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HOW MUCH DO FINANCIAL INDICATORS CONTRIBUTE TO RESOURCE CONSUMPTION AND ENVIRONMENTAL SUSTAINABILITY IN CHINA?

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ABSTRACT

This study examines how financial development, GDP, the Shanghai Composite Index, and crude oil prices affect coal consumption and CO_2 emissions in China from 1992 to 2022. We highlight the importance of financial development as a key driver of GDP in emerging economies and its connection to energy use and environmental issues. Employing two different ARDL models, results show that crude oil prices, financial development, and GDP positively affect coal consumption. However, the previous year's financial development and the Shanghai Composite Index are linked to higher CO_2 emissions over the long term. Additionally, the error correction model shows that about 28.26% of short-term imbalances in CO_2 emissions are corrected each year, while 14.74% of coal consumption imbalances return to their long-term balance annually. These findings emphasise the stability of CO_2 emissions and coal consumption systems, highlighting the need for sustainable policies to address the environmental challenges of financial development and energy use in China.

Keywords: Resource consumption, co_2 emissions, financial development, ardl model

Jel Codes: Q01, O44, R15

FİNANSAL GÖSTERGELER ÇİN'DE KAYNAK TÜKETİMİNE VE ÇEVRESEL SÜRDÜRÜLEBİLİRLİĞE NE KADAR KATKIDA BULUNUYOR?

ÖZ

Bu çalışma, finansal kalkınma, GSYİH, Şangay Bileşik Endeksi ve ham petrol fiyatlarının 1992'den 2022'ye kadar Çin'deki kömür tüketimini ve CO_2 emisyonlarını nasıl etkilediğini incelemektedir. Gelişmekte olan ekonomilerde GSYH'nin önemli bir itici gücü olarak finansal gelişmenin önemini ve bunun enerji kullanımı ve çevre sorunlarıyla bağlantısını vurguluyoruz. İki farklı ARDL modeli kullanılarak elde edilen sonuçlar, ham petrol fiyatları, finansal gelişme ve GSYH'nin kömür tüketimini olumlu yönde etkilediğini göstermektedir. Bununla birlikte, bir önceki yılın finansal gelişimi ve Şangay Bileşik Endeksi, uzun vadede daha yüksek CO_2 emisyonları ile bağlantılıdır. Ayrıca, hata düzeltme modeli, CO_2 emisyonlarındaki kısa vadeli dengesizliklerin yaklaşık %28,26'sının her yıl düzeltildiğini, kömür tüketimindeki dengesizliklerin ise %14,74'ünün her yıl uzun vadeli dengesine döndüğünü göstermektedir. Bu bulgular, CO_2 emisyonları ve kömür tüketim sistemlerinin istikrarını vurgulamakta ve Çin'de finansal kalkınma ve enerji kullanımının çevresel zorluklarını ele almak için sürdürülebilir politikalara duyulan ihtiyacı ortaya koymaktadır.

Anahtar Kelimeler: Kaynak tüketimi, co_2 emisyonları, finansal kalkınma, ardl modeli

Jel Kodları: Q01, O44, R15

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INTRODUCTION

As the world's second-largest economy, China's industrial activities have positioned it as a major consumer of global resources, with significant implications for both domestic and international markets (Duan & Guo, 2021; STATISTA, 2024). This intricate interplay between economic indicators and environmental outcomes highlights the need for sustainable development practices, particularly as the nation confronts issues of pollution, resource depletion, and climate change. It is noteworthy that China has undergone a transition from an industrial-based economy towards one that is increasingly reliant on services, which has resulted in shifts in resource consumption patterns (Useche et al., 2024).

The correlation between financial development and energy use demonstrates that improved access to capital intensifies energy demands across various sectors, while trade openness exacerbates competition and resource consumption (Xu & Ding, 2024). Furthermore, local government practices frequently prioritise economic growth over environmental protection, which has led to the implementation of controversial regulatory practices that impede sustainability efforts (Houser, 2014; Schonhardt, 2023). China has made notable progress in clean energy investments in recent years, accounting for nearly half of the world's low-carbon spending in 2022. This reflects a growing commitment to environmental sustainability.

However, concerns persist regarding the sustainability of this trajectory and the ability to decouple growth from resource depletion, given the country's economic growth model, which is heavily dependent on energy consumption. The ongoing challenges of balancing these dynamics underscore the need for strategic policy initiatives aligning economic objectives with environmental stewardship (Aleman & Sendich, 2021; Chen et al., 2022).

