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Role of Environmental Tax, Financial Development and Political Stability to Address the Renewable Energy Challenges: Empirical Study for MENA Region

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Abstract

The rise in economic growth and use of energy in developing countries are causing a big increase in the environmental pollution that harms the public health. So, this study is about the incline towards renewable energy in developing countries. It looks at how things like having more money, taxing pollution, and having a stable government can help these countries to use more renewable energy. We have compiled the data from approximately 21 MENA countries from 1990 to 2020 using GMM and CSARDL approaches. The results from CSARDL matched the results from GMM, which makes the findings reliable and strong. The long- term findings showed that although green invention and the use of renewable energy cut emissions, financial development raises carbon emissions. However, there was a notable variation in the emigrations mitigating impacts of both variables, with green invention having a lesser significance with emission mitigation. While the short-run outcome likewise yields parallel conclusions, the magnitude of their measure is comparatively lower. The finding report the incorporation of green technology and renewable energy with financial sector will be useful to counter the environmental consequences.

Keywords: Renewable energy adoption; financial development; political stability; environmental taxes; CSARDL, MENA region.

Introduction

Developing economies have been finding it delicate to expand their economy recently, but they're also dealing with environmental issues brought on by rising situations of assiduity, urbanization, transportation, and energy consumption. These nations are coming to understand that reliance on fossil fuels, similar as coal and oil painting, is one of the main causes of pollution in the terrain. The impact of climate change and carbon dioxide emigrations on the global ecosystem has garnered substantial attention in recent times. There's great promise for clean energy sources like the sun, wind, and water to both match global energy demands and guard the terrain. The primary issue is that these nations cannot go the more precious clean energy results; adopting clean energy can be precious and delicate due to this. Exemplifications of similar renewable energy sources are solar panels and wind turbines. Notwithstanding the problems with these resources, economies are finding it delicate to change the energy balance by using further renewable energy and lower nonrenewable energy. Nevertheless, it’s pivotal to look into the elements that support choices about renewable energy.

We need strong international environmental accords to mitigate environmental degradation and keep global temperatures at respectable situations. Paris and the Kyoto Protocol are the two

most well- known international environmental agreements. In order to minimize carbon dioxide emigrations, these agreements explosively advise using renewable energy sources and enhancing energy effectiveness. In order to cleave to international environmental accords, a number of industrialized and developing nations have seen renewable energy sources as environmentally friendly alternatives. Solar radiation, downfall, geothermal heat, swells, and other natural resources are the sources of renewable energy, which is regarded as clean energy that can lessen its negative goods on the environment. To further support current and future profitable conditions, these sources are sustainable. Since 1950s, the carbon emission ratio has been increased by fourth times which is around 80 percent of total greenhouse emissions.

Any nation's profitable growth appears to be facilitated by financial development, which also appears to appreciatively impact environmental quality. A developed financial system can lower lending costs, attract foreign investment, and reduce emissions through the creation of energy effectiveness. It's the one that really determines how good the environment is. In addition, the state's well financial structure provides funding for exploration and development. Despite several attempts by scholars to investigate the relationship between environmental indicators and financial progress, the results remain equivocal. Financial development, on the other hand, increases the energy sector's funding sources, which lowers carbon dioxide emigration. First, it speeds up the product process, which increases air pollution in the end.

Political steadiness is vital for nations to prosper efficiently. The nation must produce a favorable political climate to draw in international investment. However, one needs more than just a strong institutional framework, sound governance to draw in international investors, and a performing popular system. It's also important to consider the continuity of these aspects to attract international investors. The Three sub-dimensions make up the idea of sustainability, which is assessed in terms of its environmental aspect the environmental, social, and economic sub-dimensions. Each nation has its own objectives for sustainable development, and to meet these objectives, different programs are put in place. The sustainable development programs are relatively new, although they've already been implemented on a small scale In Turkey (Kirikkaleli and Osmanlı 2023).

