transformation in the informal business sector in a rural South African town. *International Journal of Entrepreneurial Knowledge*, 12(2), 1–16. <https://doi.org/10.37335/ijek.v12i2.195>

- Nessipbay, O., Tagabay, B., Serikova, M., Zhagyparova, A., Basshieva, Z., & Sembiyeva, L. (2024). Analysis of the impact of tax administration on the balance of the state budget in the context of the country's economic development. *Montenegrin Journal of Economics*, 19(3), 235–246. <https://doi.org/10.14254/1800-5845/2024.20-3.17>
- Nghia, T., & Hang, T. (2025). The impact of technology on tax evasion: an empirical study in ASEAN countries. *Polish Journal of Management Studies*, 31(1), 199-212. <https://doi.org/10.17512/pjms.2025.31.1.11>.
- Ntuli, F., Ntshangase, B. A., & Msosa, S. K. (2025). Innovative Financial Management Reforms: A Catalyst of Good Governance in the South African Public Sector. *Financial Markets, Institutions and Risks*, 9(4), 16-29. [https://doi.org/10.61093/fmir.9\(4\).16-29.2025](https://doi.org/10.61093/fmir.9(4).16-29.2025)
- Obeng, C., & Attor, C. (2022). Interconnection among cryptocurrencies: using vector error correction model. *International Journal of Entrepreneurial Knowledge*, 10(2), 24–41. <https://doi.org/10.37335/ijek.v10i2.157>
- Pakhnenko, O., Yarovenko, H., Semenog, A., Mordan, Y., & Tarasenko, O. (2025). Uncovering patterns of digital transformation of European economies using self-organizing maps. *Problems and Perspectives in Management*, 23(3), 581–596. [https://doi.org/10.21511/ppm.23\(3\).2025.42](https://doi.org/10.21511/ppm.23(3).2025.42)
- Paraschiv, D.M., Muhammad, A., Petrariu, I.R., Gheorghe, M., Dieaconescu, R.I. and Istudor, M., 2024. Shaping Europe’s Digital and Sustainable Future: Analysis of the Digital Economy and Society Index in the Pre- and Post-Pandemic Period. *Amfiteatru Economic*, 26(Special Issue No. 18), 1012-1030. DOI: <https://doi.org/10.24818/EA/2024/S18/1012>
- Reswita, Y., Lukman, S., Febrianto, R., & Adrianto, F. (2026). Ownership structure, digital transformation, and corporate tax avoidance: Evidence from Indonesia. *Investment Management and Financial Innovations*, 23(1), 347–359. [https://doi.org/10.21511/imfi.23\(1\).2026.26](https://doi.org/10.21511/imfi.23(1).2026.26)
- Rivero del Paso, L., Pattanayak, S., Uña, G., & Tourpe, H. (2023). Digital solutions guidelines for public financial management (IMF Technical Notes and Manuals No. 2023/07). International Monetary Fund. <https://www.imf.org/-/media/files/publications/tnm/2023/english/tnmea2023007.pdf>
- Ruthvika, J., & Hedau, A. (2025). Digital Inclusion and Economic Equity: Evaluating the Role of Business Analytics in Overcoming Socioeconomic Challenges. *SocioEconomic Challenges*, 9(4), 150-164. [https://doi.org/10.61093/sec.9\(4\).150-164.2025](https://doi.org/10.61093/sec.9(4).150-164.2025)
- Samarkhanov, A., Junusbekova, G., Kenzhin, Z., & Yesmagambetov, D. (2025). The impact of socio-economic and political factors on the development of e-government in developed and developing countries. *Problems and Perspectives in Management*, 23(4), 554–565. [https://doi.org/10.21511/ppm.23\(4\).2025.38](https://doi.org/10.21511/ppm.23(4).2025.38)
- Shao, X. and Chen, S., 2024. Research on Tax Compliance Incentive Effects of Platform Companies from the Perspective of Incomplete Contract – An Empirical Study Based on China. *Amfiteatru Economic*, 26(65), pp. 330-344. DOI: <https://doi.org/10.24818/EA/2024/65/330>
- Sibt-e-Ali, M., Xia, X., Yi, W., & Vasa, L. (2025). Quantifying the role of digitalization, financial technology, governance and SDG13 in achieving environment conservation in the perspective of emerging economies. *Environment, Development and Sustainability*. <https://doi.org/10.1007/s10668-024-05940-4>
- Slyusarevskyy, M. M., & Chunikhina, S. L. (2025). The Russian–Ukrainian War as a Social Situation. *European Journal of Interdisciplinary Studies*, 17(1), 88–100. <https://doi.org/10.24818/ejis.2025.06>
- Stănescu, R.-D. (2024). The Endeavor to Develop the Public Administration: Innovation as an Alternative Approach for Future Advancements. *European Journal of Interdisciplinary Studies*, 16(2), 144–154. <https://doi.org/10.24818/ejis.2024.16>
- Tsymbal, L., & Demediuk, A. (2025). Economic Security of Ukraine Under War: A Foreign Trade Perspective. *Safety and Security Advances*, 1(1), 63-78. [https://doi.org/10.61093/ssa.1\(1\).63-78.2025](https://doi.org/10.61093/ssa.1(1).63-78.2025)
- Ualtayev, M., Ualtayeva, A., Kaliyeva, S.A. & Vasa, L. (2024). Problems and prospects for legal regulation of innovations in digital and information technologies of the labour market in Kazakhstan. *Transformations in Business & Economics*, 23(3), 325-344.
- Ugulava G. (2026). Two Faces of Decline in Public Governance: Accountability Erosion and Rent-Seeking. *Public Governance, Regulation and Law*, 2(1), 20-32. [https://doi.org/10.61093/pgrl.2\(1\).20-32.2026](https://doi.org/10.61093/pgrl.2(1).20-32.2026)

