



DOES E-GOVERNMENT FOSTER WELFARE? AN EMPIRICAL INVESTIGATION FOR DEVELOPING COUNTRIES

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ABSTRACT

In this study, the effect of e-government on welfare is examined using ordinary least squares estimations for developing countries. A cross-sectional data set was created by averaging the data available between 2003 and 2020. The study basically examines the transmission channels through which e-government affects welfare. These channels serve as crucial pathways that link e-government initiatives to welfare outcomes. By examining these channels, the study seeks to unravel the significance of e-government as a determinant of welfare. When the transmission channels are considered, e-government is an essential variable that explains welfare. According to the findings of the study, the most important channel through which e-government affects welfare is regulatory quality, which accounts for about 15% of the total impact. Furthermore, the study identifies corruption and political stability as additional channels through which e-government influences welfare. These channels, although accounting for a relatively smaller proportion of the total impact, still play significant roles in shaping welfare outcomes. Overall, the findings emphasize the multi-dimensional nature of e-government's impact on welfare. By considering various transmission channels, this study provides valuable insights into the mechanisms through which e-government initiatives can effectively improve overall welfare in developing countries.

Keywords: E-government, welfare, transmission channels, corruption, regulatory quality.

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E-DEVLET REFAHI TEŞVİK EDİYOR MU? GELİŞMEKTE OLAN ÜLKELER ÜZERİNE AMPİRİK BİR İNCELEME

ÖZ

Bu çalışmada, gelişmekte olan ülkeler bağlamında e-devletin refah üzerindeki etkisi sıradan en küçük kareler yöntemi kullanılarak incelenmiştir. 2003-2020 yılları arasında mevcut verilerin ortalaması alınarak kesitsel bir veri seti oluşturulmuştur. Çalışma temel olarak e-devletin refahı etkilediği aktarım kanallarını incelemektedir. Çalışma, bu kanalları inceleyerek e-devletin refahın bir belirleyicisi olarak önemini ortaya çıkarmayı amaçlamaktadır. Aktarım kanalları dikkate alındığında, e-devlet refahı açıklayan önemli bir değişkendir. Çalışmanın bulgularına göre, e-devletin refahı etkilediği en önemli kanal, toplam etkinin yaklaşık %15'ini oluşturan düzenlemelerin kalitesi kanalıdır. Ayrıca yolsuzluk ve siyasi istikrar değişkenleri de e-devletin refahı etkilediği diğer aktarım kanalları olarak incelenmiştir. Bu kanallar, toplam etkinin nispeten daha küçük bir oranını oluştursa da refah sonuçlarının şekillenmesinde hala önemli roller oynamaktadır. Genel olarak bulgular, e-devletin refah üzerindeki etkisinin çok boyutlu doğasını vurgulamaktadır. Bu çalışma, çeşitli aktarım kanallarını dikkate alarak, e-devlet girişimlerinin gelişmekte olan ülkelerde genel refahı etkili bir şekilde artırabileceği mekanizmalar hakkında önemli bilgiler sunmaktadır.

Anahtar Kelimeler: E-devlet, refah, aktarım kanalları, yolsuzluk, düzenlemelerin kalitesi

INTRODUCTION

E-government is defined as the use of information and communication technologies in the public sector. Hence, it is a valuable tool to eliminate the inefficiency caused by traditional paper-based systems (Khan et al., 2021). Integrating workflows, improving processing times, and providing open information transfers have become increasingly crucial in-service delivery processes. These developments have forced states to make changes in their service delivery processes. The rapid evolution and advancements in information and communication technology have affected society in many aspects. Citizens, corporations and the public sector expect efficient, effective, transparent, participatory, and personalized services that reduce administrative burdens from institutions. In this process, private enterprises and citizens rapidly regulate methods for receiving and providing services. Due to recent technological advancements, public institutions have also adapted their service delivery methods and formats. From the public's viewpoint, these structural changes have begun to contribute to many improvements, quality business, and functioning processes. In this sense, the e-government system forms the basis of the online service delivery processes of the public sector. Moreover, Saylam and Yıldız (2022) state that e-government is a tool that removes citizens from being passive in service procurement processes and empowers them more as active users and even co-producers of government information and services.

