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Analyzing the achievement of the sustainable development goals (SDGs) in Saudi Arabia and the impact of the COVID-19 pandemic

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Abstract

Purpose – This paper aims to investigate the relationship between the Kingdom of Saudi Arabia (KSA)'s expenses in the health and social fields and the achievement of sustainable development goals (SDGs) 1 (elimination of poverty) and 3 (good health and well-being). This paper also examines the effects of the COVID-19 pandemic on these expenses and goals.

Design/methodology/approach – This paper observes the public expenses and the targets of the SDGs of KSA during 1981–2022. This paper tests the stationarity of the variables and then uses the ordinary least square model or the autoregressive distributed lag model, depending on the unit root test results. This paper also observes the change in target goals between the two years of the pandemic and the two preceding years.

Findings – The results show the influence of social expenditure on the progress of SDG-1, whereas the impact of health expenditure on SDG-3 is not significant. This paper also proves the impact of the pandemic on public expenses and social SDGs.

Practical implications – This paper attracts the attention of policymakers to the importance of assessing their SDG initiatives and the consequent outcomes. Additionally, this paper documents the initiatives for sustainable development in KSA, an important emerging country. Given the universal nature of the SDGs and the importance of KSA as an economic power with a large youth human capital potential, the findings offer insights applicable beyond KSA and provide valuable lessons for governments worldwide regarding the optimization of public spending for SDG achievement. Moreover, monitoring SDG advancement in this important country helps assess the progress of the the United Nations (UN)'s 2030 Agenda for Sustainable Development. Therefore, This paper helps boost the completion of this agenda and contributes to the bottom-up approach of the UN 2030 Vision, implicating all categories of stakeholders, including the academic community.

Originality/value – This paper furthers the literature on SDG achievement by analyzing the relationship between public expenses and SDGs. This paper contributes to the debate concerning the best methodology suitable for SDG valuation and adds to the few studies using autoregressive tests. Moreover, this paper enriches the scarce studies dealing with emerging countries and reviews the assessment of SDGs in KSA. Additionally, this paper investigates the effect of the COVID-19 pandemic on the assigned resources for SDGs and, consequently, on the related indicator scores.

Keywords SDG, Health, Social, Public expenses, COVID-19

Paper type Research paper

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1. Introduction

The United Nations (UN) Sustainable Development Summit 2015 adopted 17 SDGs to guide global development over 15 years. These goals aim for a sustainable world by addressing poverty, environmental conservation, economic development, social sustainability and efficient governance (UN, 2020 SDGs; UNDP, 2020). Their achievement necessitates the implication of all stakeholders: governments, businesses, communities and individuals. State involvement in achieving SDGs includes laying the foundations and leveraging regulations, institutions and financial resources. Accordingly, the progress of SDGs is influenced by government initiatives and resource allocation (Alinska *et al.*, 2018). For instance, the promotion of budgets and activities within social and healthcare institutions plays a significant role in realizing social objectives, such as eradicating poverty (SDG-1) and ensuring good health and well-being (SDG-3).

Some papers examined the impact of assigned funds on some SDGs, mainly poverty elimination (SDG-1) and hunger eradication (SDG-2) (Pradhan *et al.*, 2023; Osuji and Nwani, 2020). However, few studies focused on the effect of government expenses on meeting the targets of other social SDGs, notably mortality rates and the tuberculosis success rate (SDG-3). In addition, the effects of the COVID-19 pandemic on government spending and SDGs remain largely unexplored. Furthermore, there is a shortage of literature conducted in the context of emerging countries, such as the Kingdom of Saudi Arabia (KSA). Nevertheless, the study in this country is crucial given the integration of the SDGs into its Vision 2030 framework and the implementation of significant policies in alignment with the UN 2030 Agenda. Indeed, the UN report on SDG achievement in KSA documented that Saudi Vision 2030 is grounded in the principles of the 2030 Agenda, adapted to the specific circumstances of the nation (Kuncic, 2021). Due to its pivotal economic and political role in the region, the SDGs' performance in this state would catalyze the advancement of other countries in the region and beyond.

Regarding the selection of the best methodology, Guariso *et al.* (2023) argued that it is intricate because efficient budgeting for the 17 SDGs is inherently challenging. Many interactions between policy issues can confuse the impact of government frames on development indexes. This connectedness complicates the choice of the appropriate methodology. Most empirical studies considered growth regressions to investigate the influence of allocating decisions on economic growth (Neduziak and Correia, 2017; Bojanic, 2013; Yilmaz, 2018). To simultaneously study all development indicators together, other papers used agent computing (Guerrero and Castañeda, 2022; Guerrero *et al.*, 2023). A few papers used vector auto-regression (Balaev, 2019).

