

Insights into Saudi Arabia's Economic Transformation: Renewable Energy, FDI, and GDP Dynamics

Nagwa A. Abdelkawy⁽¹⁾ Abdullah S. Alshamery⁽²⁾ Munira Z. Aljohar⁽³⁾

(Received: May 18, 2024 – Accepted for publication: July 28, 2024)

Abstract: This study analyzes the dynamic interplay among key economic indicators—Foreign Direct Investment (FDI), Exports (Exp), Government Consumption Expenditure (GC), and Renewable Energy consumption (RE)—and their effects on Saudi Arabia's Gross Domestic Product (GDP) from 2000 to 2021. Using a comprehensive econometric framework that includes Ordinary Least Squares (OLS) analysis, Vector Autoregression (VAR) models, and Granger Causality tests, this research uncovers the economic drivers shaping Saudi Arabia's Vision 2030. The study finds that FDI and renewable energy consumption significantly predict GDP growth. While many studies have explored the impact of various economic indicators on growth, definitive findings on their predictive relationships with GDP growth in Saudi Arabia are limited. This study fills this gap by highlighting significant predictive relationships, particularly how FDI and renewable energy consumption can drive GDP growth. The results suggest that policies promoting FDI, and renewable energy investments could greatly enhance Saudi Arabia's economic development, aligning with Vision 2030. A novel aspect of this research is its identification of structural changes in economic relationships following major renewable energy policy initiatives introduced in 2019-2020, providing empirical evidence of policy impacts on economic dynamics. These findings not only contribute to academic discussions on economic diversification but also offer actionable insights for policymakers to optimize Saudi Arabia's transition towards a more diversified and sustainable economy.

Key words: Economic Development, Gross Domestic Products (GDP), Foreign Direct Investment (FDI), renewable energy consumption, Saudi Arabia, VAR model, Granger Causality.

رؤى حول التحول الاقتصادي في المملكة العربية السعودية: ديناميات الطاقة المتجددة والاستثمار الأجنبي المباشر والنتائج المحلي الإجمالي

نجوى أمين عبد القوي⁽¹⁾ عبد الله سلطان الشمري⁽²⁾ منيرة زكي الجوهري⁽³⁾

(قَدِّمَ للنشر 1445/11/10 هـ - وقَبِلَ للنشر 1446/01/22 هـ)

المستخلص: تقدم هذه الدراسة تحليلاً للتفاعل بين المؤشرات الاقتصادية الرئيسية مثل الاستثمار الأجنبي المباشر، الصادرات، الإنفاق الحكومي، واستهلاك الطاقة المتجددة وتأثيرها على الناتج المحلي الإجمالي في السعودية من 2000 إلى 2021. باستخدام إطار اقتصادي شامل يتضمن تحليل المربعات الصغرى العادية، نماذج الانحدار الذاتي المتجه، واختبارات التسبب في غرانجر، تكشف الدراسة عن رؤى حول المحركات الاقتصادية التي تشكل رؤية السعودية 2030. على الرغم من وجود العديد من الدراسات التي تبحث في تأثير المؤشرات الاقتصادية المختلفة على النمو الاقتصادي، إلا أن الأدبيات حول المملكة العربية السعودية تفتقر إلى نتائج قاطعة بشأن العلاقة التنبؤية بين هذه المتغيرات ونمو الناتج المحلي الإجمالي. تسد هذه الدراسة هذه الفجوة من خلال الكشف عن علاقات تنبؤية هامة، وتسلط الضوء على الدور الحاسم للاستثمار الأجنبي المباشر واستهلاك الطاقة المتجددة في التنبؤ بنمو الناتج المحلي الإجمالي. وتشير النتائج إلى أن السياسات التي تشجع الاستثمار الأجنبي المباشر واستثمارات الطاقة المتجددة، يمكن أن تعزز وبشكل كبير التنمية الاقتصادية في المملكة العربية السعودية، بما يتماشى مع رؤية 2030. إن الحدائق الرئيسية في هذا البحث هي تحديده للتغيرات الهيكلية في العلاقات الاقتصادية بعد المبادرات السياسية الرئيسية للطاقة المتجددة التي تم تقديمها في 2019-2020، مما يوفر أدلة تجريبية على تأثير السياسات على الديناميات الاقتصادية. وتقدم هذه النتائج رؤى عملية لصانعي السياسات بهدف نقل المملكة نحو اقتصاد أكثر تنوعاً واستدامة. يساهم البحث في إظهار أهمية الاستثمار الأجنبي المباشر والطاقة المتجددة والحاجة إلى استراتيجيات اقتصادية معدلة تستجيب للاتجاهات المحلية والعالمية في الاستدامة.

الكلمات المفتاحية: التنمية الاقتصادية، الناتج المحلي الإجمالي، الاستثمار الأجنبي المباشر، استهلاك الطاقة المتجددة، المملكة العربية السعودية، نموذج VAR، السببية المتقدمة (جرانجر)...

(1) Assistant Professor, Economics Department, King Faisal University, Saudi Arabia. Email: nabelkawy@kfu.edu.sa

(2) Assistant Professor, Economics Department, King Faisal University, Saudi Arabia. Email: ashammre@kfu.edu.sa

(3) Researcher. Email: Munirahaljohar@gmail.com

(1) أستاذ مساعد في قسم الاقتصاد، جامعة الملك فيصل.

(2) أستاذ مساعد في قسم الاقتصاد، جامعة الملك فيصل.

(3) باحث.

1. Introduction

Saudi Arabia is at a crucial point in its economic development, driven by the ambitious goals of Vision 2030. This national agenda aims to diversify the economy and reduce reliance on oil revenue, requiring significant changes influenced by factors like Foreign Direct Investment (FDI), exports, government spending, and renewable energy. These factors are essential in shaping the economic landscape, presenting both opportunities and challenges in moving toward a more diversified and sustainable economy.

Historically, Saudi Arabia has heavily depended on oil exports, which constituted a significant portion of its GDP. However, recent years have seen a concerted effort to attract FDI to diversify the economy. John Dunning's Eclectic Paradigm (Dunning, 1980) explains this shift, highlighting how ownership, location, and internalization advantages drive FDI. According to the Ministry of Investment, FDI net inflows to Saudi Arabia increased by 21% year-on-year, reaching approximately SAR 105.2 billion in 2022 (Figure 1). This growth placed Saudi Arabia tenth among G20 countries for FDI net flows in 2022 and 16th for FDI balance (Saudi Central Bank, 2023). Key sectors attracting FDI include technology, renewable energy, and infrastructure. Renewable energy, especially solar and wind power, has also become a key focus of Vision 2030. The Diffusion of Innovations Theory by Everett Rogers (Rogers, 1962) explains how new technologies spread, aligning with the government's efforts to promote renewable energy and achieve widespread adoption. In 2019, major renewable energy projects like the Sakaka solar power plant and the Dumat Al Jandal wind farm were launched. The installed capacity of renewable energy in Saudi Arabia has been steadily increasing, with the government aiming to generate 50% of its electricity from renewable sources by 2030 (Vision 2030, n.d.).

The Structural Change Theory, developed by Arthur Lewis and expanded by Hollis Chenery (Lewis, 1954; Chenery, 1979), emphasizes the importance of moving from an oil-dependent economy to a diversified one. This theory stresses the role of investment in human capital, infrastructure, and technological innovation in driving economic transformation. For Saudi Arabia, this shift involves reducing dependence on oil revenues

and investing in renewable energy and high-tech industries to achieve sustainable economic growth.

Despite these efforts, there remains a gap in the comprehensive analysis of the combined effects of FDI and renewable energy consumption on Saudi Arabia's economic growth. Previous research has not definitively addressed the predictive relationships between these economic indicators and GDP growth. This study aims to fill this gap by providing new insights through advanced econometric models, revealing the dynamic relationships between FDI, renewable energy consumption, and GDP growth in Saudi Arabia. One novel contribution of this research is identifying structural changes in economic relationships following renewable energy policy initiatives, which previous studies have not extensively explored.

Saudi Arabia's economic transformation, guided by Vision 2030, aims to diversify the economy and reduce dependency on oil revenues. This transformation requires a deeper understanding of the interplay between FDI and renewable energy consumption, both critical drivers of sustainable economic growth. While significant progress has been made in attracting FDI and promoting renewable energy projects, a gap remains in comprehensively analyzing their combined effects on the economy. This study seeks to fill this gap by using advanced econometric models to explore the dynamic relationships between FDI, renewable energy consumption, and GDP growth in Saudi Arabia.

This study aims to achieve three primary objectives crucial for understanding and supporting Saudi Arabia's economic transformation under Vision 2030:

Firstly, analyze how FDI inflows contribute to GDP growth, informed by the Eclectic Paradigm. This objective is essential for informing policies that create a more favorable investment climate. Such policies could enhance regulatory frameworks and offer incentives to attract foreign investors, supporting economic diversification efforts.

Secondly, determine the extent to which renewable energy consumption influences economic performance and sustainability, guided by the Diffusion of Innovations Theory. The results from this assessment could advocate for policies that provide financial

incentives for renewable energy investments and reduce barriers to such investments.

Thirdly, explore the interactions between FDI, renewable energy consumption, and other key economic indicators, such as government consumption and exports, to understand their combined effects on Saudi Arabia's GDP from 2000 to 2021. Understanding these interactions is crucial for developing integrated economic strategies that promote both FDI and renewable energy as pillars of economic growth.

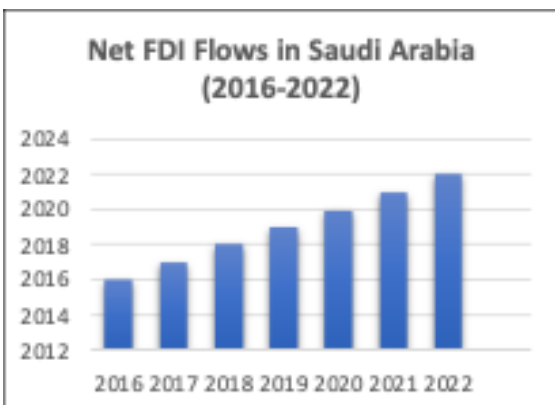
The study's outcomes aim to influence policy-making by highlighting the importance of FDI and renewable energy consumption. For example, the government could introduce incentives for foreign investments in renewable energy and streamline FDI regulatory frameworks.

This study significantly contributes to the literature on Saudi Arabia's economic development by identifying structural changes due to renewable energy policies, employing comprehensive econometric analysis, and providing actionable insights for Vision 2030. These recommendations are crucial as Saudi Arabia diversifies its economy and reduces reliance on oil revenues.