This article's primary contribution is an analysis of the MENA region's capability to transition to low- carbon energy sources and a look at the factors that are driving this metamorphosis. First, we concentrate on the significance and function of political governance in this energy blend metamorphosis process. Consistent programs on profitable activities, environmental challenges, the energy transition, etc., are facilitated by political stability. On the other hand, the government's increased stability helps to advance renewable energy sources. Secondly the study also looks at how important financial development is when creating energy programs. Increasing financial development helps to improve the financial structure, which increases the vacuity of finances. The application of renewable energy sources rather than nonrenewable energy is encouraged by the expansion of these funding sources. Still, for MENA nations, its is need of time to explore the interconnection between financial development and renewable energy. Thirdly, we look at how environmental taxes and technology advancements can encourage the usage of renewable energy. Last but not least, the current study confirms the former findings using a variety of econometric approaches.

The study's subsequent sections are arranged as follows a detailed analysis of the material literature is given in the coming section. The model and data sources are presented in Section (3). Section (4) provides an explanation of the econometric technique. Section (5) of the paper concentrates on the empirical findings, and Section (6) provides a summary and a discussion of the policy implications. Incipiently, suggestions for future directions are produced.

Literature Review

This section of the exploration nearly into how the use of clean energy is impacted by factors likes as financial stability, stable governance, and pollution freights. In order to comprehend this subject, we must be apprehensive of the background of clean energy exploration. The study's section on the literature review provides an overview of what's presently known about this subject, including crucial findings, similarities and differences among studies, and notable discoveries. By pressing the gaps and constraints in the current exploration, this study further highlights the necessity for fresh investigation. Three sections make up the literature review portion of the study, and each one aims to give a thorough and accessible explanation of what's known from earlier studies.

There are numerous advantages to using a renewable energy source in addition to meeting energy requirements. Long- term financial earnings are another benefit of using renewable energy sources, in addition to environmental ones. It's also possible to gain redundant money by exporting fossil energies and abundant renewable energy that would else be employed domestically (Jalilvand 2012). The health of the earth and the well- being of all species are intertwined in several international environmental law instruments, but global legal administrations have infrequently adopted a comprehensive and ecosystem- based perspective. Aware of the significance of natural diversity for elaboration and the preservation of the biosphere's life- sustaining systems is a demand outlined in the 1992 Convention on Biological Diversity. The Retention of essential health links between humans, wildlife, domesticated creatures and shops, and all nature" is one of the more recent demands made by the Berlin Principles 2019 on One Earth, One Health, and One Future. The economy is impacted by environmental taxation in a variety of ways, from favorable to negative. Green taxes incentivize ecologically salutary profitable exertion while discouraging environmentally dangerous exertion. The principles of taxation, including equity, profitable effect, and practicality, ought to be upheld in any script (Nchofoung, Fotio, and Miamo 2023). These issues are substantially about guarding the environment and promoting sustainable growth and development (Nathaniel, Adeleye, and Adedoyin 2021).

Environmental taxes, like carbon taxes, can be used to make enterprises and individuals pay for adopting clean technology and minimizing their environmental impact. They can also be used to internalize the external costs of environmental pollution. Environmental levies may grease the perpetration of the Paris Agreement and quicken the shift to low- carbon, climate- flexible husbandry by acting as a source of profit for clean energy and climate action (Sarpong et al. 2023). Carbon emissions can be reduced by using renewable energy sources, which are energy sources that are produced by solar power or other natural resources including wind, sun, biomass, hydroelectricity, and thermal energy. The effect of both NRE and RE on the environment in MENA states was examined. The experimenters came to the conclusion that whereas NRE deteriorates the terrain, shaft doesn't significantly ameliorate environmental performance (Albaker et al. 2023).

A crucial factor impacting how sustainable development unfolds is the intricate link between environmental taxes and the use of renewable energy. The imposition of an environmental tax, which is considered a profitable tool, internalizes the external charges related to resource reduction and pollution. However, by assessing taxon carbon emigrations and other dangerous pollutants, environmental taxation encourages businesses and individuals to switch to more environmentally familiar energy sources. A growth in the use of clean energy is being concurrently with the shift towards cleaner energy sources, which helps to smooth the shift down from fossil energies that are high in carbon. likewise, putting into practice effective environmental duty laws encourages the de-

velopment of new green energy results in addition to encouraging the adoption of proven clean energy technology (Su, Qamruzzaman, and Karim 2023).