In short, we can state that despite KSA's extensive initiatives to align with the 2030 UN Agenda and its importance as an economic power with substantial human capital, empirical evidence of its progress toward SDGs is scarce. Hence, this research aims to explore the performance of SDGs in KSA, especially the social goals SDG-1 and SDG-3. Furthermore, there is a dearth of studies linking social SDGs to their corresponding public resources and investigating the impact of the COVID-19 pandemic on this association. Our study addresses this gap and verifies the relationship between social SDG performance and related social public expenditure during 1995–2021. We also investigate the impact of the COVID-19 pandemic on social resource allocation and SDG achievement. Furthermore, we contribute to the debate concerning the best methodology for SDG valuation, and we enrich the limited literature using autoregressive tests in this context. After controlling for stationarity, we perform the autoregressive distributed model (ARDL) to analyze the effect of social expenses on social SDGs.

Our results show a significant impact of public social expenses on the poverty index, which confirms previous research showing that a rise in government expenditure on social issues enhances SDG initiatives (Pradhan *et al.*, 2023; Bissio, 2019; Schröder *et al.*, 2020; Hametner and Kostetckaia, 2020; Gaspar *et al.*, 2019). However, we did not find a significant relationship between health expenses and SDG-3. This result is contrary to the work of

Osuji and Nwani (2020), who documented a significant association between Nigerian health performance and government expenditure strategies. Contrary to Talukder *et al.* (2022) and Elavarasan *et al.* (2022), we found that social expenses and the poverty index decreased significantly during the COVID-19 pandemic.

Our findings hold several theoretical and practical originalities. First, we contribute to the limited literature on SDG-1 and SDG-3 and their association with related public expenses. This aligns with the bottom-up approach of the UN 2030, which involves diverse stakeholders, including the academic community. Second, our empirical valuation would be insightful for decision-makers, helping them improve resource allocation strategies for better SDG achievement. Considering the universal nature of SDGs, this study might also offer insights applicable beyond KSA and provide valuable lessons for governments worldwide regarding optimizing public spending for SDG achievement. Third, our results suggest an evaluation framework for assessing the progress of the UN 2030 Agenda. This is particularly pertinent due to KSA's status as a major economic power, ranking among the top 20 countries globally, and its preeminent human capital potential with a substantial youth population. Indeed, the progress of SDGs in this standing part of the world contributes to global progress. Furthermore, we enrich the methodological approach by using the ARDL model to address the potential non-stationarity problem. Finally, we contribute to improving our understanding of the impact of the pandemic COVID-19 on public social expenditure and related SDGs.

The rest of the paper is structured as follows. Section 2 analyzes the conceptual framework and literature review. Section 3 introduces the methodology, and Section 4 discusses the results. Finally, Section 5 presents the conclusion.

2. Conceptual framework and literature review

2.1 The theory of sustainable development

The sustainable development theory emerged in the 1980s, addressing the balanced development of the economy, environment and society. Primarily, the theory focused on three pillars: people, the planet and profits. As over the years, greater attention was paid to policy, governance was added as the fourth pillar of sustainable development (Mensah, 2019; Ndlovu *et al.*, 2020; Acuto, 2020).

In September 2000, the United Nations Millennium Summit adopted the millennium development goals (MDGs) with the principal aim of eliminating extreme poverty. These objectives became an internationally approved pattern for directing national development and partnerships and provided a framework for the development of humanity (Longyu *et al.*, 2019). These goals lasted until 2015, at which point the United Nations General Assembly replaced them with the SDGs, closing the gaps in the MDGs and implementing the paradigm of development cooperation (Herrera, 2019). The SDGs adopt a bottom-up approach that implicates all categories of stakeholders, involving governments, civil society, businesses, international institutions and the academic community (Hummel and Szekely, 2022; United Nations General Assembly, 2015). There are 17 goals based on five pillars: planet, people, peace, prosperity and partnership. Countries are assumed to achieve these goals using strategic programs that balance economic development, social equity and environmental quality (Krsailnikova *et al.*, 2020). This requires an integrative structure and collective planning that joins the initiatives of several stakeholders through the use of ambitious and action-oriented strategies. This role returns to governmental institutions.

2.2 The institutional theory

The first institutional perspective, historical institutionalism, suggests that public policy issues are not just channeled by the interests or preferences of the strongest social forces.

They are also conducted through past and existing agreements. In contrast, the sociological approach interprets institutionalism widely and adds moral models, symbols and cognitive systems to formal procedures and rules (Scott and Meyer, 1994). Alternatively, new institutionalism models support a perspective of democratic order in which responsibility is an outcome of the institution of the citizens, individuals are equal, free and discipline-oriented actors, and governance is instructed and rule-restricted (Olsen, 1998, 2010). These schemes are currently influenced by the emergence of international standards used as norms for good production (Brunsson and Jacobsson, 2000). For instance, SDGs are international standards recommending that all stakeholders, notably public institutions, develop frames that integrate sustainable targets. Alinska *et al.* (2018) and Osuji and Nwani (2020) stress the role of public sector institutions in achieving the SDGs. This responsibility is completed by the partnership of the private sector. The necessary financial resources are derived from both public expenditure and the financial sector.