The paper is structured as follows: The literature review highlights existing research gaps. The methodology section details data sources and analytical techniques. The results section presents findings on GDP growth impacts and interactions among economic indicators. The discussion interprets results within Saudi Arabia's economic context and Vision 2030. Finally, the conclusion and recommendations summarize key findings and provide actionable policy recommendations.

Figure 1: Net Foreign Direct Investment in Saudi Arabia

Source: The figure was drawn by the authors using data from: Saudi Central Bank, "Monthly Statistics Bulletin," December 2023. Available here.



2.Literature Review

The economic diversification and sustainability goals of Saudi Arabia, as outlined in Vision 2030, have driven significant research into the roles of renewable energy and FDI in the kingdom's economic transformation. Recent studies provide valuable insights into these dynamics, highlighting key areas for further exploration and refinement.

Renewable Energy and Economic Growth

Recent research has advanced our understanding of the positive relationship between renewable energy consumption and GDP growth in Saudi Arabia. For example, Berradia, Abid, and Gheraia (2023) found a significant positive impact of renewable energy consumption on real GDP using advanced econometric techniques such as Bootstrap ARDL Bounds Testing. This study emphasizes renewable energy's role in economic diversification and sustainable development. Waheed (2023) also underscores the importance of both renewable and non-renewable energy sources in contributing to Saudi Arabia's GDP, advocating for balanced energy policies that promote sustainability alongside economic expansion.

Amran, Y. A., Amran, Y. M., Alyousef, R., and Alabduljabbar, H. (2020) provide a detailed analysis of renewable energy production in Saudi Arabia, emphasizing its alignment with Vision 2030's objectives. Their findings underscore the potential for renewable energy to drive economic growth and diversification, particularly as the country scales up projects like the Sakaka solar power plant and the Dumat Al Jandal wind farm.

The Oxford Institute for Energy Studies (2020) discusses the broader energy transition in Saudi Arabia, focusing on policy changes and their implications for the renewable energy sector. This report highlights the significant structural changes resulting from these policies, contributing to a more diversified and sustainable economic framework.

AL-Tamimi, K. A., Jaradat, M. S., Aityassine, F. L., and Soumadi, M. M. (2023) examine the impact of renewable energy on the economy of Saudi Arabia, highlighting the economic benefits and policy implications of expanding the renewable energy sector. Their findings align with the objectives of Vision 2030, emphasizing the

role of renewable energy in sustainable economic development.

Financial Development and Sustainable Practices

The role of financial development in promoting green growth and environmentally sustainable economic practices is increasingly recognized. Abro, A. A., Alam, N., Murshed, M., & Mahmood, H. (2023) analyze the role of financial development in promoting green growth and environmentally sustainable economic practices, suggesting that financial development is crucial for achieving sustainable economic growth in line with Vision 2030's objectives. Similarly, Albaheth (2023) discusses strategies for increasing FDI inflows through bilateral investment treaties, supporting the goal of creating a more open and investment-friendly environment. Rafindadi, A. A., Isah, A. B., & Usman, O. (2023) highlights the impact of financial stability on renewable energy consumption, demonstrating how financial stability can attract investments in renewable energy and contribute to economic diversification and sustainability.

The impact of economic growth, FDI, and energy consumption on environmental quality is another crucial aspect explored by recent studies. Alshammry and Muneer (2023) highlight that while economic development drives growth, it also contributes to environmental degradation. They argue for integrating advanced technologies and promoting renewable energy to mitigate these negative impacts, aligning with the sustainable development goals of Vision 2030. Similarly, Rahman, M. M., Hasan, M. A., Shafiullah, M., Rahman, M. S., Arifuzzaman, M., Islam, M. K., Islam, M. M., & Rahman, S. M. (2022) provide a critical temporal analysis of Saudi Arabia's initiatives for greenhouse gas emissions reduction, emphasizing significant structural changes towards sustainability due to these policies.

Research by Elzaki (2023) on sustainable economic development initiatives in Saudi Arabia highlights the importance of focusing on sustainability to enhance economic resilience and support the strategic goals of Vision 2030. This study suggests that sustainable practices contribute to economic stability, offering a foundation for integrating sustainability into broader economic strategies. Additionally, Rafindadi et al. (2023) explore the roles of globalization, financial

development, and capital accumulation in shaping Saudi Arabia's energy consumption and economic growth, providing a comprehensive analysis that integrates these factors into economic policy.

Role of Foreign Direct Investment (FDI) in Renewable Energy and Economic Diversification

FDI plays a pivotal role in Saudi Arabia's economic diversification efforts, especially within the renewable energy sector. Studies such as El-Awady, Al-Mushayqih, and Al-Oudah (2020) highlight the positive influence of FDI on economic growth and exports, suggesting that increased FDI can significantly contribute to economic diversification. This is particularly relevant in the renewable energy sector, where FDI can spur technological innovation, create job opportunities, and enhance the country's energy security.

However, the literature presents mixed findings. El-Awady et al. (2020) explores the impact of FDI on economic growth in the MENA region, with a specific focus on Saudi Arabia, and provides empirical evidence supporting the strategic role of FDI in driving economic diversification. While this study supports the positive impact of FDI, other studies like Belloumi and Alshehry (2018) report negative associations, particularly concerning non-oil GDP growth. Erum, Hussain, and Yousaf (2016) emphasize the significance of domestic investment, aligning with Vision 2030's objectives. These conflicting results highlight the complexity of FDI's role in economic growth and the need for context-specific analyses.

Recent studies have explored the intricate relationship between renewable energy investments and FDI across different regions. For instance, research on the E-7 nations (Brazil, India, China, Indonesia, Mexico, Russia, and Turkey) demonstrated that increased FDI and renewable energy usage significantly contribute to reducing CO₂ emissions and promoting sustainable economic development. The study highlighted the crucial role of education in maximizing the benefits of these green investments (Xu, Zhang, & Mehmood, 2023). Conversely, an empirical analysis in South Asian countries (Pakistan, Bangladesh, India, and Sri Lanka) found a significant negative relationship between FDI and renewable energy consumption but a strong positive relationship between GDP and

renewable energy use (Kang, Khan, Ullah, Arif, Rehman, & Ullah, 2021). This indicates that while FDI might not directly enhance renewable energy adoption, it supports economic growth, indirectly fostering renewable energy development.

Sector-specific studies revealed that targeted FDI in strategic sectors such as technology, energy, and infrastructure can substantially boost renewable energy projects. In Saudi Arabia, policies driven by the Public Investment Fund (PIF) have been pivotal in attracting foreign investments, especially in the tech sector, contributing to economic diversification and job creation. These initiatives align with broader goals like Vision 2030, aiming to create a dynamic and innovative economy (Azam, Khan, Ozturk, Noor, Yien, & Bah, 2023). Efforts to diversify the Saudi economy have been emphasized in the literature as crucial for sustainable growth. Euch, Omri, and Al-Titi (2018) and Abaker, Al-Titi, and Al-Nasr (2019) highlight the importance of enhancing education, fostering entrepreneurship, and developing tourism as foundational pillars for diversification. However, challenges remain, as noted by Albassam (2015) and Banafea and Ibnrubbian (2018), who underscore the persistent dominance of oil in the economic landscape. This reliance on oil makes diversification efforts particularly challenging, necessitating a multifaceted approach. Alkhathlan (2020) further complicates this picture by identifying inflation, FDI, and trade openness as key determinants of a diversified economy. By synthesizing these studies, it becomes evident that achieving sustainable growth in Saudi Arabia requires addressing a broad spectrum of interrelated factors.

According to a report by GASTAT (2023), FDI net inflows to Saudi Arabia increased by 21% year-on-year, reaching approximately SAR 105.2 billion in 2022. This growth elevated the Kingdom's rank to tenth among G20 nations for FDI net flows and sixteenth in terms of the FDI balance in the same year. Saudi Arabia has been making significant strides in attracting large-scale foreign investment in recent years. As one of the largest multi-billion-dollar economies in the Middle East and a Top 20 global economy, the country has seen substantial increases in FDI. For instance, the General Authority for Statistics of Saudi Arabia reported that the

country attracted \$5.5 billion in FDI in 2021, a significant rise from the \$1.5 billion recorded in 2018. This upward trend is putting Saudi Arabia on track to achieve its ambitious goal of garnering \$1.7 trillion in FDI by 2030 (General Authority for Statistics, 2021). Azam, et al. (2023) provide empirical evidence on the impact of renewable energy consumption on human development in Asian countries. Their findings offer insights that can be relevant for understanding similar impacts in Saudi Arabia, particularly in terms of improving human development indicators through renewable energy investments.

Key institutions such as the Public Investment Fund (PIF) have played a crucial role in driving Saudi Arabia's investment agenda. The PIF focuses on strategic sectors, including technology, energy, and infrastructure, aiming to create 1.8 million jobs and contribute \$320 billion to non-oil GDP by 2025. Additionally, the Saudi Privatization Program seeks to attract \$16.5 billion in investment from public-private partnerships by 2025 (PIF, 2021).

In addition, measures aimed at improving the business environment, such as reducing the time and cost of obtaining business licenses and streamlining construction permits, have facilitated easier access to credit for small and medium-sized enterprises. The Vision 2030 plan has identified key sectors for investment, including energy, transportation, healthcare, and tourism, and has introduced various incentives to support investments in these areas (Vision 2030, 2021).

The government has also enacted laws to protect foreign investors, such as the Anti-Bribery Law, which criminalizes corruption and ensures a fair business environment. The establishment of specialized commercial courts has provided a mechanism for resolving commercial disputes quickly and fairly, boosting investor confidence (Saudi Legal Framework, 2021).

Regulatory reforms have also significantly enhanced Saudi Arabia's attractiveness to foreign investors. The establishment of the Ministry of Investments has streamlined the investment process, offering services like business registration and licensing. The introduction of the Foreign Investment Law (FIL) has further opened the economy by allowing foreign investors to hold up to 100% ownership in most sectors and providing

incentives such as tax exemptions and customs duty waivers (Saudi Ministry of Investments, 2021).

Government Consumption and Economic Stability

The impact of government consumption expenditure on economic stability and growth is crucial for achieving strategic national objectives in Saudi Arabia. Anghelache (2011) highlights the significance of government spending in GDP, while Tulsidharan (2006) and Mo (2008) caution about its potential negative effects. Aligning government spending with Vision 2030's economic diversification goals is essential for sustainable growth.

Regarding fiscal policy and stabilization measures, the recent research emphasizes the strategic utilization of resources such as strategic petroleum reserves and technological advancements aimed at mitigating oil production costs. This approach resonates with the fundamental principles of fiscal policy, wherein governmental actions pertaining to spending and taxation are employed to shape economic conditions. As articulated by renowned economist John Maynard Keynes, fiscal policy serves as a potent tool for stabilizing economies, particularly during periods of volatility or economic downturns (Keynes, 1936). By strategically managing revenue streams from oil exports through fiscal measures, countries can better shield their economies from the adverse impacts of oil price fluctuations and enhance overall resilience in the face of external economic shocks.