The economic literature of today has concentrated on financial development as a critical element of environmental quality. Numerous papers have examined this relationship between financial development and CO2 emissions. Additionally, a current debate highlights the significance of reformulating this system in order to finance sustainable development, given the part that financial development had in the spread of renewable powers (Saadaoui 2022). Incipiently, a variety of studies examining the goods of the formal frugality on energy and the environment have been presented; however, there's presently lower exploration on the question of how unconventional activities affect the environment. This link is necessary, nevertheless, because the unconventional sector, occasionally known as the "shadow economy" (SEC), avoids various environmental restrictions and isn't subject to sanctioned oversight, while other governmental oversights operate on the fringe of official oversight sweats to reduce environmental pollution. SEC may encourage the use of renewable energy indeed though it's built on an unofficial framework (Zhang and Razzaq 2022).

Methodology

This study investigates the ways in which environmental fees, political stability, and financial substance can accelerate the adoption of renewable energy sources. The conception is displayed in Figure 1. According to the involvement of financial institutions, the process of expansion of renewable energy projects tend to boost in the region. This is due to the high cost of structure and other design- related charges. Investors and design inventors can gain the finances they want through banks, stock markets, and other financial channels in a well- developed financial system.

A wholesome financial system also results in cheaper financing costs for renewable energy systems. This is as a result of reduced interest rates and improved risk- sharing strategies. Growth in the economy also encourages the development of new financing strategies for renewable energy, similar as carbon requests and green bonds, which enable individual investors in clean energy systems. The expansion of renewable energy is facilitated by each of these elements.

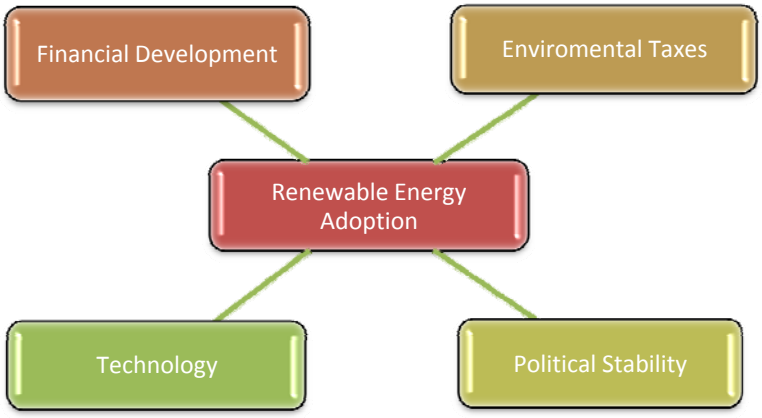

Figure 1. Determinants of renewable energy adoption

A key factor influencing the use of renewable energy is political stability. A stable political climate makes a nation more suited for long- term planning and structure investment in renewable energy. Consistent laws and regulations, which lower the pitfalls involved in investing in renewable

energy systems, are another outgrowth of political stability. Investor confidence is increased by these programs' constancy.

A stable political environment makes it possible to give a solid foundation for renewable energy. Stable governments, constantly supported by impulses like feed- in tariffs and renewable portfolio norms, are suitable to put in place expansive renewable energy programs and set ambitious targets. Furthermore, by allaying investor fears of unlooked-for policy shifts, nationalization, or the seizure of renewable energy means, political stability raises investor confidence in the renewable energy markets.

The use of environmentally friendly energy sources can be significantly increased by environmental taxes like carbon impositions or emigrations trading programs. Adopting green energy and renewable energy results is financially encouraged by these tariffs. Such activities will be useful to enhance the practice of renewable energy. Environmental tax money can also be used to fund exploration and development, structure systems, subsidies, and other renewable energy- related enterprise. By encouraging a move toward grown, more sustainable energy sources like renewable energy, these tariffs also mitigate the negative goods of consuming fossil energies. In summary, the combination of financial development, political stability, and environmental taxes have significant importance in accelerating the acceptance of renewable energy, as illustrated in the theoretical framework of this study.

$$RA_{it} = f(FDev_{i,t}, Etax_{i,t}, TE_{i,t}, PSb_{it}) \quad (1)$$

Where *RA* is renewable energy adoption, *Fdev* is financial development, *Etax* is environmental tax, *TE* is technology and *PSb* is political stability.