Although past research has intensively examined China's resource consumption and China's environmental policies, there is a significant gap in the literature in addressing the joint impacts of macroeconomic indicators—i.e., GDP, financial development, crude oil price, and stock market performance—on resource consumption in a combined analytical framework. Previous studies have concentrated either on single discrete elements (e.g., energy use or trade determinants) or employed sectoral analyses, which frequently fail to capture the interrelated dynamics between financial markets, energy prices, and overall economic development. To fill this research void, this paper incorporates these variables into a unified econometric framework, thereby offering a more complete evaluation of their combined effect on China's resource utilisation. Moreover, unlike prior work that has a primary emphasis on regulatory shortcomings or technical fixes, this work explicitly assesses the influence of market-based drivers (e.g., stock market volatility and oil price volatility) on sustainability results, providing novel implications for policymakers in pursuit of balancing economic and environmental imperatives.

This research examines the influence of gross domestic product (GDP), financial development, crude oil prices, and the Shanghai Composite Index on resource consumption and environmental sustainability in China, which will represent a crucial area of investigation, reflecting the complex interrelationship between rapid economic growth and its associated environmental consequences. The subsequent sections of this research are structured as follows: Section 1 presents a comprehensive examination of the relevant literature, with particular attention to seminal works that inform the research framework. Section 1 also provides a comprehensive account of the research methodology, including a detailed description of the data sources, variables, and econometric models employed. Section 2 presents the empirical results and provides a comprehensive discussion of their implications. In conclusion, Section 3 presents the findings of the study, providing a summary of the main results and suggesting avenues for future research.

1. Literature Review And Hypothesis Development

Since energy is used to produce all commodities and services in developing countries, controlling energy demand requires an understanding of the factors that influence energy consumption (Sadorsky, 2010). China, as a developing country, meets 90% of its total energy consumption from fossil fuels, and especially coal consumption is considered the main cause of air pollution and greenhouse gas emissions (Ji and Zhang, 2019). In this context, there is a consensus that fossil fuel consumption and carbon emissions cause climate change and that fossil fuel consumption should be reduced (Ji and Zhang, 2019). In the empirical literature, various factors of CO_2 emissions and coal consumption have been analysed over the last two decades. Many researchers used panel data methods for country groups, while some used time series techniques with country-based approaches. In these studies, many factors such as financial development (Acheampong, 2020; Li and Wei, 2021; Adebayo et al., 2021; Awosusi et al., 2022) economic growth (Yıldırım et al., 2012; Tang et al., 2016; Adebayo, 2023, Jiang et al., 2025), crude oil prices (Wei et al., 2022; Dai et al., 2023; Zaghdoudi et al., 2023), stock markets (Gu et al., 2020; Chang et al., 2020; Wu et al., 2022; Aswani et al., 2024) were analyzed as determinants of energy consumption and sustainable environment. In this study, consistent with the empirical literature, we use CO_2 emissions and coal consumption as dependent variables while GDP, financial development, Shanghai Composite Index, and crude oil prices are independent variables.

Remarkably, many studies in the empirical literature reveal that the relations among economic growth, energy consumption and efficiency, CO_2 emissions and financial development exist in the long run (Shahbaz et al., 2013; Apergis and Payne, 2014; Zhang et al., 2023; Kirikkaleli and Umar, 2024).

The study by Dilanchiev et al. (2024) examines the nexus among carbon emissions, economic growth and the use of renewable energy for the Caucasus countries using panel causality and panel VAR techniques. The results indicate bidirectional causality between economic growth and energy use, supporting the feedback hypothesis. A pioneering study by Wolde–Rufael (2010) investigates the relationship between economic growth and coal consumption in terms of six major coal-consuming countries for the 1965-2005 period. According to the results, a unidirectional causality exists from coal consumption to economic growth in Japan and India, while there is an opposite causality in China and South Korea. In contrast, for South Africa and the United States, the causality between coal consumption and economic growth is bidirectional. Gyimah et al. (2022) have demonstrated that economic growth leads to increased renewable energy consumption, which in turn boosts foreign direct investment. Ali et al. (2024) investigate the determinants of a sustainable environment for China over the period 2000-2018 using the Fourier ARDL analysis in terms of the long run. The results indicate that financial innovation and economic growth decrease environmental quality and increase CO_2 emissions. Liu and Song (2020) examine the relationship between financial development and carbon emissions in China for the 2007-2016 period. The findings indicate that while financial development will significantly increase emissions in the local province, it will also dramatically reduce emissions in adjacent areas, leading to an overall reduction in carbon emissions.