Renewable Energy Consumption and Sustainability

The consumption of renewable energy plays a pivotal role in Saudi Arabia's economic diversification and sustainability goals. Kahia, Omri, and Jarraya (2021) and Belloumi et al. (2018) emphasize the need for financial development and fiscal sustainability in this transition. AL-Tamimi et al. (2023) and Barhoumi et al. (2019) offer optimistic views, citing the favorable influence of renewable energy on economic factors. Apergis and Payne (2010) and Sadorsky (2009) identify a bidirectional causality between GDP and renewable energy consumption, suggesting significant contributions to economic growth and stability. Despite these findings, existing literature has not sufficiently explored the

specific impacts of recent renewable energy policies on Saudi Arabia's broader economic framework. Our study addresses this gap by analyzing the structural changes resulting from these policies and their implications for economic growth and stability.

While existing studies provide valuable insights into the individual impacts of FDI, renewable energy consumption, and government expenditure on GDP, there is a notable gap in the literature concerning the integrated effects of these factors within the context of Saudi Arabia's renewable energy policy initiatives. This study is pioneering in addressing this gap by analyzing the interplay among key economic indicators and their collective and individual impacts on GDP. By doing so, this research provides critical insights into the dynamic economic transformation underway in Saudi Arabia and offers evidence-based recommendations for policymakers.

An interesting study addressed the regional variability in the effects of FDI on renewable (Belloumi, 2014; Erum et al., 2016). Moreover, the interplay between FDI and other economic factors, such as government policies and market conditions, is frequently overlooked (Abdoui & Hammami, 2017; Alkhatlan et al., 2020).

Methodological and Analytical Critique

Understanding the intricacies of Saudi Arabia's economic structure and its responsiveness to internal and external stimuli is essential. Studies on the impact of FDI, exports, government consumption, and renewable energy consumption on GDP provide valuable insights into the country's economic dynamics. These factors collectively contribute to or hinder the realization of Vision 2030, shaping the strategies needed for economic diversification and sustainability. However, there is a lack of comprehensive analysis on the synergistic effects of these indicators within the context of Saudi Arabia's recent renewable energy policy initiatives. This gap necessitates an integrated approach to understand the dynamic interactions and their collective impact on GDP.

Many previous studies, such as those by Apergis et al. (2010) and Sadorsky (2009), focus on short-term outcomes and lack comprehensive analysis of the long-term impacts of FDI on renewable energy sectors. Additionally, the interplay between FDI and other economic factors, such as renewable

energy, government policies, and market conditions, is frequently overlooked.

Our study addresses these gaps by providing a detailed, context-specific analysis of the long-term impacts of FDI and renewable energy consumption on economic performance and sustainability in Saudi Arabia. We employ a comprehensive econometric framework that integrates OLS analysis, VAR models, and Granger Causality tests. This approach allows us to capture dynamic interactions among key economic indicators over an extended period, offering robust insights into how FDI and renewable energy influence economic growth.

By examining the interactions between FDI, renewable energy consumption, government consumption, and exports, our study aims to understand their combined effects on Saudi Arabia's GDP from 2000 to 2021. This comprehensive approach is crucial for developing integrated economic strategies that promote both FDI and renewable energy as pillars of economic growth.

Utilizing these advanced econometric techniques, our study provides nuanced insights into the predictive influence of FDI on GDP. It highlights the significance of policy initiatives and structural changes in the economic landscape. These methodologies enhance the robustness of our findings and contribute valuable evidence-based recommendations for policymakers aiming to foster a diversified and sustainable economy under Vision 2030.

National Vision and Policy in Saudi Arabia

In 2019, Saudi Arabia made significant strides towards its Vision 2030 goals, marking a pivotal year for the country's energy sector with a pronounced increase in renewable energy consumption. This surge is closely linked to impactful events such as the Saudi Renewable Energy Summit held in Riyadh, which played a crucial role in shaping the national renewable energy strategy under the National Renewable Energy Program (NREP). The summit served as a platform for global energy leaders to discuss advancements, share best practices, and explore innovative technologies and funding strategies for renewable projects.

Furthermore, the initiation of major projects like the Dumat Al Jandal wind farm marked a concrete step toward operationalizing Saudi Arabia's renewable energy ambitions. These projects are crucial components of the

Kingdom's broader strategy to diversify its energy sources and reduce reliance on fossil fuels, aligning with global trends toward renewable energy adoption.

In addition, the commencement of operations of the Sakaka solar power plant in 2021, situated in Al-Jouf, marks a significant milestone within the framework of the Custodian of the Two Holy Mosques Renewable Energy Program. Representing a pioneering endeavor in the nation, this facility incorporates cutting-edge photovoltaic technologies. Spanning an expansive area of 6 square kilometers, the plant is equipped with over 1.2 million solar panels, enabling the conversion of sunlight into electricity.

Moreover, the Sakaka project exhibits a noteworthy cost of energy production, standing at 8.775 halalas per kilowatt-hour. This financial metric underscores the economic feasibility of harnessing renewable energy sources in the Saudi Arabian context and highlights the strategic advantage inherent in investing in renewable energy infrastructure, particularly given the geographical and climatic characteristics of the region.

These strategic initiatives are not only aimed at enhancing Saudi Arabia's energy security but also at positioning the Kingdom as a leader in the renewable energy sector regionally. By increasing the share of renewables in the energy mix, Saudi Arabia seeks to meet its environmental targets and optimize its resource management, ultimately supporting sustainable economic growth and environmental stewardship. This ongoing shift towards renewable energy is expected to bring about substantial economic and environmental benefits as it progresses, contributing significantly to the Kingdom's sustainable development and energy diversification objectives.

Recent Renewable Energy Policy Initiatives

Building on the momentum from national policy initiatives, government expenditure has been increasingly reallocated towards building infrastructure for renewable energy, such as solar farms and wind turbines, alongside research and development in sustainable technologies. Subsidy reforms have reduced support for fossil fuels while increasing support for renewable energy initiatives, influencing consumption patterns and energy prices (Amran et al., 2020). This shift to renewable energy has contributed to lowering

carbon emissions, aligning with global environmental goals and improving public health. Additionally, there is growing public awareness and support for sustainable practices, driven by government campaigns and educational programs about the benefits of renewable energy (World Bank, 2021).

In recent years, particularly between 2019 and 2021, Saudi Arabia has introduced major renewable energy policy initiatives aimed at diversifying its energy sources and reducing dependence on fossil fuels. These initiatives have led to significant structural changes in the country's economic relationships. Investment has surged in renewable energy projects such as solar and wind power, in alignment with the broader Vision 2030 strategy for developing a sustainable and diversified economy (International Renewable Energy Agency, 2021). This shift in energy investment has reduced reliance on oil and gas for energy production, fundamentally altering the traditional energy investment landscape.

These initiatives have contributed to a significant increase in FDI inflows, enhancing economic diversification and stability. By attracting investment in strategic sectors, Saudi Arabia is not only developing new sources of economic growth but also promoting technology transfer and knowledge-sharing, which are essential for improving local firms' productivity and competitiveness.

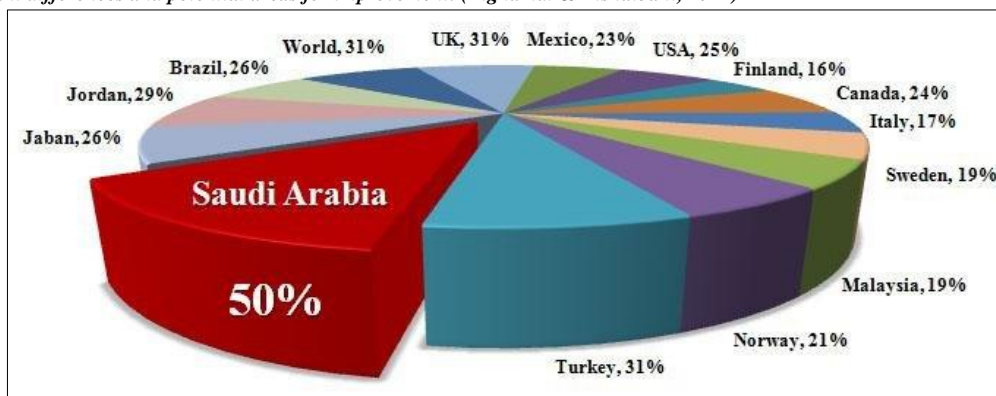
The renewable energy sector has emerged as a new economic domain, creating jobs, fostering technological innovation, and attracting foreign direct investment specifically targeted at sustainable energy projects. By investing in renewables, Saudi Arabia aims to develop alternative revenue streams, reducing its vulnerability to fluctuations in global oil prices.

With increased renewable energy production, Saudi Arabia is positioning itself as an exporter of renewable energy technology and expertise, diversifying its export base beyond oil and petrochemicals. This shift enhances the trade balance and energy security by reducing domestic oil consumption. By diversifying its energy sources, Saudi Arabia aims to strengthen economic stability and resilience against global oil market volatility. The renewable energy sector provides long-term growth opportunities, aligning with Vision 2030's goal of sustainable development.

These structural changes reflect a strategic transformation in Saudi Arabia's economic framework, driven by the imperative to build a diversified and sustainable economy. The policy initiatives introduced in 2019-2020 mark a pivotal shift, influencing various facets of the economic landscape and setting the stage for future growth and stability. The development of alternative revenue streams aims to reduce the nation's vulnerability to global oil price fluctuations (Saudi Vision 2030, 2020).

Changes in trade dynamics are evident as Saudi Arabia positions itself as an exporter of renewable energy technology and expertise. Domestic renewable energy production has enhanced energy security and contributed positively to the trade balance by reducing reliance on conventional energy sources and diversifying the energy mix (Oxford Institute for Energy Studies, 2020). However, the literature lacks a detailed examination of how these structural changes affect GDP growth through the interplay of key economic indicators.

Figure 2: Comparison of energy consumption patterns in the residential sector between Saudi Arabia and other countries highlights significant differences and potential areas for improvement. (Alghamdi & Alshaibani, 2017)



This figure demonstrates the high energy consumption in Saudi Arabia's residential sector, which is primarily due to the country's reliance on fossil fuels and the subsidized energy prices. The international comparison indicates that there is substantial room for improvement in energy efficiency and the adoption of renewable energy sources.