Our study delves into the association between Saudi government expenditures in the health and social sectors and the social objectives outlined in SDG-1 and SDG-3. Therefore, it underpins the sociological approach, exploring how social structures and norms influence social goals. Furthermore, public institutions' efforts toward the SDGs emphasize responsible and sustainable practices that contribute positively to society and the environment. Therefore, our paper is also grounded in the new institutionalism approach, as universal organizations invite public institutions to establish frameworks that integrate international norms aimed at sustainable targets. Accordingly, our paper is also founded on the theory of sustainable development.

2.3 The impact of the COVID-19 pandemic

The COVID-19 pandemic has exerted a unique impact on the progress of the SDGs. This significant influence might either speed up the progression by resolving specific challenges or impede advancement by increasing the challenges. Alternatively, the pandemic can be considered as an opportunity to address key SDG challenges by analyzing the changes that emerged within this defined period and realigning the trajectory toward SDGs (Elavarasan *et al.*, 2022; Fenner and Cernev, 2021). Zhou and Moinuddin (2021) suggest that fostering the progression of affected SDGs and all environmental goals can put them back on track. Other authors document that adhering to the sustainable dimension of environmental, social and governance moderated the adverse financial effects of the crisis. Furthermore, firms hedged against COVID-19 by showing their commitment to sustainable initiatives and ethical conduct during turbulent periods (Al Amosh and Khatib, 2023a, 2023b). Similar to several other countries, KSA, faced revenue disruption, primarily stemming from oil price fluctuations. This breakdown impacted the government's spending capacity and, accordingly, the allocation of resources toward sustainability initiatives. Furthermore, additional healthcare expenses, due to the pandemic, induced higher allocated resources for medical infrastructure and healthcare services. This increased expenditure affected the government's budget allocation and, hence, other areas associated with the SDGs. This shift in resource allocation would impact the country's progress toward SDGs.

2.4 The assessment of sustainable development goals in KSA

Kuncic and Sosa Andrés (2021) analyzed the efforts of KSA in SDG initiatives in a report published by the United Nations. We review the main assessments of this report related to the social goals addressed in our study SDG-1 and SDG-3. Regarding the social objectives, the KSA covers the fundamental living needs of all families within the Kingdom (SDG-1). Current income statistics show a positive trend: the monthly income of Saudi households grew from Saudi Riyal 10,723 in 2013 to 11,494 in 2018. Concerning the healthcare system (SDG-3), the government has invested heavily in expanding quality infrastructure. Indeed, the sector has continually been the top beneficiary of government expenditures. As a result, access to hospital facilities has increased, with three-quarters of the population residing within 5 km of a health facility. Furthermore, preventive care measures, such as high vaccination rates, have led to a significant decline in infant mortality (18.9 in 2000, compared to 6.0 in 2018). In addition, life expectancy at birth reached 75.2 years in 2020 and is expected to reach 78.4 years for men and 81.3 years for women by 2050 (The King Khalid Foundation, 2019).

2.5 The research gaps

As suggested by institutional theories and the sustainable development theory, the government is responsible for investing in strategies that promote human conditions. Previous literature has examined the performance of SDGs and their association with government expenditure. The first stream of studies investigated the achievement of the SDGs as a whole. Bissio (2019) studied the correlation between the Human Development Index and the Global SDG index for a sample of the top and bottom 10 ranked countries in 2019. He found a significant correlation and concluded that richer countries more frequently achieved SDGs. Hametner and Kostetckaia (2020) used the European Union (EU) SDG indicator set developed by Eurostat in 2017 to investigate the progress of the EU Member States toward SDG. They documented that countries labeled "SD leaders" demonstrated minimal additional progress in reaching the SDGs, while significant advancements were observed for lower-scoring countries. Gaspar *et al.* (2019) estimated the annual increase in spending necessary to achieve significant progress toward SDGs for 155 countries. They documented that the average additional spending needed by emerging economies corresponded to approximately 4% of GDP, while this rose to approximately 15% of GDP in developing countries. Sachs *et al.* (2021) examined SDG achievement for 193 countries during 2015–2020, noting significant progress in low- and middle-income countries, particularly in East and South Asia. Although Africa's scores remained comparatively low, the region registered substantial improvements across several SDGs. On the other hand, despite starting with the highest average scores, OECD countries showed relatively limited progress. They concluded that SDG achievement requires a significant increase in social expenditure. Using variance decomposition, vector auto-regression and impulse response estimation techniques, Leventon *et al.* (2021) compiled an exhaustive study that addressed the leverage points for sustainability transformation and argued that governments prefer to allocate most of their funds to SDGs that are easy to achieve relative to those necessitating significant transformation. Alinska *et al.* (2018) proxied SDG development in Poland to GDP growth for the period 2007–2015 and found that growth was driven by total general government expenditure, the final consumption expenditure of households and total general government revenue. Guerrero *et al.* (2023) focused on the impact of international aid on SDG achievement in recipient countries for the period 2000–2013. They provided evidence of the favorable effect of the aid as a proportion of government expenditures, especially for Asian and African countries. Guariso *et al.* (2023) showed that the agent-computing simulations proved a significant impact of public spending on SDG achievement in Mexico during 2008–2020.