The empirical model, which was developed in response to the study done, uses the rate of total energy consumption to represent the consumption of renewable energy as a deputy for the relinquishment of renewable energy. We have modified the variables by using the natural log for each variable before conducting the empirical analysis. Both the data smoothing and the plainness influence of the repressors are directly produced by the log-direct metamorphosis. Based on the log-direct specification, the following model represents the renewable energy adoption function

$$LnRA_{i,t} = \beta_0 + \beta_1 LnFDev_{i,t} + \beta_2 LnEtax_{i,t} + \beta_3 LnTE_{i,t} + \beta_4 LnPSb_{i,t} + \varepsilon_{i,t} \quad (2)$$

Equation (2) has the intercept β_0, adaptability β_1, β_2, β_3, and β_4; technology is represented by TE; and the disturbance factor, $\epsilon_{i,t}$, is believed to be independently and identically distributed.

For econometric estimations, we have collected the data from 1990 to 2020, which has been collected from multiple sources, such as, World Development Indicators (WDI), International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD) and Worldwide Governance Indicators (WGI). Table 1 provides an explanation of the variables in our exploration model and lists the data sources that we used to get the information for our analysis.

Table 1. Variables

Notation	Variables	Definition	Sources
RA	Renewable Energy Adoption	Renewable energy consumption as a ratio to total energy consumption	WDI Database
Fdev	Financial Development	Financial Development	IMF Database
Etax	Environmental Taxes	Total environmental Taxation	OECD Database
TE	Technology	No. of patents	WDI database
PSb	Political Stability	Political Stability and the Absence of Violence	WGI Database

Econometric strategy

When doing empirical exploration with panel data, it's extremely important to do across-sectional dependence test, particularly if the sample unit consists of developing and transitional nations with analogous profitable features. Trade barriers have dropped, profitable integration has expanded, and globalization is to condemn for the increase in geographical dependence in panel data. The overlooked interconnectedness of spatial units in empirical data can lead to deformation, contradictory results, and incorrect conclusions. therefore, in order to remove similar biases and inconsistencies, we conducted across-sectional dependent test using the individual test by, which is recommended for both balanced and unstable panels (Giovannetti and Hamoudia 2022). The following is the expression for the Pesaran test statistic

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=I}^{N-1}\sum_{j=i+1}^{N}\widehat{corr}_{ij}\right)\sim N(0,1) \quad (3)$$

$$LMadj = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\frac{(T-k)\hat{\rho}_{ij}^{2}-\mu_{Tij}}{\nu_{Tij}} \quad (4)$$

Where the ordered pairwise correlation that responds to each cross section in each period is represented by *N* for sample size and *T* for time period. Likewise, the *CD* test may yield deceiving results if there's no pairwise group-average correlation but there are still on-zero individual pairwise correlations.

Panel unit root testing

Next, we used the second- generation unit root test, which is CADF and CIPs, to verify the steady features of panel data. In the case of cross-sectional dependence, the application of first generation unit root test is misleading, as it ignores diversity, cross section dependence (Choi 2001). Accordingly, the following is the mathematical expression for CADF:

$$\Delta Y_{i,t}=\alpha_i + \gamma_i Y_{i,t-1} + \beta_i \bar{Y}_{t-1} + \sum_{j=0}^{k}\delta_{i,j}\,\Delta Y_{i,t-j} + \sum_{j=1}^{k}\theta_{i,j}\,\Delta Y_{i,t-j} + \varepsilon_{i,t} \quad (5)$$