In this context, we develop the following hypotheses based on the literature given above.

H_1: CO_2 = f (GDP, FD, Shanghai composite index, crude oil prices)

H_2: Coal consumption = f (GDP, FD, Shanghai composite index, crude oil prices)

2. Analysis and Findings

The aim of the study is to analyse the effect of GDP (Per Capita US$) and financial development from World Bank, the Shanghai Composite Index, and crude oil prices on coal consumption and CO_2 emissions in China for the 1990-2022 period. The time frame for analysis is determined based on the availability of data across the variables under study. The data structure is illustrated in Figure 1.

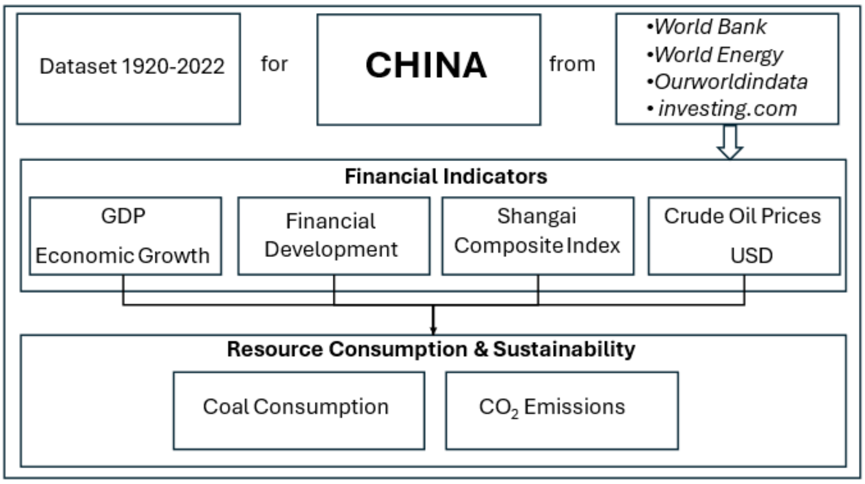

Figure 1. Data Structure of the Research

The definitions and sources of the variables used are shown in Table 1.

Table 1. Description of Variables

Variables	**Definition**	**Source**
GDP	Gross domestic product (per capita) (US$)	Worldbank
FD	Domestic Credit to the Private Sector (% of GDP)	Worldbank
SHCOM	Shanghai Composite Index	Investing.com
CRUDEOILP	US$	Investing.com
COAL	Consumption from coal-measured in terawatt-hours	Ourworldindata.org
CO2	CO2 Emissions from Energy	WorldEnergy

The Autoregressive Distributed Lag (ARDL) method, developed by Pesaran et al. (2001), is used in this research because it is effective in testing for cointegration and dynamic interactions among variables, especially when there are few sample sizes and when variables have mixed orders of integration (I(0) or I(1)). In contrast to traditional cointegration methods (e.g., Johansen, 1988), the ARDL technique does not require all the variables to be of the same order of integration and hence offers greater flexibility in empirical application. Further, the ARDL model simultaneously estimates short-run adjustments and long-run equilibria within a single reduced form estimation framework, which minimises potential omitted variable or misspecified dynamics bias (Pesaran & Shin, 1999).

The most important benefit of the ARDL model is its robustness to endogeneity problems, as it uses a lagged error-correction mechanism (ECM) to differentiate between short-run disturbances and long-run equilibrium. This is particularly relevant to our research, where macroeconomic determinants such as GDP, financial growth, and crude oil prices can have endogenous relations with resource consumption. Moreover, the autoregressive distributed lag (ARDL) bounds test method yields statistically valid outcomes, even in the presence of structural breaks—a characteristic behaviour of emerging economies such as China (Nkoro & Uko, 2016).

All variables are converted to logarithmic form before ARDL estimation to reduce heteroskedasticity and interpret coefficients as elasticities. To verify that there are no I(2) variables that would render the ARDL framework invalid, the stationarity of the series is thoroughly assessed using the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. These test findings must be agreed upon to determine integration orders.

Given that all the series are integrated of order one, I(1), and integrated of order zero, I(0), the ARDL model is used to examine both long-term and short-term dynamics. In this regard, the ARDL(2,3,3,4,3) model for CO_2 and the ARDL(2,0,0,0,0) model for coal consumption were identified as the most appropriate models based on the Schwarz Information Criterion (SIC), using EViews 13 software. The estimation results for these models can be found in Table 2.