According to these previous studies, there is some evidence of the effect of public expenses on the progress of the SDGs. However, an important limitation is the difficulty of dealing with all the goals together. Moreover, proxying all the goals with only one global indicator makes it hard to identify the specific low- or high-scored targets behind poor or high performance. These limitations were addressed by the second stream of studies focusing on specific SDGs, especially social goals related to poverty, social conditions and health. Pradhan *et al.* (2023) used OLS to prove the positive impact of government expenditure in India on the reduction of the multi-poverty index during 2006–2022 extended to 2030, using forecasting scenarios. Schröder *et al.* (2020) integrated circularity indicators into the Human Development Index to overcome the limitations of the existing human development approach. These limitations include the lack of criteria for long-term environmental sustainability essential for preserving nature, which is the fundamental basis of human existence. This integration will expand the implementation of SDGs related to human development, particularly SDGs 1, 3, 4, 5 and 10. Osuji and Nwani (2020) proved that health and education depend positively on the Nigerian government's expenditure strategy for the period 2000–2018. Hogan *et al.* (2018) computed a health service coverage index using geometric instruments for 183 countries during 2010–2015. They documented that this index increased life expectancy by 21 years on average. Subramanian *et al.* (2023) proved that the majority of Indian districts (over 75%) are not targeted by key SDG metrics like poverty, access to basic services, anemia, stunting the growth of children, child marriage, domestic violence and tobacco consumption. Kherbache and Oukaci (2020) found that the decrease in Algerian real investment since 2009, with an increased funding gap from 201.49% to 385.6%, engendered uncertainty about the accomplishment of sanitation targets. These studies underscore the relevant and accurate insights gained by focusing on individual SDGs rather than examining all SDGs collectively. This permits the identification of the specific goal contributing to either good or poor sustainable performance. However, a more precise investigation involves examining the specific targets within each goal to identify the dimensions responsible for high or low SDG achievement.

In sum, the literature review documents some evidence of the impact of government expenses on social SDGs. However, there is a dearth of literature addressing its effect on health targets. Moreover, to our best knowledge, no prior research has explored the association between public expenditures and social SDGs in emerging markets, especially in KSA. Despite the extensive sustainable initiatives, economic significance and preeminent youth population of this country, the gap remains unaddressed. We aim to contribute to bridging this gap and investigate the impact of Saudi public expenses on advancing social goals related to poverty and health. Therefore, we address two hypotheses:

H1. There is a significant impact of social expenses on the progress of SDG-1: poverty elimination.

H2. There is a significant impact of health expenses on the progress of SDG-3: good health and well-being.

The third area of the literature regarding SDG achievement examined the impact of the pandemic COVID-19 on the SDGs. Some studies examined the effects on specific fields of the SDGs. Le Quéré *et al.* (2020) proved a global decrease in CO2 emissions of countries worldwide by 4 to 7% in 2020 compared to 2019, attributed to behavior change, notably reduced mobility. Wang and Han (2021) used a sector-based international matrix to prove that both external and internal carbon emission indices of most countries diminished as a consequence of carbon reduction in the US. Other authors conducted bibliometric analyzes and literature reviews. Wang and Huang (2021) showed that the pandemic had a positive effect on 14 SDGs while harming 17 SDGs. Tonne (2021) proved that COVID-19 exposed vulnerabilities in human development and society and compelled governments to improve sustainability decisions. Talukder *et al.* (2022) demonstrated that COVID-19 hampered SDG progress, impacting six pivotal aspects: economic, social, environmental, political, technological and public health. Additional literature compared sustainability scores before and after the pandemic. Fulzele *et al.* (2021) surveyed and analyzed the opinions of Indian stakeholders about the impact of the pandemic on SDGs. They proved a significant positive effect on SDG-7, a negative impact on SDG-13 and static progress on SDG-9. Elavarasan *et al.* (2022) compared the scores of SDGs before and after the pandemic. They highlighted that SDG-1 is the most impacted objective, with a score of 0.69, followed by SDG-8, with a score of 0.55. Only SDG-14 showed a slight positive effect, with an impact score of – 0.04. Elsamadony *et al.* (2022) observed 65 indicators across 72 countries for the period from April 2020 to February 2021. Their findings reveal the detrimental effects of the pandemic on affordable and clean energy (SDG-7), gender equality (SDG-5), sustainable cities and communities (SDG-11), responsible consumption and production (SDG-12) and decent work and economic growth (SDG-8), with global scores estimated to be −0.21, −0.38, −0.22, −0.16 and −0.28, respectively. Finally, other authors proved that the pandemic boosted sustainability disclosure. Mintah and Gulko (2023) used content and financial analysis of eight British airline firms over 16 years to prove that the pandemic has significantly increased environmental disclosures. El-Feel *et al.* (2024) applied comparison tests on 1,984 firms from 47 countries from 2014 to 2020 and revealed that more socially responsible firms tend to show more honest and transparent disclosure.