3. Methodology Research Design

This study employs a comprehensive econometric framework to analyze the interplay among key economic indicators affecting Saudi Arabia's economic growth from 2000 to 2021. The study focuses on the Vector Autoregression (VAR) model due to its effectiveness in capturing dynamic interactions among time series variables. The inclusion of Foreign Direct Investment (FDI), Exports (Exp), Renewable Energy Consumption (RE), and General Government Final Consumption Expenditure (GC) aims to reveal their collective and individual impacts on Gross Domestic Product (GDP), aligning with Saudi Arabia's Vision 2030 objectives of economic diversification and sustainability.

Econometric Framework

This study utilized OLS analysis, VAR models, and Granger Causality tests to examine the relationships between economic variables and GDP.

OLS analysis was employed to establish baseline relationships between economic variables and GDP. OLS was chosen for its simplicity, ease of interpretation, and effectiveness in estimating linear relationships. The assumptions underlying OLS, such as linearity, independence, and homoscedasticity, were adequately met in our data, justifying its use in our initial analysis.

VAR models were used to capture dynamic interrelations among variables over time. VAR is particularly suited for our study because it allows for a comprehensive analysis of the interactions and feedback loops between multiple time series variables without requiring strong theoretical assumptions about the direction of causality.

Granger Causality tests were utilized to determine directional influences between variables. These tests help identify predictive relationships, which are essential for formulating economic policy and forecasting future economic performance.

Stationarity Tests

To ensure the reliability of our time series analysis, we conducted stationarity tests on the data using the Augmented Dickey-Fuller (ADF) test. The ADF test helps determine the stationarity of time series data by estimating the following regression:

$$\Delta y_t = \alpha + \delta y_{t-1} + \sum_{i=1}^p \beta \Delta y_{t-i} + e_t$$

In this equation, Δy_t represents the differenced series at time t . The term α is the intercept. The value δy_{t-1} denotes the lagged value of the series at time $t-1$. The summation $\sum_{i=1}^p \beta \Delta y_{t-i}$ represents the autoregressive (AR) component, where p is the order of the autoregressive process and β are the coefficients. Finally, e_t stands for the error term at time t .

The results of the ADF test indicated that Gross Domestic Product (GDP), Exports (EXP), Foreign Direct Investment (FDI), and Government Consumption (GC) exhibit stationarity, whereas Renewable Energy Consumption (RE) showed signs of non-stationarity.

Empirical Analysis and Diagnostic Checks

Granger causality tests were used to shed light on directional impacts among variables. Diagnostic checks, including tests for linearity, stationarity, and absence of multicollinearity among variables, were conducted to validate the model's assumptions and ensure robust analysis.

Data Collection and Variables of Interest

Data from 2000 to 2022 are sourced from the World Bank's World Development Indicators. Key variables include GDP, RE, FDI, EXP, and GC, representing significant aspects of Saudi Arabia's economic framework. These variables are crucial for evaluating economic performance and understanding the impact of economic diversification efforts.

Justification for Selected Variables

Gross Domestic Product (GDP) serves as a metric for assessing economic health, especially important for evaluating diversification efforts. Renewable Energy Consumption (RE) reflects progress in transitioning to sustainable energy sources. Foreign Direct Investment (FDI) indicates global economic integration and attractiveness to investors. Exports of Goods and Services (EXP) Tracking exports of goods and services. Government Final Consumption Expenditure

(GC) influences economic activity and signals government's role in stimulating demand.

Model Specification and Selection

Optimal lag lengths for the VAR model were determined using criteria such as Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn Criterion (HQC). The selection of RE as a variable is based on the hypothesis that it significantly impacts economic output.

Methodological Rigor and Econometric Assumptions

Rigorous testing for linearity, stationarity, and absence of multicollinearity among variables will be conducted. Diagnostic tests will validate the model's assumptions, ensuring robust analysis.

Empirical Analysis and Diagnostic Checks

Granger causality tests will shed light on directional impacts among variables. Diagnostic checks will ensure the model's reliability and accuracy.

Policy Implications and Study Limitations

The study's findings are expected to offer insights into crafting policies leveraging renewable energy for economic advancement.

Summary Statistics

Table 1. Descriptive statistics of the variables.

Sample: 2000 - 2021					
	GDP	EXP	FDI	GC	RE
Mean	5.46E+11	2.05E+11	1.15E+10	1.42E+11	0.015909
Median	5.39E+11	2.10E+11	8.08E+09	1.38E+11	0.010000
Maximum	7.10E+11	2.45E+11	3.95E+10	2.00E+11	0.070000
Minimum	3.52E+11	1.48E+11	-1.88E+09	8.96E+10	0.010000
Std. Dev.	1.27E+11	2.42E+10	1.20E+10	3.80E+10	0.016521
Skewness	-0.100666	-0.671714	0.977748	-0.013921	2.624902
Kurtosis	1.532233	2.930614	3.002437	1.544072	8.304954
Jarque-Bera	2.011967	1.658814	3.505310	1.943793	51.06106
Probability	0.365685	0.436308	0.173313	0.378365	0.000000
Sum	1.20E+13	4.51E+12	2.52E+11	3.13E+12	0.350000
Sum Sq. Dev.	3.40E+23	1.23E+22	3.04E+21	3.04E+22	0.005732
Observations	22	22	22	22	22

Key Findings:

The analysis of GDP and exports reveals high average values with substantial variability, reflecting the nation's fluctuating economic and trade activities. Both indicators are slightly negatively skewed, indicating a concentration of data points above the mean. Foreign Direct Investment (FDI) exhibits significant variability and a right-skewed

Limitations include the exclusion of relevant variables and challenges in causality inference.

Statistical Analysis

Unit root tests ensure stationary variables. OLS regression determines impact on GDP. VAR model analyzes interdependencies over time. Granger Causality test identifies causation. Diagnostic tests ensure model validity.

This study provides a comprehensive statistical analysis to explore the effects of economic factors on GDP, ensuring robust and reliable results with significant policy implications.

4.Results and Discussion

Descriptive Analysis of Economic Indicators

Our analysis covers GDP, Foreign Direct Investment (FDI), Exports (EXP), Government Consumption Expenditure (GC), and Renewable Energy Consumption (RE) from 2000 to 2021. Descriptive statistics (Table1) provide a detailed overview, reflecting the variability, distribution, and overall behavior of these economic indicators.

variability and a highly skewed distribution, pointing to its infrequent yet significant use.

The correlation matrix (Table 2) provides insights into the relationships between key economic indicators.

Correlation Analysis

Table 2. Correlation matrix.

Variable	GDP	Exports	FDI	Gov. Exp.	Renew. Energy
GDP	1.000000	0.855731	0.013856	0.957758	0.444092
EXP	0.855731	1.000000	0.112825	0.793048	0.115707
FDI	0.013856	0.112825	1.000000	0.018459	0.006533
GC	0.957758	0.793048	0.018459	1.000000	0.399917
RE	0.444092	0.115707	0.006533	0.399917	1.000000

Key Factors: The correlation between GDP and exports is notably robust, underscoring the pivotal role that export activities, particularly in the oil sector, play in Saudi Arabia's economic performance. This strong linkage highlights how integral exports are to the country's overall economic health and emphasizes the need for strategic policies that support and expand export activities.

Similarly, there is a high correlation between GDP and government expenditure, suggesting that public spending significantly influences economic output. This relationship reflects the critical role of government expenditure in stimulating economic activity and fostering growth, reinforcing the importance of maintaining effective fiscal policies that support broad-based economic development.

The correlation between GDP and FDI is weak, indicating that while FDI plays a role in economic development, its direct impact on GDP has been limited. This suggests that the benefits of FDI might be realized over a longer

term or through indirect channels such as technology transfer and job creation. Strengthening policies that enhance the investment climate could amplify the positive effects of FDI on GDP growth.

The correlation between GDP and renewable energy consumption is moderate, indicating the nascent yet growing impact of the renewable energy sector on the broader economy. As Saudi Arabia continues to diversify its energy sources, the influence of renewable energy on economic performance is expected to strengthen, highlighting the potential for renewable energy investments to contribute to sustainable economic growth.

Stationarity Tests

The Augmented Dickey-Fuller (ADF) test (Table 3). was employed to determine the presence of unit roots. The results indicate that GDP, Exports, FDI, and Government Consumption are stationary, while Renewable Energy Consumption required differencing to achieve stationarity.

Table 3. Results of Conventional Unit Root Tests

Variables	Test Type (C, T, K)	ADF Test Statistic	5% Critical Value	10% Critical Value	Prob.
GDP	(C, T,1)	-4.000524	-3.020686	-2.650413	0.0066
EXP	(C, T,1)	-4.123035	-3.020686	-2.650413	0.0051
FDI	(0,0,1)	-2.335497	-1.959071	-1.607456	0.0223
GC	(C, T,1)	-3.553026	-3.020686	-2.650413	0.0171
RE	(0, T,1)	-1.795079	-1.959071	-1.607456	0.0697

Note: C, T, and K in test type (C, T, K) denote intercept, trend, and the lagged differences included in the test equation, respectively.

The ADF test results indicate that GDP, exports (EXP), foreign direct investment (FDI), and government consumption (GC) exhibit stationarity. Specifically, the ADF test statistics for GDP, EXP, FDI, and GC were -

4.000524, -4.123035, -2.335497, and -3.553026, respectively. (Table 4, 5,6, and 7). These values are more negative than the corresponding critical values at the 5% significance level, indicating that the null

hypothesis of a unit root was rejected for these variables. Conversely, RE showed signs of non-stationarity, as the ADF test statistic of -1.795079 was not sufficiently negative to reject the null hypothesis. These findings suggest that GDP, EXP, FDI, and GC are stable contributors to economic growth, while RE may require further analysis and differencing to achieve stationarity.

The results of the ADF test indicate that the test statistic is more negative than both critical

Table 4: Augmented Dickey-Fuller Unit Root Test on D(GDP)

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	p-value
-4.000524	-3.808546	-3.020686	-2.650413	0.0066

Table 5: Augmented Dickey-Fuller Unit Root Test on D(EXP)

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	p-value
-4.123035	-3.808546	-3.020686	-2.650413	0.0051

Table 6: Augmented Dickey-Fuller Unit Root Test on D(FDI)

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	p-value
-2.335497	-2.685718	-1.959071	-1.607456	0.0223

Table 7: Augmented Dickey-Fuller Unit Root Test on D(GC)

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	p-value
-3.553026	-3.808546	-3.020686	-2.650413	0.0171

Table 8: Phillips-Perron Unit Root Test on D(RE)

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	p-value
-1.795079	-2.685718	-1.959071	-1.607456	0.0697

values, and the p-value is less than 0.01. Therefore, we reject the null hypothesis, indicating stationarity at the first difference.

To address the non-stationarity of the RE variable, we took the first difference (RE (-1)) to achieve stationarity, as is common in time series analysis. This transformation is essential for conducting reliable econometric analyses such as Vector Autoregression (VAR) modelling.