E-government refers to the government's use of technology, mainly web-based internet applications, to provide residents, business partners, employees, corporations, and public institutions with quick and effective access to government information and services (Layne & Lee, 2001). Decreased corruption levels, higher transparency, greater convenience, increased disposable income, and cost reductions in administrative transactions are several beneficial outcomes of e-government. E-government contributes to the development of the country, effective use of social and economic resources, and strengthens the trends towards increased transparency (Cho & Choi, 2004). E-government provides 24/7 access to government services, information and document management, and information sharing (Jaeger, 2002). Furthermore, e-government regulates and simplifies the government's activities for citizens and sharing information and correspondence among its institutions. Hence, as described by Helbig et al. (2009), e-government can be used as a policy tool to promote administrative reform.

E-government has several benefits. By enabling effective management of resources, e-government improves the efficient use of existing natural resources. As a result, the country's natural resources can be preserved for future generations (Castro & Lopes, 2021). Castro & Lope (2021) examined the effects of e-government on sustainable development. The findings suggest that e-government may enhance a country's economic, social, and environmental development on the path to sustainable development. E-government particularly increases the likelihood of achieving sustainable development in developing and transition economies. Other advantages of e-government include better service delivery to citizens, easier access to information, increased efficiency in business processes, lower costs, enabled participation in decision-making processes, improved the quality of life, supporting good management, ensuring accessibility, and facilitating interaction with citizens (Al-Khateeb et al., 2015; Asogwa, 2013; Basu, 2004; Layne & Lee, 2001; Ojha et al., 2008; Osei-Kojo, 2017; Shahkooh et al., 2008; Worldbank, 2015). In conclusion, e-government can be defined as a system that aims to increase access to public services, promote easy and direct interaction with the government (Sharma et al., 2021), and thereby promote good governance.

The purpose of this study is to investigate the relationship between e-government and welfare using data from developing and emerging countries. The research has two primary objectives. The first objective is to investigate the influence of the e-government development index on welfare utilizing the ordinary least square method for 128 developing and emerging countries. The second objective is to determine the possible transmission channels through which the impact of e-government on welfare occurs.

A sample of 128 developing and emerging economies was selected in

order to work with a more homogeneous sample in terms of development level and profile of countries. This homogeneity will allow us to assess the welfare effects of e-government more consistently. Another reason for selecting developing and emerging countries is to assess the potential for improving service quality and increasing social welfare through the widespread use of digital applications in these countries. The underlying logic is based on the idea that the effective utilization of e-government applications can serve as an alternative pathway for economic development in these countries.

This study makes important contributions to the existing literature in two main respects. First, it examines the relationship between e-government and welfare with a particular focus on developing and emerging countries. This categorization is important as it provides insights that may differ from studies conducted in developed countries. Second, the study aims to reveal the transmission channels through which the impact of e-government on welfare is realized. This is particularly original as it goes beyond a direct relationship and explores possible mechanisms through which e-government initiatives can affect the welfare of citizens in developing and emerging countries. This examination of transmission channels adds depth to the research and provides a clear understanding of the complex links between e-government and welfare.

The remainder of the paper is organized as follows: Section 2 involves the literature review. Section 3 presents the data and descriptive statistics. Section 4 provides a brief overview of the methodology based on cross-country regression. Moreover, the role of transmission channels in the e-government-welfare nexus is discussed in this section. Section 5 concludes the paper.

I. LITERATURE REVIEW

E-government may constitute direct and indirect effects on welfare. This section examines the impact of e-government on welfare through corruption, governance, transparency, and accountability channels.

Corruption may arise in various forms depending on the government structure and institutional culture of a society. Although there are studies indicating that corruption has positive effects on the economics of countries with weak institutional structures (see Acemoglu (1998) and Leff (1964), it generally harms the economic and social structure. According to Elbahnasawy (2014), for example, corruption suppresses investments, leading to a detrimental influence on economic growth. The following are the leading causes of the unfavorable effects of corruption:

- Distorts public spending and allocation of resources.
- Weakens public institutions, the enforceability of contracts, and property rights.
- Increases income inequality and poverty.
- Directs talented people towards rent-seeking activities.
- Increases economic inefficiency, the unpredictability of policies, and political instability.