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} CADF \quad (6)$$

Cross sectional ARDL

When panel data has large cross sectional dimensions and short time periods, the CSARDL model performs well. Features of ARDL(Autoregressive Distributed Lag) models and fixed effects models are combined in this model (Chudik et al. 2016). These cross-sectional pars are added as supplementary repressors in the CSARDL model, which allows for improved evaluation and control of unobserved diversity and biases from missing variables. According to (Chudik and Pesaran 2015), the fine expression of CSARDL is as follows

$$LnRA_{i,t}=\sum_{I=0}^{p}\sigma_{i,I}\;LnRA_{i,t-1} + \sum_{I=0}^{q}\beta_{i,I}\,Z_{i,t-1} + \sum_{I=0}^{r}\acute{\varphi}_i\,I\bar{X}_t + \varepsilon_{i,t} \quad (7)$$

Where, $Xt - I = LnRAi$,— $IZi,t - I$ denoting the mean cross-section of all under-observation variables that obliterate the spillover effects.

GMM technique

GMM was used for evaluation in this work since it takes endogeneity, rear reason, periodical correlation, and heteroscedasticity into consideration. Biased parameter estimators could affect from the estimate procedure if these concerns are ignored. However, because it employs pause differences as a tool, the system GMM estimator works more to address these problems:

$$LnRA_{i,t}= \pi LnRA_{i,t-1}+\beta_1 LnFDev_{i,t} +\beta_2 \mathrm{LnE}tax_{i,t} + \beta_3 LnTE_{i,t} + \beta_4\ \mathrm{LnP}Sb_{i,t} + \varepsilon_{i,t} \quad (8)$$

Here, $\varepsilon_{i,t}= \mu_t + \eta_i + V_{i,t}$
Where, μ_t and η_i represent the time and individual-specific effect.
E (μ_i) = E ($V_{i,t}$) = E ($\mu_{i\,,V_{i,t}}$) = 0
The modified version of the above equation is as follows:

$$\Delta LnRA_{i,t}=(\pi 1)LnRA_{i,t-1}+\beta_1 LnFDev_{i,t}+\beta_2 LnEtax_{i,t}+\beta_3 LnTE_{i,t}+\beta_4 LnPSb_{i,t}+\varepsilon_{i,t} \quad (9)$$

Results and Discussion

Table 2 provides the statistical characteristics of the factors used in this study, including the total number of compliances, the mean, the standard divagation, and the minimum and outside values. The smallest and maximum values indicate how distributed the data is, the standard deviation shows how far compliances diverge from the mean, and the mean value aids in determining the parameter's average value in developing countries.

Table 2. Descriptive statistical summary

Variables	Obs	Mean	Std. Dev	Min	Max
LnRA	486	3.6745	0.8652	-0.2765	5.4422
LnFdev	486	-0.9966	0.3827	-2.9748	-0.4049
LnEtax	486	-0.9374	3.1156	-10.8347	4.2371
LnTE	486	0.4234	2.5002	-5.2078	5.5987
LnPSb	486	-0.8180	2.677	-7.2307	0.8654

This study uses a many primary experiments, similar as the cross-sectional dependence (CD), slope unity, and unit root tests, before advancing to the panel data estimation technique. Table 3 displays the outcomes of the CSD. In addition, this study uses a Biased- Adjusted LM test, which is applicable when N< T, to evaluate error sampling independence. The test's outgrowth is shown in Table 4. The absence of cross-sectional independence is verified by the results of both tests. The reasons behind sampling dependence are different. One possible reason is the circumstance of wide shocks that impact several countries or areas worldwide, each with its own unique consequences. Another argument for sampling dependence is the presence of original spillover goods. These results are related to the shocks or impacts that are transferred between neighboring countries or regions and affect in correlations in their macroeconomic indicators. There are several ways that the spillover goods might do, for as through trade, financial connections, or the spread of technology. Likewise, Table 5 presents the findings of a pitch unity test conducted for the current disquisition. The result shows that there are differences in pitch values between panels.

Table 3. CD test by Pesaran (2004)

Variable	CD-Test	P-value	Corr	Abs (corr)
LnRA	5.62***	0.000	0.085	0.587
LnFdev	29.58***	0.000	5.97	0.707
LnEtax	-0.40	0.863	-0.006	0.484
LnTE	13.52***	0.000	0.303	0.688
LnPSb	0.38	0.887	0.006	0.422
Note: *** signifies level of significance at 1%.				