- United Nations, Department of Economic and Social Affairs (United Nations). (2024). *United Nations e-government survey 2022: Accelerating Digital Transformation for Sustainable Development*. United Nations. <https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2024>
- Uppsala University. (n.d.). *UCDP Dataset Download Center*. UCDP - Uppsala Conflict Data Program. <https://ucdp.uu.se/downloads/>
- Valaskova, K., Juracka, D., Nagy, M., & Chaudhuri, S. (2025a). Digital readiness across the European Union: A multidimensional empirical assessment of structural determinants, intra-regional disparities, and strategic implications in the era of Industry 5.0. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 20(3), 1035-1086. <https://doi.org/10.24136/eq.3886>
- Valaskova, K., Nagy, M., Figura, M., & Rousek, P. (2025b). Res publica digitalis: The uneven digital transformation of the European public sector and the impact of policy disparities on governance, service efficiency, and socioeconomic inclusion. *Oeconomia Copernicana*, 16(3), 1177-1260. <https://doi.org/10.24136/oc.3866>
- Vasylieva, T., Kasperowicz, R., Tiutiunyk, I., & Lukács, E. (2023). Transparency and trust in the public sector: Targets and benchmarks to ensure macroeconomic stability. *Journal of International Studies*, 16(4), 117-135. doi:10.14254/2071-8330.2023/16-4/8
- World Bank. (2021). *GovTech maturity index: The state of public sector digital transformation*. International Bank for Reconstruction and Development / World Bank. <https://documents1.worldbank.org/curated/en/495831623303257484/pdf/GovTech-Maturity-Index-The-State-of-Public-Sector-Digital-Transformation.pdf>
- World Bank. 2024. *World Development Report 2024: The Middle-Income Trap*. Washington, DC: World Bank. doi:10.1596/978-1-4648-2078-6
- World Bank. (2025). *Global Economic Prospects, June 2025*. Conference edition. Washington, DC: World Bank. URL: <https://openknowledge.worldbank.org/server/api/core/bitstreams/35bb4b31-e9b0-4a1e-8c6c-df4336558673/content>
- World Bank. (n.d.-a). *E-Government Development Index (EGDI)*. World Bank Data360. [https://data360.worldbank.org/en/dataset/UN\\_EGDI](https://data360.worldbank.org/en/dataset/UN_EGDI)
- World Bank. (n.d.-b). *World Bank Open Data*. <https://data.worldbank.org/indicator>
- Yarovenko, H., Kuzior, A., Norek, T., & Lopatka, A. (2024). The future of artificial intelligence: Fear, hope or indifference?. *Human Technology*, 20(3), 611-639. <https://doi.org/10.14254/1795-6889.2024.20-3.10>
- Yarovenko, H., Bilovodska, V., Bylbaz, R., Pankiv, O., Baghirzade, M., Niemi, O., & Djakons, D. (2025a). Digital Readiness of European Countries to Combat Corruption and Cyber Threats: Panel Analysis. *Business Ethics and Leadership*, 9(2), 238-265. [https://doi.org/10.61093/bel.9\(2\).238-265.2025](https://doi.org/10.61093/bel.9(2).238-265.2025)
- Yarovenko, H., Ohol, D., Ashirbekova, L., & Popp, J. (2025b). Digital transformation and economic development in Europe: Classical and machine-oriented approaches. *Journal of International Studies*, 18(4), 256-284. doi:10.14254/2071-8330.2025/18-4/13
- Yefimenko, A., Boronos, V., Serpeninova, Yu., & Koldovskiy, A. (2025a). Innovative and Technological Determinants of Corruption Reduction: How do Knowledge and Technology Contribute to Public Integrity and Transparency?. *Knowledge Economy and Lifelong Learning*, 1(1), 21-34. [https://doi.org/10.61093/kell.1\(1\).21-34.2025](https://doi.org/10.61093/kell.1(1).21-34.2025)
- Yefimenko, A., Malaniuk, V., Bagirzadeh, M., Duranowski, W., Djakona, A., Celika, M., & Kalenyuk, I. (2025b). Can Digitalisation and Technological Development Reduce Corruption? Evidence from a Structural Analysis in Ukraine. *Business Ethics and Leadership*, 9(2), 266-287. [https://doi.org/10.61093/bel.9\(2\).266-287.2025](https://doi.org/10.61093/bel.9(2).266-287.2025)
- Zámek, D., Zakharkina, Z. (2024). Research Trends in the Impact of Digitization and Transparency on National Security: Bibliometric Analysis. *Financial Markets, Institutions and Risks*, 8(1), 173-188. [https://doi.org/10.61093/fmir.8\(1\).173-188.2024](https://doi.org/10.61093/fmir.8(1).173-188.2024)
- Zozulinsky, A. (2024). The Financial, Economic and Social Consequences of the Russo-Ukrainian War: Bibliometric Analysis. *Financial Markets, Institutions and Risks*, 8(3), 134-162. [https://doi.org/10.61093/fmir.8\(3\).134-162.2024](https://doi.org/10.61093/fmir.8(3).134-162.2024)