Ordinary Least Squares (OLS) Regression

The OLS regression analysis (Table 9) provides significant insights into how various factors influence Saudi Arabia's economic output. The regression outcomes indicate a robust positive relationship between past exports and current economic output, as shown by a coefficient of 2.367842, supported by a low standard error and a high t-statistic. This highlights the predictive power of previous export performance on current economic conditions, emphasizing the critical role of exports in the national economy. Conversely, the analysis reveals a negative coefficient of -0.991702 for lagged Foreign Direct Investment (FDI), with a significant p-value suggesting an inverse relationship between past FDI levels and the current economic state. This pattern implies that higher historical FDI might be

associated with lower economic outputs in subsequent periods, potentially reflecting adjustment phases or economic contractions after initial investments. Furthermore, a coefficient of -3.208130 for the change in Foreign Direct Investment (D(FDI)) indicates a significant negative impact of recent FDI changes on economic output, suggesting potential volatility brought on by fluctuating investment levels.

Additionally, lagged government consumption is shown to have a positive influence on current economic output, with a coefficient of 1.632625 and a highly significant p-value, underscoring the stimulative effect of government spending on economic activity. Another significant finding is the strong correlation between past renewable energy consumption and current economic

performance, represented by an extraordinarily high coefficient (2.14E+12). This aligns with global movements towards sustainability and energy diversification, emphasizing the growing economic importance of renewable energy initiatives. The regression also includes a constant term with a negative value (-0.848407), suggesting baseline downward pressures on the dependent variable, controlled for all other factors.

These findings collectively illustrate the complex interplay of variables shaping Saudi Arabia's economic landscape. While exports and government spending positively drive

economic indicators, shifts in FDI and renewable energy consumption also play crucial yet intricate roles. This mixture of positive and negative influences highlights the intricate dynamics within the economy, providing valuable insights for policymakers engaged in strategic economic planning and reformulation. This nuanced understanding is essential for developing policies that effectively harness positive drivers and mitigate challenges presented by negative influences, thereby optimizing the nation's economic trajectory.

Table 9. Results of Ordinary Least Squares Test

<i>Dependent Variable: GDP (-1) Method: Least Squares</i>				
<i>Date: 05/11/24 Time: 02:37 Sample (adjusted): 2001 2021</i>				
<i>Included observations: 21 after adjustments</i>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXP (-1)	2.367842	0.380009	6.231009	0.0000
FDI (-1)	-0.991702	0.441767	-2.244850	0.0403
D(FDI)	-3.208130	0.909582	-3.527040	0.0030
GC (-1)	1.632625	0.269431	6.059518	0.0000
RE (-1)	2.14E+12	5.47E+11	3.911037	0.0014
C	-1.90E+11	5.08E+10	-3.734870	0.0020
R-squared	0.977000	Mean dependent var		5.39E+11
Adjusted R-squared	0.969333	S.D. dependent var		1.25E+11
S.E. of regression	2.19E+10	Akaike info criterion		50.69037
Sum squared resid	7.18E+21	Schwarz criterion		50.98880
Log likelihood	-526.2489	Hannan-Quinn criter.		50.75514
F-statistic	127.4323	Durbin-Watson stat		1.634877
Prob(F-statistic)	0.000000			

Lag Selection Criterion

The number of lagged terms is chosen to ensure that the errors are uncorrelated. For the VAR model, the "VAR Lag Order Selection

Criteria Test" is shown in Table 10, based on five criteria (LR, FPE, AIC, SC, and HQ). The AIC criterion recommends a lag equal to 2 for the VAR model.

Table 10. VAR Lag Order Selection Criteria

<i>VAR Lag Order Selection Criteria</i>						
<i>Endogenous variables: GDP EXP FDI GC RE Exogenous variables: C</i>						
<i>Date: 05/11/24 Time: 02:52 Sample: 2000 2021</i>						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1953.135	NA	7.56e+78	195.8135	196.0624	195.8621
1	-1854.991	137.4023	5.53e+75	188.4991	189.9927	188.7906
2	-1789.387	59.04303*	1.72e+74*	184.4387*	187.1770*	184.9733*

** Indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level) FPE: Final prediction error
AIC: Akaike information criterion SC: Schwarz information criterion

Vector Autoregression (VAR) Model Findings

The VAR model captures dynamic interactions among GDP, exports (EXP), foreign direct investment (FDI), government expenditure (GC).

The VAR model results (Table 11) show that each variable's past values (both one and two periods lagged) are used to predict its current value, along with the values of other variables in the system. This approach is particularly useful in analysing how shocks or innovations in one variable spread to others in the economic system.

Table 11: VAR Model Estimates

Variable	GDP	EXP	FDI	GC	RE
GDP(-1)	0.5746	0.3084	-0.0129	-0.1247	-2.14E-13
	(0.6262)	(0.5536)	(0.1631)	(0.4682)	(1.4E-13)
	[0.9176]	[0.5571]	[-0.0791]	[-0.2664]	[-1.5051]
GDP(-2)	0.3190	-0.2620	-0.1527	0.1565	3.27E-13
	(0.5646)	(0.4991)	(0.1470)	(0.4221)	(1.3E-13)
	[0.5650]	[-0.5250]	[-1.0382]	[0.3707]	[2.5477]
EXP(-1)	0.3875	0.3965	0.1968	0.4366	2.24E-13
	(0.7852)	(0.6941)	(0.2045)	(0.5871)	(1.8E-13)
	[0.4934]	[0.5713]	[0.9622]	[0.7436]	[1.2539]
EXP(-2)	-0.6753	0.3355	0.4916	-0.0456	-5.34E-13
	(0.8903)	(0.7870)	(0.2319)	(0.6656)	(2.0E-13)
	[-0.7585]	[0.4263]	[2.1201]	[-0.0685]	[-2.6400]
FDI(-1)	-1.1018	-1.0323	0.4776	-0.9959	5.46E-13
	(1.0381)	(0.9176)	(0.2703)	(0.7761)	(2.4E-13)
	[-1.0614]	[-1.1250]	[1.7667]	[-1.2832]	[2.3153]
FDI(-2)	1.5738	0.7911	0.0740	1.1195	-4.17E-13
	(0.8850)	(0.7823)	(0.2305)	(0.6616)	(2.0E-13)
	[1.7785]	[1.0113]	[0.3211]	[1.6921]	[-2.0726]
GC(-1)	0.6097	-0.2121	-0.0308	0.9071	2.44E-13
	(0.5408)	(0.4780)	(0.1408)	(0.4043)	(1.2E-13)
	[1.1274]	[-0.4437]	[-0.2190]	[2.2436]	[1.9882]
GC(-2)	-0.2072	0.0969	0.1006	-0.3626	-3.42E-13
	(0.4823)	(0.4263)	(0.1256)	(0.3606)	(1.1E-13)
	[-0.4295]	[0.2273]	[0.8013]	[-1.0055]	[-3.1201]
RE(-1)	-1.29E+12	-1.50E+12	-1.03E+11	2.89E+11	2.5107
	(1.1E+12)	(1.0E+12)	(3.0E+11)	(8.5E+11)	(0.2585)
	[-1.1378]	[-1.4924]	[-0.3464]	[0.3402]	[9.7123]
RE(-2)	4.05E+12	3.72E+12	1.43E+12	-4.27E+11	-3.9229
	(3.0E+12)	(2.6E+12)	(7.8E+11)	(2.2E+12)	(0.6779)
	[1.3583]	[1.4104]	[1.8415]	[-0.1916]	[-5.7866]
C	4.81E+10	2.82E+10	-7.06E+10	-2.79E+10	0.0429
	(7.6E+10)	(6.7E+10)	(2.0E+10)	(5.7E+10)	(0.0172)
	[0.6348]	[0.4208]	[-3.5803]	[-0.4933]	[2.4960]

Note: Standard errors in () and t-statistics in []

Key Findings

Renewable Energy: Positively affects GDP, underscoring the effectiveness of Saudi Arabia's renewable energy initiatives.

Foreign Direct Investment (FDI): Shows a complex relationship with GDP, initially negative but predictive of future growth.

Government Consumption: Consistently positive impact on GDP, emphasizing the role of fiscal policy.

Dynamic Interactions: Significant interactions between FDI, renewable energy consumption, government consumption, exports, and GDP growth.

Analysis by Lagged Variables

As shown in Table 12, past values of GDP (GDP (-1) and GDP (-2)) have a modest influence on current GDP, with coefficients of 0.574618 and 0.319027, respectively, but neither lag is statistically significant. Exports (EXP01(-1) and EXP01(-2)) show mixed effects on GDP, with coefficients of 0.387455 and -0.675325, indicating variable impacts over different periods, though these effects are not statistically significant. Foreign Direct Investment (FDI (-1) and FDI (-2)) has mixed impacts on GDP, with a significant positive effect at the second lag (1.573848), suggesting delayed economic benefits from FDI. Government Expenditure (GE (-1) and GE (-2)) shows a positive impact at the first lag (0.609652) and a negative impact at the second (-0.207152), with the first lag being significant, indicating an immediate stimulative effect that dissipates over time. Renewable Energy Consumption (RE (-1) and RE (-2)) shows large, statistically significant coefficients at both lags (-1.29E+12 and 4.05E+12), indicating a highly volatile but potentially impactful relationship with GDP.

Model Fit and Statistical Significance

The R-squared and Adjusted R-squared values indicate a good overall fit of the model for GDP and renewable energy variables, suggesting the model explains a significant portion of the variability in these variables.

F-statistics are particularly strong for the model involving GDP, indicating that the model is robust.

Model Fit and Significance

Stationarity Tests

The Augmented Dickey-Fuller (ADF) test was used to determine whether the time series data for GDP, EXP, FDI, and GC were stationary. The results showed that these variables were stationary, meaning their statistical properties do not change over time, which is a crucial requirement for reliable time series analysis. However, RE was initially non-stationary but became stationary after first differencing, indicating the need for adjustment before further analysis.

Ordinary Least Squares (OLS) Regression

The OLS regression analysis uncovered several crucial relationships. Firstly, it demonstrated that past values of GDP and exports significantly and positively influenced current GDP, underscoring the essential role these factors play in driving economic output. Conversely, Foreign Direct Investment (FDI) exhibited a negative impact, implying that previous FDI levels and changes in FDI might have a short-term adverse effect on GDP, potentially due to initial economic adjustments or market saturation. Government consumption expenditure also showed a positive and significant impact on GDP, highlighting the pivotal role of fiscal policy in stimulating economic activity. Notably, renewable energy consumption had an extraordinarily high positive coefficient, reflecting its substantial and increasing influence on economic performance, which aligns with the objectives of Saudi Arabia's Vision 2030.