Table 4. Bias-Adjusted LM test

Test	Statistic	P-value
LM	198.099***	0.000
LM adjusted (2-sided test)	11.140***	0.000
LM CD (2-sided test)	2.992***	0.000
Note: *** Signifies level of significance at 1%		

Table 5. Slope heterogeneity test

	Statistics	P-value
Delta	19.896***	0.000
Adj. Delta	23.013***	0.000
Note *** signifies level of significance at 1 %		

The variables are then tested for stationary using a unit root test. In order to address the issues of slope cross-section dependency and heterogeneity, this study employed a second-generation stationary test. Section reliance presents difficulties for CADF in comparison to CIPS, which takes both slope heterogeneity and section dependency into consideration. Table 6 displays the results of the unit root test, which show that the dependent variable is stationary at first difference. The stationarity states of PSb at the first difference above and Fdev, Etax, and TE at the level are explained by the CADF results. Every independent variable, including Etax, is stationary at first difference, according to the CIPS results.

Table 6. CADF and CIPS unit-root test results

Variable	CADF		CIPS	
	I(0)	I(1)	I(0)	I(1)
LnRA	-2.016 (0.117)	-2.577*** (0.000)	-1.947	-3.842***
LnFdev	-3.146*** (0.000)	-2.899*** (0.000)	-3.225***	-6.446***
LnEtax	-2.004* (0.089)	-2.982*** (0.002)	-1.0991	-5.065***
LnTE	-3.326* (0.049)	-1.663*** (0.003)	-3.137***	-4.886***
LnPSb	-2.084 (0.899)	-2.873*** (0.000)	-3.356***	-5.632***
Note: *** , **, * signifies level of significance at 1, 5 and 10 %.				

In order to evaluate the possibility of a long- run equilibrium relationship between variables, integration testing is essential as the stationary test indicates that some of the model's variables are time- variant. Use of alternate- generation integration tests is pivotal, as evidenced by the cross-sectional dependence observed. The Westerlund Durbin- Hausman Panel cointegration approach is chosen for this study because it doesn't require determining the order of integration, indeed in light of the heterogeneous order of integration within the model. To further address the difficulties presented by diversity and cross-sectional reliance in panel data analysis, this error-correction-grounded integration approach was developed (Persyn and Westerlund 2008). Table 7 presents the

integration test's result. Long- run equilibrium is shown by the integrating relationship between the variables.

Table 7. Error-Correction–Based Integration Approach

Stat	Value	z-value	p-value
Gt	-1.023	4.053	0.746
Ga	-2.162	3.973	0.478
Pt	-1.325	5.014	0.151*
Pa	-1.542	4.126	0.151*
Note: *** , **, * signifies level of significance at 1, 5 and 10 %.			

Furthermore, the two-step GMM approach has been incorporated which handles the issue of endogeneity. Addressing data problems similar as endogeneity autocorrelation, heteroscedasticity, and cross-sectional reliance is pivotal for accurate and effective results. A suitable strategy that successfully addresses these issues and provides respectable results is the dynamic system GMM fashion. Cross-sectional dependence reduces the degree of correlation between cross-sections over the same time period; this difficulty is explained by time- fixed goods (Petersen 2009)important presuppositions. Nevertheless, the eventuality for heteroscedasticity, autocorrelation, and CD problems is also taken care of using clustered robust standard crimes. As a means of furnishing dependable statistical conclusion, the preliminarily described fashion provides standard crimes that take into consideration both the autocorrelation and heteroscedasticity of the panel data, as well as the eventuality for compliances to cluster within orders. With a thorough explanation of the data, Table 8 presents the system GMM analysis results. Strong common significance among the variables in the model is indicated by the figured F- statistic value, which is largely significant based on the individual tests. Also, the null hypothesis is supported by the Hansen J test result, which suggests that the necessary variables in the model are licit and meet the needed assumptions.