Although there is considerable heterogeneity among countries, corruption generally occurs in public institutions. The main reason is the inadequacy of audits in public institutions, the excess of administrative burdens, and the arbitrary and asymmetric service procedures for citizens. Such corrupted practices are encountered, especially in tenders, recruitment processes, and public service delivery.

While the complex and vague rules and procedures in delivering public services create opportunities for corruption, standardized business processes prevent public officials from engaging in illegal activities such as bribery. E-government initiatives aim to simplify and standardize these bureaucratic processes, thereby reducing uncertainties and the possibility of corruption (Khan et al., 2021). E-government lowers interactions between corrupt officials and the public, resulting in greater openness and accountability. Andersen (2009) states that e-government implementation has significantly reduced corruption.

E-government contributes to the reduction of corruption in several ways. Many studies claim that e-government contributes significantly to removing corruption by simplifying processes, increasing reliance, and eliminating the need for an intermediary, mainly when citizens receive services from institutions. Table 1 summarizes several advantages of e-government.

TABLE 1 | Possible channels through which e-government reduces corruption

Advantages of e-government	Related studies
Increasing transparency and reducing the problem of asymmetric information	(Asogwa, 2013; Krishnan et al., 2013)
Limiting discretion	(Krishnan et al., 2013; Shim & Eom, 2008)
Limiting the possibilities for arbitrary treatment	(Shim & Eom, 2008)
Providing citizens with the ability to monitor government decisions and actions	(Krishnan et al., 2013)
Simplifying processes	(Khan et al., 2021; Shim & Eom, 2008)
Enabling the questioning of irrational procedures	(Khan et al., 2021; Krishnan et al., 2013)
Reducing the intermediate communication channels	(Khan et al., 2021)
Facilitating the audit process	(Al-Khateeb et al., 2015; Khan et al., 2021; Shahkooh et al., 2008)
Improving citizens' perceptions of transparency, efficiency, and corruption	(Khan et al., 2021)
Promoting good governance	(Garcia-Murillo, 2010)
Empowering reform-oriented authorities	(Garcia-Murillo, 2010)
Building trust	(Al-Khateeb et al., 2015; Shahkooh et al., 2008)
Reducing administrative and participation costs	(Asogwa, 2013; Khan et al., 2021)
Facilitating access to information	(Asogwa, 2013)
Reducing administrative burdens	(Author, 2021)

Park & Kim (2020) examine the relationship between e-government and corruption using data from a panel of 214 countries from 2003 to 2016. The findings show that e-government significantly reduces corruption. Pathak and Prasad (2005) found that e-government projects eliminate corruption in many areas and significantly reduce it in many others in their study for India. The decrease in corruption level led to a positive effect on social cohesion. Moreover, the authors concluded that e-government could be an effective tool in combating corruption and promoting social cohesion in developing countries. Other studies that emphasize the positive effects of e-government on the elimination of corruption include Ojha et al. (2008), Worldbank (2015), Abu-Shanab et al. (2013), and Elbahnasawy (2014).

In addition to the studies that mentioned the positive effects of e-government on corruption using an aggregate index, some studies consider the effect of specific applications of e-government on corruption. For example, Neupane et al. (2014) examined the effects of the public e-tender system on corruption. They state that the public e-tender system can help the government, bidders, and public tender practitioners fight against corruption. Furthermore, Shim and Eom (2008) state that e-participation will prevent corruption by increasing government transparency and accountability.

Another factor that has a positive impact on welfare is good governance. Good governance practices improve citizens' welfare by increasing citizens' trust in the state and establishing justice in service delivery processes. In general, a country's quality institutions and service processes may positively affect welfare, development, and investments. Castro and Lopes (2021) state that good management can promote sustainable development by contributing to effective resource allocation. In this context, e-government has the potential to play a critical role in ensuring good governance.