Table 2. ARDL Models

Dependent Variable: LCO2				**Dependent Variable: LCOAL**			
Selected model: ARDL(2,3,3,4,3)				**Selected model: ARDL(2,0,0,0,0)**			
Variable	**Coefficient**	**t-Statistic**	**Prob.***	**Variable**	**Coefficient**	**t-Statistic**	**Prob.**
LCO2(-1)	1.284374	7.885243	0.0000	LCOAL(-1)	1.477656	10.03488	0.0000
LCO2(-2)	-0.566981	-4.686093	0.0009	LCOAL(-2)	-0.625034	-4.712378	0.0001
LCRUDEOILP	-0.000662	-0.032999	0.9743	LCRUDEOILP	0.064497	3.002017	0.0060
LCRUDEOILP(-1)	-0.011133	-0.454946	0.6589	LFD	0.104287	1.999813	0.0565
LCRUDEOILP(-2)	0.071128	2.864457	0.0168	LGDP	0.025865	2.40189	0.0241
LCRUDEOILP(-3)	-0.055055	-3.363017	0.0072	LSHCOM	-0.012783	-0.61878	0.5417
LFD	-0.272338	-1.353469	0.2057	R-squared	0.996767		9.575177
LFD(-1)	0.697286	3.540414	0.0054	F-statistic	1541.745		2.245162
LFD(-2)	-0.074555	-0.759808	0.4649	Prob(F-statistic)	0.0000		
LFD(-3)	-0.156354	-1.926115	0.083				
LGDP	-0.139185	-0.326072	0.7511				
LGDP(-1)	1.147844	2.234203	0.0495				
LGDP(-2)	-0.636536	-1.573804	0.1466				
LGDP(-3)	1.23307	2.476696	0.0327				
LGDP(-4)	-1.602589	-4.056715	0.0023				
LSHCOM	0.077523	3.13949	0.0105				
LSHCOM(-1)	-0.038288	-1.626291	0.1349				
LSHCOM(-2)	0.051571	2.635545	0.0249				
LSHCOM(-3)	0.075798	2.720467	0.0215				
R-squared	0.999542						
F-statistic	1212.326						
Prob(F-statistic)	0.00000						
Diagnostic tests			Prob	Diagnostic tests			Prob.
Jarque-Bera			0.857629	Jarque-Bera			0.741136
Breusch-Godfrey Serial Correlation LM Test:			0.1165	Breusch-Godfrey Serial Correlation LM Test:			0.3167
Heteroskedasticity Test: Breusch-Pagan-Godfrey			0.2308	Heteroskedasticity Test: Breusch-Pagan-Godfrey			0.7765
Stability test				Stability test			

Ramsey RESET Test			0.7782	Ramsey RESET Test			0.162

The diagnostic tests for the model estimated using the Ordinary Least Squares (OLS) method reveal no issues of a deterministic or stochastic nature for both models. In other words, the statistical results confirm that the models' functional form is correctly specified, with no evidence of autocorrelation or heteroscedasticity. Additionally, the residuals are normally distributed, and the Ramsey RESET tests confirm the models' stability. The CUSUM and CUSUM-of-squares tests are employed to assess whether there has been any structural change affecting the stability of the estimated ARDL models. Figure 2 presents the visual results of these stability tests for the ARDL models.