Table 8. The Results of the System GMM

Dep var LnREA			
Variable	**Coeff**	**t-statistics**	***p*-value**
LnRA (-1)	0.8346	19.98***	0.000
LnFdev	0.2934	1.97*	0.055
LnEtax	0.1034	1.90*	0.047
LnTE	-0.1458	-2.08*	0.087
LnPSb	0.3575	1.86**	0.036
Constant	0.8934	2.87***	0.008
F-Stat (p-value)	351.5*** (0.000)		
AR(2)	0.256		
No. of instruments	20		
Hansen stat (p-value)	21.19 (0.334)		
Note: *** , **, * signifies level of significance at 1, 5 and 10 %. Coeff stats the coefficient.			

The evaluated measure of the lagged dependent variable, LnRA (-1) is statistically significant with a positive coefficient. The dependent variable's pause measure is predicted to fall between 0 and 1. As a result, $\pi -1$ lies between-1 and 0, suggesting that countries or ages with lower baseline

renewable energy relative to total energy employed grow their renewable energy adoption rate more quickly.

The measure value of 0.3231 for financial development suggests that it has a significant positive influence on the uptake of renewable energy sources. The usage of renewable energy in all profitable sectors is greatly facilitated by the growth of the financial assiduity. Access to capital, similar as investment finances and loans, is essential for the implementation of renewable energy systems. Well- established financial requests and institutions help reduce financial obstacles to the relinquishment of renewable energy by making it simpler for individualities and families to gain financing.

The results shown in Table 8 indicate that environmental taxes have a notable and favorable impact on the uptake of renewable energy. Two types of environmental impositions that offer financial impulses for the use of sustainable energy sources are carbon taxes and emissions trading schemes. These costs are generally not regard into the pricing of fossil energies, which leads to market failures and wasteful use of resources. Environmental taxes put a financial burden on environmentally mischievous activities, making them more precious than further provident alternatives similar as renewable energy. This financial benefit leads to a rise in the adoption of sustainable energy techniques.

In case of environmental taxes, we have confirmed a positive coefficient, implying that the increase in environmental taxes leads to enhance the adoption of renewable energy. The implementation of sustainable energy sources can be financially incentivized by environmental impositions similar as emigrations trading programs and carbon levies. The internalization of external costs associated with traditional energy sources, similar as greenhouse gas emissions, environmental pollution, and health goods, through environmental levies improves the profitable feasibility of renewable energy. The market failures and poor resource allocation result from the pricing of fossil energies, which generally doesn't take these costs into account. These outcomes are inline with the research of (Albaker et al. 2023; Samour, Baskaya, and Tursoy 2022).

The findings also demonstrate how strongly political stability influences the adoption of renewable energy sources. Political insecurity, corruption, and uneven laws can discourage both foreign and indigenous investment in renewable energy systems. Stable political climates, however, give an ideal setting for long-term investment in renewable energy. Long- term commitments to renewable energy systems are encouraged by harmonious laws and regulations, which also lessen query and boost investor confidence. This result supports former exploration by (Breetz, Mildenberger, and Stokes 2018) and (Akintande et al. 2020), which stressed the part of political stability in promoting the use of renewable energy. Our results validate the delicacy and perfection of our disquisition, since they align with those of (Hao et al. 2021). The negotiation effect could explain this mischievous effect. Technological advancements and improvements in energy effectiveness could lead to a reduction in overall energy use. This reduction in energy use could be seen positively from the viewpoint of sustainability and resource conservation, but it could also affect in a drop in the share of renewable energy use relative to total energy use.

This study also used the CSARDL technique, which offers objective and dependable long- and short- term estimations when cross-sectional dependence arises, to check for robustness. Table 9 displays the results.

The outcomes demonstrated the unfavorable and substantial measure value of the pause dependent variable, which represents convergence. According to GMM exploration, both in the short and long terms, FDev has a progressive effect on the uptake of renewable energy sources. While en-

vironmental regulations and political stability have minimum short- term goods, they've a significant and positive long- term impact on the use of renewable energy. The disquisition finds that, contrary to the GMM's conclusion, technology influences the relinquishment of renewable energy in a progressive manner in the short term but has a statistically negligible long- term impact. Overall, the results demonstrate that fiscal substance, political stability, and environmental levies have a significant impact on the relinquishment of renewableenergy.The move to greener, more sustainable energy sources is supported by the presence of environmental obligation legislation, a stable political terrain, and fiscal coffers that are available for investment in renewable energy. Therefore, the close alignment of the CSARDL outgrowth with the system- GMM evaluations confirms the results' robustness.