Alaaraj and Ibrahim (2014) empirically examined the impact of e-government practices on good governance using a survey among managers and employees of 600 SMEs in Beirut, Lebanon. The results of the study show that e-government applications, in general, have a positive and significant effect on good governance. Gupta et al. (2018) highlight four dimensions in a study examining the benefits of e-governance in India. These are economic benefits, service quality, governance quality, and personal development. In this context, the e-governance services provided by the New Delhi Municipal Council (NDMC) were selected. Perceptions of 515 people using e-governance services regarding the dimensions of e-governance benefits were examined. As a result, economic benefits were the most beneficial dimension of e-governance services. Service quality and governance quality are the other dimensions that e-governance contributes.

According to Rotchanakitumnuai (2013), e-governance not only improves efficiency and corporate performance but may also provide solutions to corruption, bureaucratic inefficiency and ineffectiveness,

nepotism, lack of accountability, and transparency. As a result, as stated by the United Nations (2020), the digitization of the state may create new opportunities to improve public administration and stimulate the economy.

The above-mentioned e-government-oriented literature is extended by adding the welfare dimension of e-government. Moreover, the literature is enriched by examining both the direct and indirect impact of e-government on welfare. In this context, the study adds a new dimension to the literature by contributing to a deeper understanding of the role of e-government on welfare.

II. DATA AND PRELIMINARY RESULTS

Table 2 contains information about the variables, abbreviations, and sources of data. A cross-sectional data set was created by averaging the data available between 2003 and 2020. The data for the e-government development index is obtained from the United Nations (UN) database¹. The index has a scale of 0 to 100, with a higher number indicating a higher level of e-government. The average prosperity index is used as a proxy for welfare. The data is obtained from the Legatum Prosperity Index². The corruption perceptions index published by Transparency International is used as a measure of perceived corruption in countries. The higher level of the index indicates a lower level of corruption. The political stability and regulatory quality series are obtained from the World Bank World Governance Indicator, with both series ranging from -2.5 to 2.5. A favorable outcome for a country is indicated by a higher level in either series, signifying the possession of a more stable political environment and a superior quality of regulations. Information about the unit of measurement, data source, and abbreviations of other explanatory variables are given in Table 2.

TABLE 2 | Variables and sources

Abbreviation	Variable	Unit of Measurement	Source of Data
W	Prosperity	0 - 100	Legatum Prosperity Index
Y	Per capita GDP	2010 constant US \$	WDI*
E	E-Government	0 - 100	United Nation
C	Corruption	0 - 100	Transparency International
S	Political Stability	-2.5 - 2.5	WDI
Q	Regulatory Quality	-2.5 - 2.5	WDI

* WDI stands for World Bank World Development Indicators database

Table 3 summarizes the correlation coefficients and descriptive statistics for the variables. The correlation analysis reveals a relatively high positive correlation between e-government and welfare. The other explanatory variables, such as per capita GDP, corruption, political

¹ The data set is constructed from "UN E-Government Surveys", please visit the website for details: <https://publicadministration.un.org/>

² Source: 2021 Legatum Prosperity Index™ (www.prosperity.com)

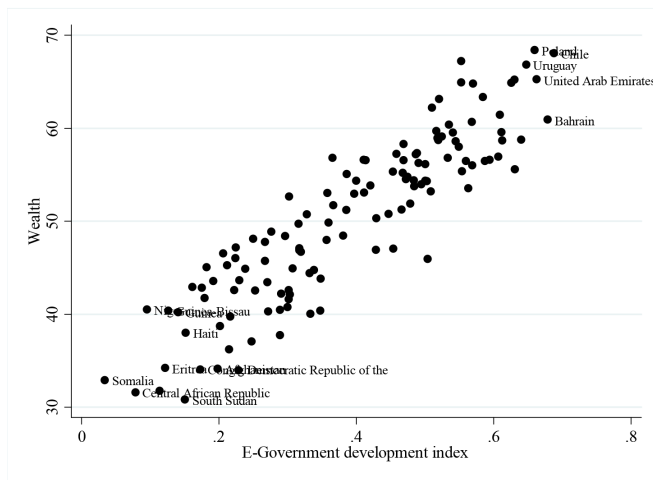
stability, and regulatory quality, also have a positive correlation with the dependent variable. As a rule of thumb, if the correlation between explanatory variables is higher than 0.80, then multicollinearity may present. The correlation between explanatory variables is below 0.80, except for the correlation between e-government and per capita GDP. The correlation between corruption and the regulatory quality index is slightly less than 0.80, which may lead to the multicollinearity problem. However, the variance inflation factor (VIF) is less than 5 for all explanatory variables. Therefore, the multicollinearity problem is not present in our empirical models. The findings of the study can be replicated and compared using a similar framework.