As evidenced by this review, some studies assess the impact of COVID-19 by comparing average SDG scores before and after the epidemic. Other authors performed panel regression analysis on two subperiods one before and another after the pandemic. However, they did not examine the effect of the pandemic on public expenses for funding SDG initiatives. Given that our study relies on time series observations from a single country, it is unfeasible to apply our econometric model to the postcrisis period of 2020–2021 due to the limited number of observations (only two). Therefore, to analyze the effect of the pandemic, we introduce a dummy variable with a value of 1 for the pandemic years 2020 and 2021 and 0 otherwise. Additionally, we compare the average SDG scores of two subphases – before and during the epidemic. We set hypothesis *H3*:

H3. The COVID-19 pandemic hampered the social public expense scores and therefore related SDGs, poverty elimination (SDG-1) and good health (SDG-3).

3. Applied methodology

3.1 Sample

We select KSA as our sample study considering its significant economic stature, substantial youth human capital potential and extensive initiatives toward achieving SDGs. We observe government expenditure on health and social affairs, relating them to specific targets. We consider the mortality rates of infants, adult females and adult males, along with the poverty index. We collected all available data from the World Bank database for health indicators spanning from 1981 to 2021 and for social indicators from 1995 to 2021. To meet the required minimum of 30 observations for the time series, we add the five available observations collected from the Ministries of Social Affairs and Finance.

3.2 Variables

We test two hypotheses regarding the association between public expenditures and two specific social SDGs: SDG-1 – Poverty Elimination and SDG-3 – Good Health and Well-being. Accordingly, the dependent variables are public expenditure allocated to poverty and health, while the independent variables are SDGs 1 and 3. We choose the most relevant and readily available metrics from the World Bank database to measure the progress of these goals. We investigate a third hypothesis, testing the impact of the COVID-19 pandemic on government expenditure and SDGs 1 and 3. We include a dummy variable set at 1 for the years 2020 and 2021 related to the crisis period and 0 otherwise. Table 1 outlines the measures of the dependent and independent variables.

3.3 Equations

To assess the first two hypotheses, we observe the relationship between public expenses and SDG scores over a time series during 1995–2021. In this specification, the relationship between the dependent and independent variables may not be properly specified in the static linear regression. We use the autoregressive dynamic model (ARDL) to test non-static relationships in historical data. Initially, we perform the augmented Dickey–Fuller test to investigate the variables' stationarity. If all variables are stationary at level 0, we use ordinary least squares (OLS). However, if the variables show stationary at levels 0 and 1, we use ARDL. We investigate long- and short-run linear relationships using equation (1):

$$\mathrm{d}(\mathrm{indicator}_{\mathrm{t}}) = \mathrm{a}_1 + \sum \alpha_i \,\mathrm{d}(\mathrm{indicator}_{t-\mathrm{i}}) + \sum \beta_i \,\mathrm{d}(\mathrm{Expenditure}_{t-\mathrm{i}}) + \gamma_1 \mathrm{Expenditure}_{t-1} + \gamma_2 \mathrm{indicator}_{t-1} + \varepsilon_{\mathrm{t}} \tag{1}$$

- Where "Expenditure" states for the public expenses, "indicator" is the metric measuring the related SDG, "a_1" is the intercept term, α_i, and β_i stand for the short-term relationship, γ_1, and γ_2 represent the long-term relationship, "i" ranges from 1 to the maximum used lag, "d = 1−C", where C symbolizes the lag operator, and "εt" signifies the residual term. Pesaran *et al.* (2001) suggest the bound test to investigate cointegration among variables, indicating a stable, long-term relationship. There is a cointegrating relationship if the F statistic exceeds the upper critical value.

To further investigate the impact of COVID-19 on SDGs (*H3*), we divide the period study into two phases before and during the pandemic. Following previous literature, we introduce a dummy variable, taking the value of 1 for the years of the pandemic (2020 and 2021) and 0 otherwise. We also compare average SDG scores before and during the crisis. Considering the significant change in SDG scores over time and for an accurate comparison with the two available observations during the crisis, we compute the percentage change of average SDG scores for two subperiods: 2018–2019 and 2020–2021.