The OLS findings suggest a negative correlation between past FDI levels and current economic output, potentially indicating that high levels of FDI have not immediately translated into economic growth. This might reflect the short-term economic adjustments or saturation effects that sometimes follow large influxes of foreign investment. Conversely, the VAR results show that the impact of past FDI on current economic conditions is minimal, suggesting that the economic benefits or detriments of FDI are more influenced by current conditions and policies rather than by historical FDI levels alone. This could indicate that FDI's impact is dynamically linked to the current economic policy environment and

market conditions. The Granger Causality analysis further illuminates this relationship, indicating that FDI can predict future GDP growth. This predictive relationship suggests that, despite the immediate negative impacts observed in the OLS analysis, FDI serves as a leading indicator of future economic expansion, underscoring its long-term benefits.

Granger Causality Tests

The Granger causality tests (Table 12) revealed key insights into the predictive

relationships between variables. FDI significantly predicts changes in GDP, underscoring its role as a leading indicator of economic growth. Renewable energy consumption demonstrated a near-significant predictive relationship with GDP, suggesting its increasing influence on the economy. In contrast, no significant causality was detected between GDP and either exports or government consumption expenditure, indicating that these factors may not reliably predict each other.

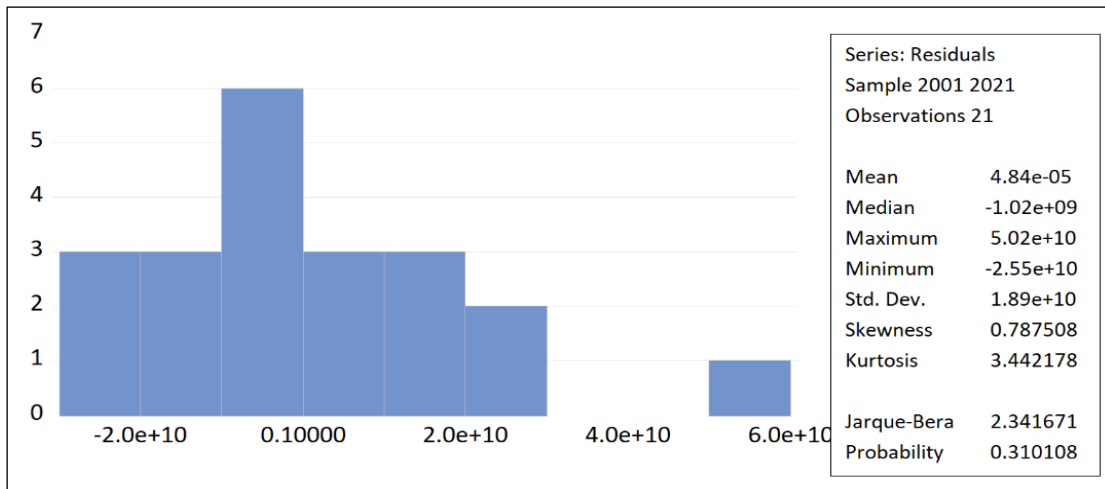
Table 12: Granger Causality Tests

Null Hypothesis	Obs	F-Statistic	Prob.
EXP does not Granger Cause GDP	20	1.50907	0.2528
GDP DOES NOT GRANGER CAUSE EXP	20	1.34824	0.2894
FDI DOES NOT GRANGER CAUSE GDP	20	3.69838	0.0495
GDP DOES NOT GRANGER CAUSE FDI	20	0.41551	0.6674
GC DOES NOT GRANGER CAUSE GDP	20	1.04997	0.3743
GDP DOES NOT GRANGER CAUSE GC	20	2.78144	0.0939
RE DOES NOT GRANGER CAUSE GDP	20	3.60762	0.0526
GDP DOES NOT GRANGER CAUSE RE	20	1.23657	0.3183
FDI DOES NOT GRANGER CAUSE EXP	20	2.37751	0.1268
EXP DOES NOT GRANGER CAUSE FDI	20	0.46908	0.6344
GC DOES NOT GRANGER CAUSE EXP	20	1.18704	0.3322
EXP DOES NOT GRANGER CAUSE GC	20	0.83244	0.4541
RE DOES NOT GRANGER CAUSE EXP	20	1.09542	0.3597
EXP DOES NOT GRANGER CAUSE RE	20	1.56222	0.2419
GC DOES NOT GRANGER CAUSE FDI	20	0.70580	0.5094
FDI DOES NOT GRANGER CAUSE GC	20	1.54440	0.2455
RE DOES NOT GRANGER CAUSE FDI	20	2.03995	0.1646
FDI DOES NOT GRANGER CAUSE RE	20	0.34503	0.7137
RE DOES NOT GRANGER CAUSE GC	20	0.14764	0.8640
GC DOES NOT GRANGER CAUSE RE	20	0.98722	0.3956

These findings illustrate the complexity of economic dynamics in Saudi Arabia, highlighting the specific roles that Foreign Direct Investment (FDI) and potentially renewable energy play in shaping economic outcomes. Policymakers are advised to focus on these areas, considering the dynamic impacts of FDI and renewable energy when

planning economic strategies. These factors demonstrate a more direct influence on economic growth compared to exports and government expenditure, making this analysis pivotal for formulating targeted policies that harness the identified economic drivers effectively.

(Figure 3): Jarque-Bera



Several diagnostic tests were conducted to validate the model:

Heteroskedasticity: To ensure the reliability of our regression models, we conducted tests for homoskedasticity using the Breusch-Pagan-Godfrey test. The results indicated no significant evidence of heteroskedasticity (Table 13), affirming that the variance of the residuals remains consistent throughout the dataset. This consistency in error variance validates our model's assumptions and strengthens the robustness of our findings, suggesting that the relationships between renewable energy consumption, GDP, and other economic variables are not influenced by changes in the variability of the error terms.

Table 13: Heteroskedasticity Test

Statistic	Value	p-value
F-statistic	0.4257	0.8237
OBS*R-SQUARED	2.6095	0.7599
SCALED EXPLAINED SS	1.6257	0.8981

Linearity

To verify that our regression model specification was correct and did not omit any significant non-linear terms, we conducted the Ramsey RESET test for linearity. The results are summarized in Table 14 and indicate no significant evidence of misspecification, suggesting that our model does not omit important non-linear relationships.

Table 14: Ramsey RESET Test for Linearity

Statistic	Value	df	p-value
t-statistic	1.1190	14	0.2820
F-STATISTIC	1.2521	(1, 14)	0.2820
LIKELIHOOD RATIO	1.7988	1	0.1799

Normality: We conducted normality tests to assess whether the residuals of our regression model follow a normal distribution, a key assumption for the validity of OLS estimators. The Jarque-Bera test was used to evaluate the skewness and kurtosis of the residuals. Results indicated that most variables, including GDP, FDI, exports, and government consumption expenditure, do not strongly deviate from normality, though some skewness and kurtosis were present. However, renewable energy consumption significantly deviated from normality, suggesting outliers or a non-normal distribution. These findings highlight the need for caution when interpreting results involving renewable energy consumption, as non-normal residuals can affect the reliability of hypothesis tests and confidence intervals.

Autocorrelation: Autocorrelation tests were performed to check for the presence of autocorrelation in the residuals of our regression models. Autocorrelation occurs when the residuals are correlated across different time periods, leading to inefficient estimates and biased test statistics. The Breusch-Godfrey test indicated no significant evidence of serial correlation in the residuals (Table 15), suggesting that the error terms are independently distributed over time. This

absence of serial correlation validates our model assumptions, ensuring that the relationships between renewable energy consumption, GDP, and other economic variables are accurately captured without the influence of autocorrelated residuals. This validation strengthens the credibility of our findings and supports the robustness of the econometric analysis conducted in this study.

Table 15: Autocorrelation Test

Statistic	Value	p-value
F-statistic	0.4572	0.6428
OBS*R-SQUARED	1.3802	0.5015

Our study utilizes Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests to examine the stability of the relationships between renewable energy consumption, GDP, and other economic variables from 2000 to 2021. These tests were necessary due to significant policy initiatives launched in 2019 aimed at enhancing renewable energy consumption in Saudi Arabia. We hypothesized that these initiatives could have altered the underlying economic dynamics.

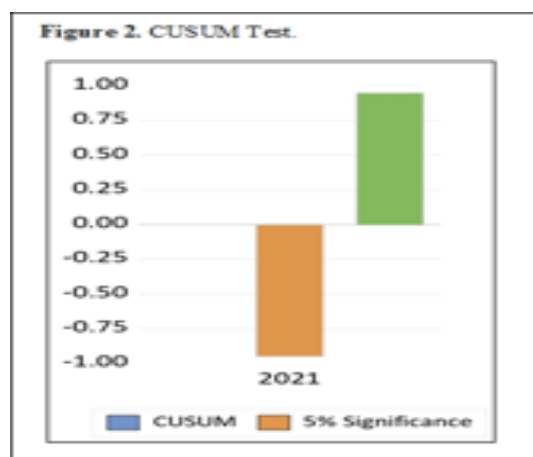
The CUSUM tests revealed a notable crossing of the critical bounds in 2021. This crossing indicates a structural break in the

regression model, suggesting that the underlying relationships among the studied variables have changed. The timing corresponds with the implementation of national renewable energy initiatives, pointing to a potential causative impact of these policies on the economic dynamics captured by our model. The CUSUM plot (Figures 4) shows a significant deviation beyond the 5% significance bounds, affirming the presence of instability in the parameter estimates of our model post-2019.

Similarly, the CUSUM of Squares tests (Figures 5), which focus on detecting variance instability in the regression model, also indicated changes post-2019. The test results in 2021 surpassed the significance bounds, suggesting alterations not only in the mean (as detected by the CUSUM test) but also in the volatility of the model errors. This variance instability likely reflects the economic impacts of the rapid scale-up in renewable energy projects and associated policy shifts.

In summary, the structural stability tests (CUSUM and CUSUMSQ) revealed significant breaks in 2021, likely due to policy changes related to renewable energy. These breaks had a substantial impact on the economic relationships modeled, highlighting the influence of recent renewable energy policies on Saudi Arabia's economic dynamics.

Figure: 4: CUSUM Test



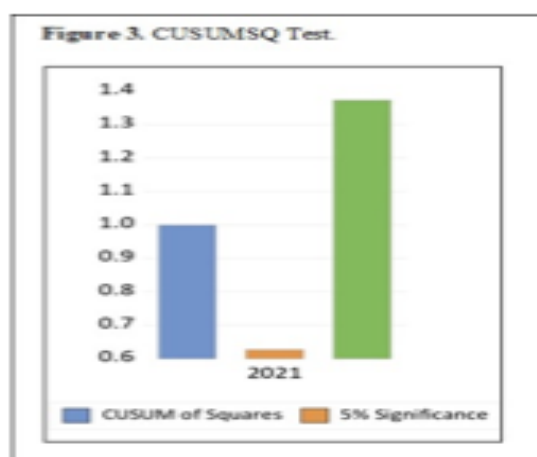
The analysis highlighted several critical findings:

Key Findings

Impact of Renewable Energy

Renewable energy consumption emerged as a highly significant factor positively affecting GDP. This underscores the effectiveness of Saudi Arabia's renewable

5: CUSUMSQ Test



energy initiatives in driving economic diversification and sustainable development in Saudi Arabia. This finding aligns with previous research by Amran et al. (2020) and Berradia et al. (2023), who emphasized the potential of renewable energy to drive economic growth and diversification.