TABLE 3 | Descriptive statistics and correlations

Variables	W	Y	E	C	S	Q
W	1.000					
Y	0.519	1.000				
E	0.898	0.514	1.000			
C	0.761	0.499	0.600	1.000		
S	0.674	0.415	0.453	0.698	1.000	
Q	0.807	0.426	0.709	0.793	0.573	1.000
Obs.	128	126	128	127	128	128
Mean	50.462	5508.264	.393	34.383	-.50	-.462
Std. Dev.	8.959	8403.879	.158	12.362	.786	.68
Min.	30.786	227.038	.034	8.75	-2.652	-2.314
Max.	68.407	64873.44	.688	71.75	1.018	1.429

Figure 1 depicts the relationship between welfare and the e-government development index. As seen from Figure 1, there is a positive relationship between welfare and e-government.

FIGURE 1 | E-government and welfare



III. METHODOLOGY: CROSS-COUNTRY REGRESSION

$$W_i = \alpha_0 + \alpha_1 \ln(Y_i) + \alpha_2 E_i + \alpha_3 X_i + \varepsilon_i \quad (1)$$

where the subscript *i* shows each cross-section unit in the sample. The dependent variable W_i stands for welfare. $\ln(Y_i)$ and E_i indicates the logarithms of per capita GDP and e-government development index, respectively. X_i is a vector of explanatory variables that contains the possible transmission channels such as corruption, political stability, and regulatory quality.

We estimate Equation (1) by including different explanatory variables in the regression. Column (1) in Table 4 shows the results of the regression estimation, including the only log of per capita GDP and e-government development index as explanatory variables. The coefficients are statistically significant at 1% and bear the expected sign. This result indicates a substantial effect of the e-government development index on welfare. An increase of one standard deviation

in the e-government development index raises welfare by about 6.94 percent point per year³.

Column (2) of Table 4 shows the results of regression estimation, including all the explanatory variables except the e-government development index. Political stability and regulatory quality have a statistically significant positive sign with a coefficient of 1.903 and 5.290, respectively. An increase in political stability by one standard deviation, which is approximately 0.786 percent point, increases welfare by 1.50 percent point per year. The regulatory quality is found to be the most important factor in explaining disparities in welfare. An increase in the regulatory quality index by 0.680 percent point, one standard deviation, increases welfare approximately by 3.60 percent point per year. As the level of corruption index in a country increases, the corrupt activities decrease, which means that the country becomes more transparent. However, the coefficient of corruption is positive, but it is not statistically significant.

TABLE 4 | Regression results

	(1)	(2)	(3)
	W	W	W
ln(Y)	1.176** (2.86)	3.063*** (9.53)	0.455 (1.29)
E	43.92*** (13.26)		32.77*** (11.64)
C		0.0845 (1.86)	0.0776* (2.33)
S		1.903*** (3.41)	2.553*** (6.28)
Q		5.290*** (6.62)	2.070** (3.20)
Constant	23.96*** (9.91)	26.71*** (8.44)	33.52*** (13.81)
Observations	126	125	125
Adjusted R ²	0.812	0.828	0.916
Mean VIF	2.71	2.51	3.20

t statistics are in parentheses under the coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: Author's own calculations.

The last column of Table 4 presents the results of regression estimation, which includes all the independent variables, including the e-government development index. We observe that the coefficients of all variables have a decrease in their value, except political stability. Also, the logarithm of GDP becomes insignificant in this regression. The coefficient of the e-government development index in the last regression of Table 1 is 32.77 and dropped nearly by a factor of 25 % relative to the first regression. An increase in e-government development index by one-standard deviation rises welfare by 5.18 percent point. The decline in the share of the e-government development index on welfare can be explained by the fact that a large portion of the effect of e-government on welfare is transmitted through other channels. In the next section, the indirect effect of each transmission channel will be determined.