Dependent variables	SDG1	SDG3
Measures (indicator)	Poverty index	Mortality rate of infant Mortality rate of adult female Mortality rate of adult male Tuberculosis treatment success rate
Independent variables	Social expenses	Health expenses
Measure (expenditure)	Social expenditure growth	Health expenses growth
Dummy variable	Takes the value of 1 for the years 2020 and 2021 related to the period of crisis and 0 otherwise	

Source: Authors' creation

Table 1.
Variable measures

4. Results

4.1 Descriptive statistics

Table 2 shows that while the maximum health expense growth is 0.26, indicating considerable attention to health expenditure, the minimum stands at −0.44. This variability indicates a non-static trend, with occasional increases and decreases. In addition, the standard deviations for mortality rates of infants, adult females, adult males and tuberculosis treatment success rates (16.75, 27.05, 37.29 and 10.92) significantly exceed those of other target indicators. Indeed, over the past 30 years, mortality ratios of males, females and infants have substantially decreased from 223, 168 and 64, respectively, to 98, 78 and 6. Simultaneously, the tuberculosis treatment success rate rose from 56 to 90. These trends highlight KSA's efforts in the health sector, resulting in reduced mortality ratios and improved tuberculosis treatment success rates, and consequently higher performance of SDG-3. Concerning the poverty index, it has decreased from 19.50 to 14.70, suggesting significant actions undertaken by the country toward ending poverty (SDG-1).

4.2 Results of the health objective

We first test the stationarity of the variables from 1981 to 2021.

As shown in Table 3, the dependent variable, the growth of current health expenditure and the independent variables related to mortality rates and tuberculosis success rate are all stationary at level 0. Therefore, OLS is deemed appropriate.

Table 4 reveals that, during 1981–2021, there is not any significant relation between health expenditure growth and mortality rates, as well as the tuberculosis treatment success rate. Consequently, hypothesis *H1* is rejected, indicating no significant impact of the growth of health expenditure on the mortality rates of infants, males and females or the tuberculosis treatment success rate. This finding does not support the sociological perspective suggesting sustainable actions by governmental institutions to contribute to society's well-being. It does not align with the new institutionalist approach and the sustainable development theory, as we did not find any significant impact of the expenditure of public health organizations on sustainable targets related to health goals. We can explain this result by the variability in health expenditure growth, which is not consistently positive; notably, the minimum is negative. Indeed, large investments in health infrastructure are not constant over time. Accordingly, there are potentially longer-term associations between the variables. This finding may also stem from the intricacies of the health systems, where other factors, such as healthcare policies, socioeconomic factors, education and environmental conditions, influence indicators. Despite this statistically insignificant result, the UN report documents a significant drop in infant mortality and a considerable increase in life expectancy as a consequence of massive investment and commitment to healthcare

Variables	Mean	Median	SD	Minimum	Maximum
Health expenses growth	0.024	0.001	0.144	−0.166	0.444
Social expenditure growth	0.06	0.08	0.14	−0.20	0.301
Poverty index	18.63	18.5	1.46	15.60	22
Mortality rate of infant	6.45	6.45	0.21	6.30	6.60
Mortality rate of adult female	109.64	108.64	27.05	78.39	168.48
Mortality rate of adult male	140.88	135.45	37.29	98.11	223.39
Tuberculosis treatment success rate	72.67	72	10.92	56	90

Source: Authors' creation

Table 2. Descriptive statistics

Table 3. Results of stationarity tests

Variable	Levels of stati.	t-stat.	Prob.	Critical values
Health expenditure	0	−3.76	0.0129	1% level −3.89 5% level −3.05 10% level −2.66
Mortality rate of adult male	0	−3.91	0.0044	1% level −3.60 5% level −2.94 10% level −2.607
Mortality rate of adult female	0	−3.24	0.025	1% level −3.60 5% level −2.94 10% level −2.607
Mortality rate of infant	0	−2.9	0.054	1% level −3.61 5% level −2.94 10% level −2.61
Social expenditure growth	0	−4.56	0.0013	1% level −3.71 5% level −2.98 10% level −2.63
Poverty	1	−3.42	0.0515	1% level −3.71 5% level −2.98 10% level −2.63

Source: Authors' creation

Table 4. Results of the impact of health expenditure on SDG3

$$\text{Indicator}_t = \alpha_i + \beta_i\,(\text{Health expenditure growth}_{t-1}) + \varepsilon_t$$

Dependent variables indicator$_i$	Independent variable health expenditure growth			
Tuberculosis treatment success rate	65.27 (0.597)			
Mortality rate of adult male		108 (0.5402)		
Mortality rate of adult female			93.6 (0.5402)	
Mortality rate of infant				8.82 (0.66)
R-squared	−51.58	−77.61	−77.44	−10.89
Adjusted R-squared	−51.58	−77.61	−77.44	−10.89

Source: Authors' creation

(Kuncic and Sosa Andrés, 2021). Descriptive statistics in Table 2 further demonstrate the country's commendable performance in health metrics, with a significant decrease in mortality rates and a substantial rise in tuberculosis treatment success. These results contrast with the work of Osuji and Nwani (2020), who demonstrated a positive association between Nigerian health performance and government expenditure strategy.

4.3 Results of the social objective

As indicated in Table 3, the dependent variable, social expenditure growth, has a stationarity level of 0, while the poverty rate is stationary at the first level. Consequently, the ARDL test is deemed appropriate.