Table 9: CSARDL estimates

Dep Var: LnREA			
Short-run estimates			
Variable	**Coefff**	**Z-stat**	***p*-value**
LnFdev	0.7349	2.72*	0.038
LnEtax	0.9636	2.93	0.325
LnTE	0.7438	2.08***	0.036
LnPSb	-0.2354	-1.94	0.154
l.d.LnRA	-0.6294	-1.91***	0.027
ECT	-07293	-6.03**	0.000
Long-run estimates			
LnFdev	0.624	1.35***	0.057
LnEtax	0.046	2.02**	0.048
LnTE	0.038	0.83	0.299
LnPSb	0.284	3.22**	0.126
Note: *** , **, * signifies level of significance at 1, 5 and 10 %. Coeff stats the coefficient.			

Conclusion and Policy Implications

The MENA region's governments face an alarming obstacle. In order to save the environment while fostering profitable growth, they must also address the goods of climate change and minimize pollution. This demonstrates a shift in perspective as further individualities understand the need of utilizing cleaner and more sustainable energy sources. As a result, there's a rising awareness that fossil energies produce a great deal of pollution and environmental detriment, and we should stop using them. Thus, this study investigates strategies to encourage the adoption of renewable energy sources by a larger number of individualities. According to the study, financial development is crucial for arising nations. It's simpler to gain capital, identify business prospects, and gain funding for renewable energy systems in countries with stronger financial institutions. It functions as a means to an end. The study also demonstrates that the use of renewable energy is beneficial when political stability exists. It's simpler to make long- term plans and apply laws that encourage renewable energy when the government is stable. It establishes an atmosphere in which the state may help and enact regulations that promote the use of renewable energy. The Investor confidence is increased by this stability, which lowers the risks associated with shifting policy. The study concludes by pointing out that trying pollution similar as carbon emigrations can promote the use of cleaner,

more sustainable energy sources. The cost of producing energy from fossil energies rises as a result of this tax, making renewable energy sources appear more charming and financially sensible.

The study's findings indicate that MENA nations may encourage the use of renewable energy by implementing environmental taxes, advancing profitable growth, and maintaining stable political systems. This is critical for developing effective policy. These results suggest that in order to address the issue of renewable energy in these nations, a combination of sound fiscal programs, stable political surroundings, and environmental regulations is needed. It's pivotal to insure political stability. It's simpler to secure funding and make long- term plans for renewable energy when political conditions are stable. To do this, we must strengthen our institutions, legislate clear programs, include further people in politics, support the law, and ensure that all of our programs are consistent.

The deployment of renewable energy must be supported by programs that support the growth of whole financial establishments and systems. The Enhancing the availability of financial resources, developing tailored financing channels, and putting in place legislative structures that encourage renewable energy investments have to be the top precedence's for governments. Similarity measures could include loan guarantee programs designed especially for renewable energy systems, adventure capital finances, and green investment finances. The Encouraging use of renewable energy sources can be achieved through the establishment of environmental taxes. Governments can give financial impulses to incentivize companies and individualities to switch to greener energy sources by placing a price on carbon emigrations or other dangerous activities. but it's compulsory to properly analyze and apply these kinds of taxes, making sure they do not disproportionately burden low income groups and considering how they might affect different profitable sectors. Their adoption can also be accelerated by lowering the financial burdens on people and companies through financial incentives like tax credits or subsidies for renewable energy systems.

The majority of the research is concentrated on arising economies, which suggests that its conclusions couldn't apply to developed economies or other geographical areas. Therefore, relative exploration involving countries or regions with different phases of development and institutional structures may give perceptive information. Likewise, future studies should concentrate on making sure that the advantages of adopting renewable energy are distributed fairly, especially to exclude people. Recognizing and removing the social and profitable obstacles to cost and availability will be essential to achieving equitable and sustainable energy transitions.

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