**Appendix A. Descriptive Statistics**

Table A1

Descriptive statistics for variables used in the tax revenue model

Variable	N	Mean	SD	Median	Min	Max	Skew	Kurtosis
EGDI	1387	0.55	0.22	0.54	0.00	0.98	-0.09	-0.78
EGDI_HCI	1387	0.75	0.20	0.80	0.00	1.00	-1.21	1.41
EGDI_OSI	1387	0.50	0.26	0.48	0.00	1.00	0.08	-0.99
EGDI_TTI	1387	0.39	0.28	0.35	0.00	1.00	0.31	-1.16
Tax revenue (trillion LCU)	1387	5.47	32.4	0.111	0.000084	659.0	11.00	159.16
GDP per capita (million LCU)	1387	1.52	5.20	0.0511	0.36	51.5	5.32	32.73
Armed conflict dummy	1387	0.14	0.34	0	0	1	2.12	2.49

Table A2

Descriptive statistics for variables used in the revenue excluding grants model

Variable	N	Mean	SD	Median	Min	Max	Skew	Kurtosis
EGDI	1387	0.55	0.22	0.54	0.00	0.98	-0.09	-0.78
EGDI_HCI	1387	0.75	0.20	0.80	0.00	1.00	-1.21	1.41
EGDI_OSI	1387	0.50	0.26	0.48	0.00	1.00	0.08	-0.99
EGDI_TTI	1387	0.39	0.28	0.35	0.00	1.00	0.31	-1.16
Revenue excluding grants (trillion LCU)	1387	9.99	62.00	0.165	0.000094	1030.00	10.33	128.22
GDP per capita (million LCU)	1387	1.52	5.20	0.054	0.36	51.50	5.32	32.73
Armed conflict dummy	1387	0.14	0.34	0	0	1	2.12	2.49

Table A3

Descriptive statistics for variables used in the social contributions model

Variable	N	Mean	SD	Median	Min	Max	Skew	Kurtosis
EGDI	872	0.63	0.18	0.63	0.00	0.98	-0.34	-0.42
EGDI_HCI	872	0.82	0.15	0.86	0.00	1.00	-1.77	4.56
EGDI_OSI	872	0.59	0.23	0.59	0.00	1.00	-0.13	-0.86
EGDI_TTI	872	0.48	0.26	0.50	0.01	1.00	-0.03	-1.19
Social contributions (trillion LCU)	872	2.40	14.00	0.03	542	184.00	8.77	86.41
GDP per capita (million LCU)	872	1.81	6.09	0.05	0.36	51.50	4.76	25.04
Armed conflict dummy	872	0.14	0.35	0	0	1	2.06	2.24

Table A4

Descriptive statistics for variables used in the customs revenue model

Variable	N	Mean	SD	Median	Min	Max	Skew	Kurtosis
EGDI	1080	0.50	0.20	0.49	0.00	0.96	0.16	-0.55
EGDI_HCI	1080	0.72	0.20	0.76	0.00	1.00	-1.08	1.23
EGDI_OSI	1080	0.45	0.25	0.43	0.00	1.00	0.27	-0.83
EGDI_TTI	1080	0.34	0.26	0.27	0.00	1.00	0.61	-0.74
Customs and import duties (trillion LCU)	1080	0.42	2.58	0.007	-0.0008	56.70	14.88	270.17
GDP per capita (LCU)	1080	1.84	5.78	0.071	0.36	51.50	4.75	25.67
Armed conflict dummy	1080	0.16	0.37	0	0	1	1.80	1.26