The results of the bound test document that the F statistic 10.26 exceeds the critical values I0 = 4.94 and I1 = 4.79 at the 1% level. Consequently, the long-run ARDL is adopted, covering the entire study period 1990–2021. Table 5 confirms a significant relationship between social expenditure growth and the poverty rate in the long-run. The coefficient of the lagged social expenditure growth is negative and significant. Consequently, hypothesis *H2* is accepted: the growth of social expenses contributes to a decrease in poverty. However, emphasizing direct causation requires a deeper theoretical and empirical investigation. Other factors may also influence poverty reduction, such as economic growth, demographic shifts, innovation, technological advances and political stability. This result aligns with the descriptive statistics documenting recent positive performance in the poverty index, which decreased from 20 to 15. Furthermore, it is consistent with previous literature showing that an increase in government expenditure on social issues promotes human development and consequently SDG initiatives (Pradhan *et al.*, 2023; Bissio, 2019; Schröder *et al.*, 2020; Hametner and Kostetckaia, 2020; Gaspar *et al.*, 2019).

From a theoretical standpoint, this finding first corroborates the sociological perspective because higher public expenses signal better social welfare programs that meaningfully impact society and reduce poverty rates. Second, our evidence validates the new institutionalist approach, thereby emphasizing the institutional capacity to overcome socioeconomic challenges and address poverty. Third, our results align with sustainable development theory, as sufficient public resources are directed toward poverty alleviation programs, thus boosting SDG-1: poverty eradication.

From a practical perspective, these results confirm the assessment of Saudi SDGs in the UN report, arguing that KSA covers fundamental living needs and that current statistics on income show a positive trend (Kuncic and Sosa Andrés, 2021). Indeed, increased social expenditure indicates extensive social welfare programs such as unemployment benefits, adequate training and assistance in securing employment, family initiative funding and social allowances (Saudi Unified National Platform, 2024).

4.4 Results of the impact of the pandemic

Table 5 documents the negative significance of the coefficient of dummy variables measuring the effect of the pandemic on the poverty index. However, it was not possible to

$$\mathrm{d(Poverty\ index}_t) = a_1 + \sum \alpha_i\,\mathrm{d(Social\ Expenditure\ growth}_{t-1}) + \sum \beta_i\,\mathrm{d(Poverty\ index}_{t-1}) + \gamma_1\,\mathrm{Social\ Expenditure\ growth}_{t-1} + \gamma_2\,\mathrm{Poverty\ index}_{t-1} + \mathrm{Dummy\ Covid} + \varepsilon_t$$

Independent and constant variables	Coefficient	Std. error	t-Statistic	Prob.*
C	3.9	1.03	3.79	(0.0009)*
Poverty (−1)	−0.209	0.053	−3.95	(0.0006)**
Social expenditure Growth (−1)	−2.13	0.66	−3.25	(0.034)*
D(Social expenditure Growth)	−0.71	0.44	−1. 66	(0.13)
Dummy Covid	−0.69	0.242	−2.86	(0.086)*
Bound test	Value	Sig	I (0)	I (1)
F-statistic	10.26	10%	3.02	3.51
K	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58

Notes: **Significant at the 1% level; *significant at the 5% level
Source: Authors' creation

Table 5. Results of the impact of social expenditure on the poverty index

verify the impact of this dummy variable on health indicators due to the matrix singularity problem. Table 6 reports the variation in allocated resources and the target scores between the two years of the pandemic and the preceding two years, except for health expense variations because of unavailable data.

The most remarkable change is the decrease of 100% of the social expense growth. The mortality rate of infants and the index of poverty continued to decrease during the pandemic, with respective negative variations of −9.3% and −6%. Accordingly, hypothesis *H3* is supported for SDG-1 and SDG-3. During the COVID-19 pandemic, social expenses, the poverty index and mortality rates decreased significantly. The decrease in social expenses can be explained by the fact that the pandemic prompted governments, including KSA, to reallocate resources to address immediate healthcare needs and mitigate the economic fallout. This reallocation often led to a decrease in social expenses, as nonessential programs and services were temporarily put on hold. On the other hand, the government might have efficiently targeted resources to programs that directly address poverty, which would have minimized the impact of reduced spending on poverty reduction. The decrease in mortality rates may relate to robust governmental measures controlling the spread of the virus. Also, the pandemic accelerated the adoption of digital technologies in various sectors, potentially leading to more efficient and accessible services, notably in healthcare. Our findings are contrary to Talukder *et al.* (2022), who found that COVID-19 hampered SDG progress in social and public health areas. They also do not support Elavarasan *et al.* (2022), who highlighted that SDG-1 is the most affected goal.

4.5 Robustness check

We test the robustness of the ARDL model related to the impact of social expenditure on the poverty index by evaluating its performance over time. We conduct the recursive residual-based stability test (CUSUM), which evaluates changes in the estimated coefficients. Additionally, we perform the cumulative group test of the squares of the recursive residuals (CUSUM of Squares), which assesses the stability of the dispersion of residuals.