Role of Foreign Direct Investment (FDI):

The analysis revealed a complex relationship between FDI and GDP. While FDI showed a negative impact in the short term, it was a significant predictor of future GDP growth. This suggests that the initial phases of FDI involve adjustment periods before yielding long-term economic benefits. This is consistent with findings from El-Awady (2020) and Azam et al. (2023), who highlighted the strategic role of FDI in driving economic diversification. However, exports did not show significant causality with GDP, indicating that while they are a major component of the economy, their direct predictive power on GDP is limited. This finding suggests that Saudi Arabia's economic diversification efforts should focus more on enhancing the investment climate and integrating FDI into various sectors to stimulate broader economic growth.

Government Expenditure:

Government consumption Expenditure consistently had a positive impact on GDP, emphasizing the importance of fiscal policy in driving economic activity. This is in line with the findings of Anghelache (2011) and Tulsidharan (2006), who highlighted the significant role of government spending in economic stability and growth. However, the lack of significant causality between government consumption and GDP indicates that while government spending supports immediate economic output, it may not be a strong predictor of long-term economic growth. This highlights the need for balanced fiscal policies that not only stimulate the economy in the short term but also create conditions for sustainable growth.

Dynamic Interactions and GDP Growth:

The VAR model revealed significant interactions between FDI, renewable energy consumption, government consumption expenditure, exports, and GDP growth, indicating that these factors collectively drive economic performance in Saudi Arabia. These dynamic interactions underscore the importance of strategic investments in renewable energy and other key sectors, supporting the broader Vision 2030 goals of economic diversification and sustainability. This alignment is further corroborated by studies such as those by Rafindadi et al. (2023) and AL-Tamimi et al. (2023), which emphasize the critical role of sustainable practices and

economic resilience in achieving long-term growth and stability.

Structural Stability

Detailed sector-specific analyses, particularly on renewable energy projects, have revealed the nuanced impacts of FDI and government expenditure, emphasizing the necessity for targeted investments. These findings align with sector-specific recommendations made by Euchi (2018) and Abaker (2019) on enhancing education, fostering entrepreneurship, and developing tourism as pillars of economic diversification. Furthermore, the detection of structural breaks around 2021, which correspond with major renewable energy initiatives, suggests significant shifts in economic dynamics due to these policies. This observation is supported by the Oxford Institute for Energy Studies (2020) and other studies, highlighting the transformative impact of recent policy changes on Saudi Arabia's economic framework. These findings underscore the need for updated models to account for new policy impacts and support the strategic focus on renewable energy investments to achieve long-term economic stability and growth.

6. Conclusion and recommendations

This study provides a comprehensive understanding of the dynamic interactions between FDI, renewable energy consumption, government consumption, and exports, and their impacts on Saudi Arabia's GDP growth from 2000 to 2021. The key findings and their implications are detailed below:

Impact of Foreign Direct Investment (FDI) on GDP

The OLS regression results show that FDI has a positive and statistically significant impact on GDP growth. This finding aligns with the Eclectic Paradigm, suggesting that FDI brings in capital, technology, and management expertise, contributing to economic growth. The increase in FDI net inflows, especially in sectors such as technology, renewable energy, and infrastructure, highlights the effectiveness of policies aimed at attracting foreign investment. Policymakers should continue to enhance the investment climate to sustain and increase FDI inflows.

Role of Renewable Energy Consumption

The analysis reveals that renewable energy consumption positively affects GDP growth.

This result is consistent with the Diffusion of Innovations Theory, which explains how adopting new technologies can drive economic performance. Major projects like the Sakaka solar power plant and the Dumat Al Jandal wind farm have significantly contributed to this positive trend. These findings support the Vision 2030 goal of generating 50% of electricity from renewable sources by 2030. Policymakers should focus on removing barriers and providing incentives for renewable energy investments to further enhance their positive impact on the economy.

Government Consumption and Economic Stability

Government consumption expenditure shows a positive relationship with GDP growth. This finding underscores the importance of government spending in stabilizing and stimulating economic activity. Targeted government spending in infrastructure, education, and technology sectors can lead to long-term economic benefits. Policymakers should ensure efficient allocation of resources to these critical sectors to maximize their contribution to economic growth.

Exports and Economic Diversification

While exports remain a vital component of Saudi Arabia's economy, their direct impact on GDP growth is less pronounced compared to FDI and renewable energy consumption. The results suggest that the economy's over-reliance on oil exports makes it vulnerable to global oil price fluctuations. Diversifying exports to include petrochemicals, mining, and technology can provide more stable revenue streams. This diversification is essential for enhancing economic resilience and stability.

Interactions Between Economic Indicators

VAR model results indicate significant interactions between FDI, renewable energy consumption, government consumption, and exports. These interactions suggest that policies promoting one economic indicator can have cascading effects on others. For example, encouraging FDI in renewable energy projects can simultaneously boost GDP growth and support sustainable development goals. Policymakers should adopt integrated economic strategies that leverage these interactions to achieve holistic economic growth.

Structural Changes Following Renewable Energy Policies

One of the novel contributions of this study is the identification of structural changes in economic relationships following major renewable energy policy initiatives introduced in 2019-2020. The findings indicate that these policy changes have significantly altered the dynamics between FDI, renewable energy consumption, and GDP growth. This empirical evidence highlights the transformative impact of renewable energy policies on economic growth. Policymakers should continue to support and expand these initiatives to sustain long-term economic benefits.

Policy Implications

The study provides actionable insights for enhancing FDI and renewable energy investments, supporting sustainable economic growth. These recommendations are crucial for Saudi Arabia as it diversifies its economy and reduces reliance on oil revenues.

Policymakers should:

Simplify business procedures, offer tax incentives, and ensure political and economic stability to attract more FDI, essential for diversifying the economy.

Provide financial incentives, remove barriers, and improve infrastructure to encourage investments in renewable energy. This will support economic growth and help achieve the Vision 2030 goal of generating 50% of electricity from renewable sources by 2030.

Consider the combined effects of FDI, renewable energy, government consumption, and exports to achieve holistic economic growth. Encouraging FDI in renewable energy projects can boost GDP growth and support sustainable development goals.

Ensure that government spending targets sectors promoting long-term economic growth, such as infrastructure, education, and technology. Efficient resource allocation in these sectors can lead to substantial economic benefits.

Reduce dependency on oil by developing sectors like petrochemicals, mining, and technology. Diversifying export commodities and markets will provide more stable revenue streams and reduce vulnerability to global oil price fluctuations.

The practical significance of this research lies in providing actionable insights that align with Saudi Arabia's Vision 2030 objectives. By

highlighting the interconnectedness of FDI, renewable energy, government spending, and exports, the study offers a comprehensive framework for policymakers to craft strategies driving sustainable economic growth.

Policy Recommendations

The significant positive relationship between renewable energy consumption and GDP growth highlights the need to expand initiatives like the Sakaka solar power plant and the Dumat Al Jandal wind farm. Prioritize the NEOM project for its 100% renewable energy plan by integrating advanced technologies and sustainable practices.

Implement funding mechanisms such as feed-in tariffs, green bonds, and public-private partnerships to provide stable funding sources and incentivize private investment in renewable energy.

Improve the investment climate by reducing the time and cost of obtaining business licenses, streamlining construction permits, and enforcing anti-bribery laws. Establish specialized commercial courts for quick and fair resolutions to commercial disputes.

Mitigate risks associated with oil market volatility by developing sectors like petrochemicals, mining, and renewable energy. This diversification will provide alternative revenue streams less susceptible to global oil price fluctuations.

Incorporate trends from the global oil market into export strategies. Understanding and anticipating oil price fluctuations can help tailor policies to mitigate adverse effects and leverage favorable conditions for maximizing economic benefits.

Conduct detailed analyses to uncover the nuanced impacts of FDI and government expenditure within domains like renewable energy, technology, and healthcare. Analyze the role of FDI in renewable energy projects for sector-specific insights.

Improve regulatory frameworks, ensure political stability, and offer incentives to sustain FDI. Encourage strategic partnerships with foreign firms for technology transfer, management know-how, and access to global markets. Foster local enterprise development, particularly SMEs.

Optimizing Government Spending Efficiency by Focusing on sectors like technology, renewable energy, and education.

Enhance fiscal policy flexibility and promote public-private partnerships in large-scale projects. Monitor and evaluate the long-term outcomes of public investments to ensure alignment with national goals.

By Investing in solar and wind projects, upgrade grids and storage solutions, and establish robust regulatory frameworks. Support research and development, form partnerships with global entities, and develop educational programs for local expertise. Ensure long-term policy support through incentives like tax breaks, subsidies, and guaranteed pricing for renewable energy output.

Limitations

While the current study provides significant insights, several key limitations should be addressed in future research:

The analysis did not incorporate IRFs, which could offer a deeper understanding of the dynamic responses of GDP to shocks in FDI, renewable energy consumption, government expenditure, and exports. Future studies should consider using IRFs to capture these temporal dynamics and potential lagged effects.

The study relies primarily on data up to 2021, which may not fully reflect the latest economic developments and policy impacts. Significant changes and implementations, particularly those associated with Vision 2030, have likely continued beyond 2021. This includes advancements in renewable energy projects, new FDI inflows, and additional government expenditure programs. The absence of post-2021 data means the study may not capture the full impact of these developments, potentially leading to gaps in analysis and conclusions. Incorporating more recent data would provide a more accurate and up-to-date understanding of Saudi Arabia's economic landscape.

The models used might not account for all potential influencing factors, such as technological advancements and international trade agreements. The detection of structural breaks, especially around 2019-2021, suggests that the models may not fully account for evolving economic dynamics. Future studies should consider re-specifying models to handle these breaks using methods like dummy variables or segmented regression techniques.

The analysis assumes stationarity and linearity in the time series data. Although differencing techniques were used to achieve stationarity, some non-linear relationships, especially in renewable energy consumption, might not have been fully captured. Future research should explore non-linear models to better understand these dynamics.

By addressing these limitations, future research can build upon the current study's findings to provide a more comprehensive understanding of Saudi Arabia's economic landscape and the factors driving its development.