A. TRANSMISSION CHANNELS FOR E-GOVERNMENT

The coefficient of the e-government development index in column (3) of Table 4 can be interpreted as the direct effect of the e-government development index on welfare. The direct effect is the proportion of the total effect when none of the transmission channels are included in the regression equation. In this section, corruption, political stability, and regulatory quality are considered as the transmission channels through which the e-government development index can affect welfare. Equation (2) is used to calculate the indirect effect of the e-government development index.

³We follow Pellegrini (2011:58) for this calculation. Multiply the standard deviation of the e-government development index (0.158) with its coefficient of (43.92); that is $0.158 * 43.92 = 6.94$.

$$X_i = \beta_0 + \beta_1 \ln(Y_i) + \beta_2 E_i + \mu_i \quad (2)$$

We estimate Equation (2) is for each variable in the X_i vector. The coefficients β_1 and β_2 capture the effect of per capita GDP, and e-government development index on the vector of dependent variables X_p , respectively. μ_i is the vector of residuals.

TABLE 5 | Indirect transmission channels

	(1)	(2)	(3)
	C	S	Q
ln(Y)	1.524 (1.07)	0.244** (3.19)	-0.0133 (-0.22)
E	37.47*** (3.73)	0.750 (1.30)	3.085*** (6.47)
Constant	7.807 (0.95)	-2.707*** (-5.95)	-1.557*** (-4.75)
Observations	125	126	126
Adjusted R ²	0.358	0.244	0.494
Mean VIF	2.72	2.71	2.71

t statistics are in parentheses under the coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Author's own calculations.

1. The Corruption Transmission Channel

E-government can eliminate possible acts of corruption by presenting applications that may be subject to corruption through fast and reliable online platforms. Corruption can create additional costs, and it is unlikely that the work and transactions made with bribery will be implemented easily. All of these can negatively affect the ease of doing business and the life quality of society. Column (1) of Table 5 presents the results of the corruption transmission channel. E-government development index has a positive and statistically significant effect on corruption level. A one-standard-deviation increase in the e-government development index increases the index of corruption level by 5.92 percent point. The reduction in corruption by this level increases the welfare by 0.46 percent point per year⁵.

2. The Political Stability Transmission Channel

Political instability reduces the motivation of the people and causes them to worry about the future. This has a detrimental impact on people's well-being and happiness. E-government services can make government administrative acts more reliable, transparent, and predictable. This, in turn, may reduce potential instability by allowing people to maintain continued trust in government. Column (2) of Table 5 presents the effect of e-government on political stability. The results show that e-government has a positive effect on political stability. A one-standard-deviation increase in e-government development index raises the political stability index by 0.12 percent point. This leads to a 0.31 percent point increase in welfare per year.

3. The Regulatory Quality Transmission Channel

The World Bank defines regulatory quality as "the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development." Putting these regulations into service with e-government applications will enable the private sector to benefit from these opportunities more easily. This, in turn, can contribute positively to welfare by increasing the ease of doing business for the private sector. The last column of Table 5 shows that a one-standard-deviation increase in the e-government development index is associated with an increase of 0.49 percent point in the regulatory quality of a country. This, in turn, leads to an increase in the welfare index by 1.01 percent per year.

B. DIRECT AND INDIRECT EFFECT OF E-GOVERNMENT

In this section, the direct and indirect effects of the e-government development index on welfare will be isolated. Additionally, the effect of each explanatory variable in the vector of X_i that are not explained by the e-government development index will be calculated. Following (Pellegrini, 2011, p. 63) we can obtain the direct and indirect effect of the e-government development index by substituting Equation (2) into Equation (1).

$$W_i = (\alpha_0 + \alpha_3 \beta_0) + (\alpha_1 + \alpha_3 \beta_1) \ln(Y_i) + (\alpha_2 + \alpha_3 \beta_2) E_i + \alpha_3 \mu_i + \varepsilon_i \quad (3)$$