## Appendix B

Table B1

Country fixed effects from the revenue model

Country	Fixed Effect	Country	Fixed Effect	Country	Fixed Effect
Afghanistan	14.8899	Gabon	13.1158	North Macedonia	13.2032
Albania	13.3540	Georgia	13.6211	Norway	14.6655
Andorra	10.1355	Germany	16.9310	Palau	8.3661
Angola	15.6309	Ghana	15.2465	Panama	13.2999
Argentina	15.8431	Greece	15.2636	Papua New Guinea	14.2874
Armenia	13.4280	Guatemala	14.3396	Paraguay	13.8378
Australia	15.5282	Guinea-Bissau	12.4166	Peru	15.5000
Austria	15.0948	Honduras	14.3544	Philippines	16.4049
Azerbaijan	15.1902	Hungary	15.1329	Poland	16.3030
Bahamas	10.7974	Iceland	11.6193	Portugal	15.1024
Bahrain	12.3815	India	18.7418	Romania	15.5888
Bangladesh	16.4137	Indonesia	17.6291	Russian Federation	17.4779
Barbados	11.1092	Iran	16.8279	Rwanda	14.8607
Belarus	14.7998	Iraq	16.5305	Samoa	11.0971
Belgium	15.2485	Ireland	14.0210	San Marino	9.3896
Belize	10.9760	Israel	14.7391	Saudi Arabia	16.0456
Bhutan	11.7338	Italy	16.8921	Senegal	15.1960
Bolivia	14.5155	Jamaica	13.5091	Serbia	14.8411
Bosnia and Herzegovina	14.0523	Jordan	14.3612	Singapore	13.6888
Botswana	13.5753	Kazakhstan	14.8622	Slovak Republic	14.3869
Brazil	17.7970	Kenya	16.1651	Slovenia	13.6291
Bulgaria	14.6480	Kiribati	11.5176	Solomon Islands	12.1963
Burkina Faso	14.6492	Korea, Rep.	16.2636	Somalia	2.8597
Burundi	14.3518	Kyrgyz Republic	14.5789	South Africa	16.4433
Cabo Verde	11.5431	Lao PDR	13.8794	Spain	16.3471
Cambodia	14.3172	Latvia	13.2247	Sri Lanka	14.7124
Cameroon	15.1447	Lebanon	13.8353	St. Kitts and Nevis	9.4017
Canada	15.6236	Lesotho	13.5157	St. Lucia	10.3606
Central African Republic	12.7415	Lithuania	13.7101	St. Vincent and the Grenadines	10.1605
Chile	15.1681	Luxembourg	12.2417	Sudan	15.2827
China	18.9615	Madagascar	14.6491	Sweden	14.9783
Colombia	16.1987	Malawi	14.6173	Switzerland	14.0967
Congo, Dem. Rep.	15.6457	Malaysia	15.4810	Tajikistan	13.8921
Congo, Rep.	14.0657	Maldives	11.3654	Tanzania	15.7954
Costa Rica	13.9178	Mali	14.4852	Thailand	16.3437
Cote d'Ivoire	14.7764	Malta	11.9277	Timor-Leste	14.0247
Croatia	14.1947	Marshall Islands	9.4505	Togo	13.7150
Cyprus	12.6053	Mauritius	12.4673	Tonga	10.2234
Czechia	14.9820	Mexico	16.9852	Trinidad and Tobago	12.8853

Denmark	14.5651	Micronesia	10.1259	Tunisia	14.8696
Dominican Republic	14.1821	Moldova	13.5280	Turkiye	17.0300
Ecuador	15.5454	Mongolia	13.5980	Uganda	15.6591
Egypt	16.8072	Morocco	15.8473	Ukraine	16.4052
El Salvador	14.0394	Mozambique	15.6078	United Arab Emirates	12.7652
Equatorial Guinea	12.7967	Myanmar	15.3246	United Kingdom	16.8353
Estonia	12.9846	Namibia	13.3970	United States	17.8222
Eswatini	12.4937	Nauru	9.4971	Uruguay	13.7285
Ethiopia	15.7945	Nepal	15.1310	Uzbekistan	15.8458
Fiji	12.2597	Netherlands	15.6470	Vanuatu	11.1174
Finland	14.4651	New Zealand	14.1823	Zambia	14.6202
France	17.1179	Nicaragua	13.6886	Zimbabwe	14.5572