Future Research Directions

Building on the findings and limitations of this study, several avenues for future research are recommended to further understand and enhance Saudi Arabia's economic development, particularly in relation to renewable energy, FDI, and government expenditure:

Including more recent data beyond 2021 will help validate and extend the current findings. Future research should aim to include data from subsequent years to assess the ongoing impacts of recent economic and policy changes.

Future research should incorporate advanced techniques such as rolling regression analysis and segmented regression models to better capture the impacts of policy shifts and structural changes identified post-2019.

To enhance model relevance and predictive power, future studies should integrate additional variables such as technological advancements, human capital development, and international trade agreements. Detailed studies focusing on specific sectors such as renewable energy, technology, and healthcare will reveal the nuanced impacts of FDI and government expenditure within these domains.

Analyzing the specific conditions under which FDI positively influences economic growth will provide deeper insights into attracting and sustaining foreign investments. Future studies should examine the impact of regulatory reforms, political stability, and market conditions on FDI inflows and their subsequent effects on the economy.

By pursuing these future research directions, scholars and policymakers can gain a deeper understanding of the complex dynamics at play in Saudi Arabia's economic

development, leading to more effective strategies for achieving sustainable and diversified economic growth.

7.References

- Abaker, M.O., Al-Titi, O., & Al-Nasr, N.S. (2019). Organizational policies and diversity management in Saudi Arabia. *Employee Relations: The International Journal*.
- Abdouli, M., & Hammami, S. (2017). Exploring links between FDI inflows, energy consumption, and economic growth: Further evidence from MENA countries. *Journal of Economic Development*, 42(1), 95-117.
- Abro, A. A., Alam, N., Murshed, M., & Mahmood, H. (2023). Drivers of green growth in the Kingdom of Saudi Arabia: Can financial development promote environmentally sustainable economic growth? *Environmental Science and Pollution Research*, 30, 23764–23780. <https://doi.org/10.1007/s11356-022-23867-z>
- Albassam, B.A. (2015). Does Saudi Arabia's economy benefit from foreign investments? *Benchmarking: An International Journal*, 22, 1214-1228.
- Alkathlan, K.A., Alkhateeb, T.T., Mahmood, H., & Bindabel, W.A. (2020). Determinants of diversification from oil sector in Saudi Arabia. *International Journal of Energy Economics and Policy*.
- AL-Tamimi, K.A., Jaradat, M.S., Aityassine, F.L., & Soumadi, M.M. (2023). Impact of renewable energy on the economy of Saudi Arabia. *International Journal of Energy Economics and Policy*.
- Amran, Y. A., Amran, Y. M., Alyousef, R., & Alabduljabbar, H. (2020). Renewable and sustainable energy production in Saudi Arabia according to Saudi Vision 2030; Current status and future prospects. *Journal of Cleaner Production*, 247, 119602.
- Anghelache, C. (2011). Analysis of the correlation between GDP and the final consumption. *Theoretical and Applied Economics*, 129-138.
- Apergis, N., & Payne, J.E. (2010). Renewable energy consumption and economic growth: Evidence from a panel of OECD countries. *Energy Policy*, 38, 656-660.
- Albaheth, H. E. (2023). Increasing FDI inflows into Saudi Arabia through bilateral investment treaties. *Croatian International Relations*

- Review (CIRR), XXIX(93), 73-90. <https://doi.org/10.2478/CIRR-2023-0054>
- Al-Ghamdi, S. A., & Alshaibani, K. A. (2017). The potential of solar energy in Saudi Arabia: The residential sector. *Journal of Engineering and Architecture*, 5(2), 32-53. <https://doi.org/10.15640/jea.v5n2a4>
- Alkhatlan, K. (2020). Impact of inflation, FDI, and trade openness on economic growth in Saudi Arabia. *Journal of Economic Studies*, 47(3), 611-624.
- Alshammry, M. A. D., & Muneer, S. (2023). The influence of economic development, capital formation, and internet use on environmental degradation in Saudi Arabia. *Future Business Journal*, 9(60). <https://doi.org/10.1186/s43093-023-00246-9>
- Azam, M., Khan, F., Ozturk, I., Noor, S., Yien, L. C., & Bah, M. M. (2023). Effects of renewable energy consumption on human development: Empirical evidence from Asian countries. *Journal of Asian and African Studies*. <https://doi.org/10.1177/00219096231173387>
- Berradia, H., Abid, M., & Gheraia, Z. (2023). Renewable energy consumption-economic growth nexus in Saudi Arabia: Evidence from a bootstrap ARDL bounds testing approach. *WSEAS Transactions on Environment and Development*, 19, 33-44. <https://doi.org/10.37394/232015.2023.19.4>
- Belloumi, M. (2014). The relationship between trade, FDI and economic growth in Tunisia: An application of the autoregressive distributed lag model. *Economic Systems*, 38(2), 269-287.
- Belloumi, M., & Alshehry, A. S. (2018). The impacts of domestic and foreign direct investments on economic growth in Saudi Arabia. *Economies*, 6(1), 18.
- Banafea, W. A., & Ibnrubbian, A. (2018). Assessment of economic diversification in Saudi Arabia through nine development plans. *ERN: Other Development Economics: Regional & Country Studies (Topic)*.
- Belloumi, M., & Alshehry, A. S. (2015). Sustainable energy development in Saudi Arabia. *Sustainability*, 7(1), 1-18.
- Barhoumi, E. M., Okonkwo, P. C., Zghaibeh, M., Belgacem, I. B., Alkanhal, T. A., Abo-Khalil, A. G., & Tlili, I. (2019). Renewable energy resources and workforce case study Saudi Arabia: Review and recommendations. *Journal of Thermal Analysis and Calorimetry*, 141, 221-230.
- Chenery, H. (1979). *Structural Change and Development Policy*. Oxford University Press.
- Dunning, J. H. (1980). Toward an eclectic theory of international production: Some empirical tests. *Journal of International Business Studies*, 11(1), 9-31. <https://doi.org/10.1057/palgrave.jibs.8490593>
- El-Awady, S., Al-Mushayqih, S., & Al-Oudah, E. (2020). An analytical study of the determinants of foreign investment in Saudi Arabia "Saudi Vision 2030". *Journal of Back and Musculoskeletal Rehabilitation*, 11.
- Elzaki, R. M. (2023). Impact of financial development shocks on renewable energy consumption in Saudi Arabia. *Sustainability*, 15(22), 16004. <https://doi.org/10.3390/su152216004>
- Erum, N., Hussain, S., & Yousaf, A.M. (2016). Foreign Direct Investment and Economic Growth in SAARC Countries. *Journal of Asian Finance, Economics and Business*, 3, 57-66.
- Euchi, J., Omri, A., & Al-Tit, A.A. (2018). The pillars of economic diversification in Saudi Arabia. *World Review of Science, Technology and Sustainable Development*, 14, 330.
- General Authority for Statistics (GASTAT). (2023). *GASTAT issues FDI index for 2022 and for Q3 of 2023*. Retrieved July 24, 2024, from <https://www.stats.gov.sa/en/news/514>
- International Renewable Energy Agency. (2021). *Renewable energy in Saudi Arabia*. Retrieved from <https://www.caschi.ch/wp-content/uploads/Saudi-Arabia-Renewable-Energy-Industry-Outlook.pdf>
- Kang, X., Khan, F. U., Ullah, R., Arif, M., Rehman, S. U., & Ullah, F. (2021). Does foreign direct investment influence renewable energy consumption? Empirical evidence from South Asian countries. *Energies*, 14, 3470. <https://doi.org/10.3390/en14123470>
- Kahia, M., Omri, A., & Jarraya, B. (2021). Green energy, economic growth and environmental quality nexus in Saudi Arabia. *Sustainability*.
- Keynes, J. M. (1936). *The General Theory of Employment, Interest, and Money*. Macmillan.
- Lewis, W. A. (1954). Economic development with unlimited supplies of labour. *The Manchester*

- School*, 22(2), 139-191. <https://doi.org/10.1111/j.1467-9957.1954.tb00021.x>
- Mo, P. H. (2008). Government expenditures and economic growth: The supply and demand sides. *Fiscal Studies*, 28, 497-522.
- Oxford Institute for Energy Studies. (2020). Saudi oil policy: Continuity and change in the era of the energy transition. Retrieved from <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2021/01/Saudi-Oil-Policy-Continuity-and-Change-in-the-Era-of-the-Energy-Transition-WPM-81.pdf>
- PIF. (2021). Public Investment Fund Program. Retrieved from <https://www.pif.gov.sa>
- Rahman, M. M., Hasan, M. A., Shafiullah, M., Rahman, M. S., Arifuzzaman, M., Islam, M. K., Islam, M. M., & Rahman, S. M. (2022). A critical, temporal analysis of Saudi Arabia's initiatives for greenhouse gas emissions reduction in the energy sector. *Sustainability*, 14(19), 12651. <https://doi.org/10.3390/su141912651>
- Rafindadi, A. A., Isah, A. B., & Usman, O. (2023). Economic development and energy consumption in Saudi Arabian economy: Do globalization, financial development and capital accumulation matter? *International Journal of Energy Sector Management*. <https://doi.org/10.1108/IJESM-07-2023-0026>
- Rogers, E. M. (1962). Diffusion of innovations. Free Press.
- Saudi Central Bank. (2023, December). *Monthly statistics bulletin*. Retrieved from <https://www.sama.gov.sa>
- Saudi Vision 2030. (2020). Saudi Arabia's Vision 2030. Retrieved from <https://www.vision2030.gov.sa/en/vision-2030/vrp/national-transformation-program/>
- Saudi Legal Framework. (2021). Anti-bribery law. Retrieved from <https://www.saudi.gov.sa>
- Saudi Ministry of Investments. (2021). Investment law and regulatory framework. Retrieved from <https://www.misa.gov.sa>
- Sadorsky, P. (2009). Renewable energy consumption and income in emerging economies. *Energy Policy*, 37, 4021-4028.
- Tulsidharan, S. (2006). Government expenditure and economic growth in India.
- Vision 2030. (n.d.). Dumat Al Jandal. Retrieved from <https://www.vision2030.gov.sa/en/expl ore-more/dumat-aljandal/>
- Xu, P., Zhang, J., & Mehmood, U. (2023). How do green investments, foreign direct investment, and renewable energy impact CO2 emissions? Measuring the role of education in E-7 nations. *Sustainability*, 15(19), 14052. <https://doi.org/10.3390/su151914052>
- Waheed, R. (2023). Energy challenges, green growth, blue indicators, and sustainable economic growth: A study of Saudi Arabia. *Evaluation Review*, 47(6). <https://doi.org/10.1177/0193841X221134653>
- World Bank. (2021). Saudi Arabia's energy sector transition. Retrieved from <https://www.worldbank.org/en/topic/energy/overview>