Figure 1 indicates that the CUSUM plot falls within the 5% critical region, suggesting no significant deviations from zero in the cumulative sum of residuals. This supports the stability of the model coefficients at the 5% significance level. Further, the CUSUM of the Squared plot mostly lies within the critical region, except for a small deviation in the second half of the period. This indicates no significant deviations from a constant level in the cumulative sum of squared residuals, confirming the stability of the dispersion of residuals at the 5% significance level. Overall, these results confirm the stability of the association between social expenditure and the poverty index.

Table 6. Variation before and after the pandemic

Variable average	Mortality rate of infant	Mortality rate of adult female	Mortality rate of adult male	Tuberculosis success treatment rate	School enrollment tertiary gender parity	Poverty	Social expenses growth	Gov. expen. education % GDP
Average before COVID-19	6.450	80.428	101.353	90	1.062	15.900	0.058	6.940
Average after COVID-19	5.850	84.579	104.151	90	1.036	14.950	−0.008	7.302
Variation	−0.093	0.052	0.028	0	−0.024	−0.060	−1.131	0.052

Source: Authors' creation

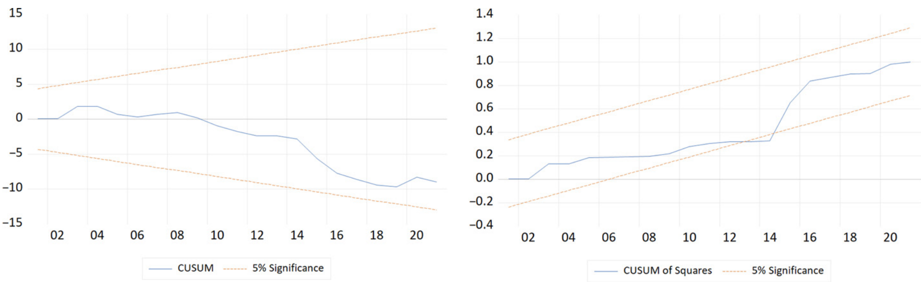
5. Concluding remarks

This paper investigates the impact of government expenditure on the performance of social SDGs in KSA. Our findings show that social and public expenses have played a role in reducing poverty. Therefore, the social welfare system, including financial social allowances, funding initiatives for productive families, unemployment benefits and adequate training, has efficiently helped poor and needy people improve their economic situation. On the contrary, despite showing favorable scores, mortality ratios and tuberculosis treatment success rates are not statistically associated with the growth of health expenses. Finally, we observed a complete decline of 100% in the growth of social expenses during the COVID-19 pandemic. However, the findings reveal a continued downward trend in the poverty index and mortality rates.

Our paper has many implications. From a theoretical standpoint, we enrich the existing literature on SDG achievement by investigating the impact of incremental public expenses. We support UN 2030 Vision's inclusive bottom-up approach, involving all stakeholder categories, including the academic community. In addition, we add to the limited literature dealing with emerging countries, notably KSA. Furthermore, we examine the effect of the COVID-19 pandemic on the resources allocated for SDGs and, consequently, on the target scores. Finally, we contribute to the few studies that used autoregressive models to examine SDG's performance.

From a practical perspective, we assess policymakers' interest and commitment toward SDGs. This evaluation would aid KSA in strategically allocating social resources. Furthermore, it would enhance targeted investments by identifying areas that require increased funding to accelerate SDG's progress. For instance, increasing the expenditure on healthcare and social issues is crucial to bolster SDG achievement. Understanding the relationship between expenditure and SDGs would also help policymakers in monitoring and enhancing the efficiency of existing social welfare programs with innovative approaches to maximizing the impact of government expenditure. These implications are also crucial for other countries in the Middle East and beyond. Given its economic prowess, coupled with its sizeable, dynamic youth population, KSA is positioned as a key player both regionally and globally. Its economic policies, societal developments and strategic decisions, especially those related to SDG achievement, would have implications that extend beyond its borders, making it a notable force of influence in the region and globally. Our analysis of the outcomes of its commitment to sustainable development offers valuable insights for other countries in the region and worldwide. Accordingly, it would catalyze and foster their partnerships and collaborative efforts to address shared challenges across borders. As KSA's advancements can also enhance SDGs' global standing, we contribute to achieving the UN 2030 agenda for SDG completion worldwide.

Our findings present some limitations due to the multifaceted relationship between public expenditure and SDG outcomes. Variables such as governance efficiency, socioeconomic



Source: Authors' creation

Figure 1. The results of the CUSUM test

disparities and cultural factors might significantly impact SDG performance, inducing complexities not adequately addressed in this study. This may explain the absence of a significant statistical relationship between health expenditures and SDG health metrics. Another limitation is the potentially lagged impact of public expenditure not captured by the econometric model. To address these limitations, we invite other researchers to include socioeconomic and cultural factors in their investigation of this association. We suggest they examine the complex relationship between the multiple variables using alternative models, such as structural equation modeling, machine learning techniques and instrumental variables. Furthermore, we propose extending the analysis to explore other SDGs and provide a more comprehensive sustainability assessment of KSA and other countries.

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