α_2 , $\alpha_3 \beta_2$ in Equation (3) are direct and total indirect effects of the e-government development index on welfare. Table 6 presents the results of the regression estimation of Equation (3). Relative to the third regression estimation in Table 4, the coefficient of the e-government development index increased by a factor of one-third. A standard deviation increase in the e-government development index increases welfare by 6.95 percent point. A one standard deviation increase in all other explanatory variables leads to a smaller effect on welfare. The influence of other factors that are not included in the model to avoid possible multicollinearity problems is transmitted to a relatively greater effect of e-government. The coefficient ($\alpha_2 + \alpha_3 \beta_2$) of the Equation (3) capture the total effect of the e-government development index on welfare. The first component of the total effect (α_2) is the direct effect, the second component of the total effect ($\alpha_3 \beta_2$) is the contribution of each channel to the total effect. The relative contribution of each transmission channel is summarized in Table 7.

TABLE 6 | Welfare regression as in Equation 3

	W
ln(Y)	1.168*** (3.46)
E	43.97*** (17.33)
$\mu(C)$	0.0776* (2.33)
$\mu(S)$	2.553*** (6.28)
$\mu(Q)$	2.070** (3.20)
Constant	23.99*** (12.86)
Observations	125
Adjusted R ²	0.916
Mean VIF	2.20

t statistics are in parentheses under the coefficients. The standard deviations are in parentheses under the independent variables. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Author's own calculations.

The relative contribution of the direct effect of the e-government development index on welfare is 74.50 percent. Regulatory quality has the largest relative contribution to the total effect among the three channels. The relative contribution of corruption and political stability channels are 6.80 and 4.34 percent, respectively. Thus, a considerable effect of the e-government development index on welfare is transmitted through the regulatory quality variable.

TABLE 7 | The relative importance of transmission channels

Transmission Channels	The direct effect of the channel (α_2)	Effect of e-government on the channel (β_2)	Contribution ($\alpha_2 \beta_2$)	Relative contribution (%) $\left(\frac{\alpha_2 \beta_2}{\alpha_2 + \alpha_3 \beta_2} \right)_{100}$
E	-	-	32.77	74.50
C	0.08	37.47	3.00	6.80
S	2.5555	0.75	1.91	4.34
Q	2.071	3.09	6.40	14.56
Total Effect			44.08	100

Concluding Remarks

In this study, the direct and indirect effect of the e-government development index on welfare is investigated. The indirect effect is captured through corruption, political stability, and regulatory quality

transmission channels. The results show that the e-government development index has a positive impact on welfare. The findings show that among the three transmission channels, regulatory quality and corruption are the most important variables that are likely to promote the welfare of society. When considering the consequences of the e-government development index on these transmission channels, policymakers in countries with a low level of regulatory quality and high levels of corruption should strive to dispose of these distorting effects.

To enhance the positive impact of e-government on welfare, policymakers should focus on several key recommendations. Firstly, there is a need to expand training programs aimed at boosting technological and digital abilities among the population. This will empower citizens to effectively engage with online services. Additionally, optimizing the functionality of online services can significantly enhance the quality of regulations, thereby positively influencing welfare of the society. To promote a better knowledge of e-government, policymakers should implement awareness campaigns and disseminate informative content. Integrating digital governance courses into educational curricula is another critical step toward increasing public awareness. These policies are intended to leverage the multifaceted nature of e-government, eventually boosting prosperity, particularly in poor nations. Implementing these policies may have the potential to reduce corruption, improve governance, and boost prosperity, especially in developing countries.

Our findings stand out that advances in e-government applications have a favorable influence on other transmission channels as well as welfare. As a result, different dimensions should be considered when evaluating the contribution of e-government development to welfare. That is, examining transmission channels may help to create a more comprehensive view of the positive social impacts of e-government applications. However, the findings are instructive and preliminary in terms of practical policies. More extensive research, advanced methodologies, and a long series of e-government are required for more detailed and comprehensive results. Hence, this study can be extended in several ways. First, in-depth country-level research may be used to provide country-specific outcomes provided that e-government data is available. Second, E-government practices may affect the crime rate, total factor productivity, good governance, public expenditures of a country. Hence, the study can be extended by including more transmission channels in the model. Third, cross-sectional dependency and country heterogeneity may be addressed by using up-to-date panel data techniques to avoid the disadvantages of the OLS technique.

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