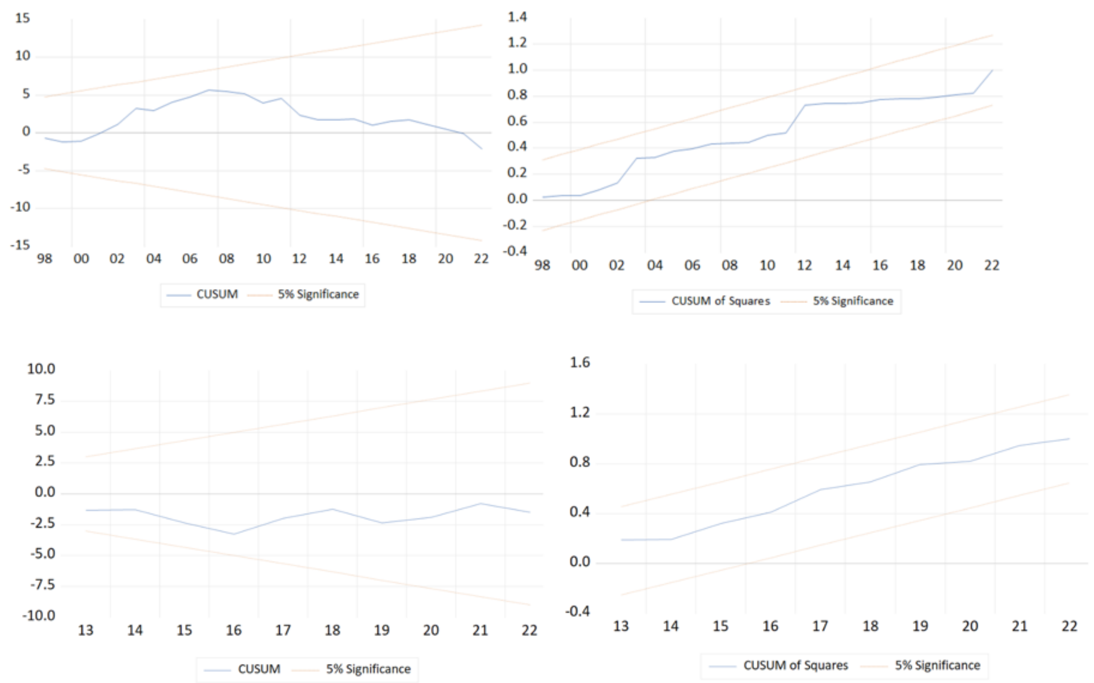

Figure 2. CUSUM and CUSUM Square Tests

Note: The upper panels display the test results for the coal consumption model, while the lower panels show the results for the CO2 emissions model.

The results of the bounds test reveal cointegration for both models, as the F-statistics exceed the critical values at the 5% significance level. This finding confirms a long-run relationship among the variables, as shown in Table 3.

Table 3. Bound Test Results

Bound Test						
Null hypothesis: No levels of relationship						
Coal Consumption			**CO_2 emissions**			
Test Statistic		**Value**	**Test Statistic**			**Value**
F-statistic		3.639745	**F-statistic**			8.102424
t-statistic		-3.7857	**t-statistic**			-4.045884
Bounds Critical Values						
	10%		**5%**		**1%**	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F-Statistic						
30	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000
35	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

Asymptotic	1.900	3.010	2.260	3.480	3.070	4.440
t-Statistic						
Asymptotic	-1.620	-3.260	-1.950	-3.600	-2.580	-4.230

The long-run coefficients for both models are presented in the table. The results indicate that crude oil prices, financial development, and GDP had a positive effect on coal consumption in China during the analysed period. In contrast, the financial development of the previous year and the previous year's Shanghai Composite Index contributed to an increase in CO_2 emissions in the long run.

Table 4. Long-Run Coefficients

CE = LCOAL(-1) - (0.437630*LCRUDEOILP + 0.707613*LFD + 0.175500*LGDP - 0.086737*LSHCOM)					**CE=LCO2(-1)-(0.015137*LCRUDEOILP(-1)+0.686605*LFD(-1)+0.009209*LGDP(-1)+0.589525*LSHCOM(-1))**				
Long Term Coefficients									
Variable *	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**	**Variable ***	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LCRUDEOILP	0.43763	0.099554	4.395918	0.0002	**LCRUDEOILP(-1)**	0.015137	0.122724	0.123344	0.9028
LFD	0.707613	0.359674	1.967376	0.0595	**LFD(-1)**	0.686605	0.240838	2.850897	0.0086
LGDP	0.1755	0.050201	3.49593	0.0017	**LGDP(-1)**	0.009209	0.033699	0.273279	0.7869
LSHCOM	-0.086737	0.144761	-0.599173	0.5541	**LSHCOM(-1)**	0.589525	0.166073	3.549784	0.0016

The error correction model results indicate significant insights into the adjustment dynamics of CO_2 emissions and coal consumption in response to economic variables. The error correction coefficient for CO_2 emissions is -0.282607, suggesting that approximately 28.26% of any short-run imbalance between CO_2 emissions and its independent variables—namely, GDP, financial development, crude oil prices, and the Shanghai Composite Index—is corrected each year. This implies that after a shock or disturbance, CO_2 emissions gradually return to their long-run equilibrium, with about 28.26% of the necessary adjustment occurring in the subsequent period. In contrast, the error correction coefficient for coal consumption is -0.147378, indicating that approximately 14.74% of any short-term imbalance between coal consumption and its long-run equilibrium is corrected annually. Following a disturbance, coal consumption slowly moves back toward equilibrium, with 14.74% of the adjustment taking place in the following period. The negative sign of both coefficients is critical, as it demonstrates that the systems for both CO_2 emissions and coal consumption are returning to equilibrium, which implies stability.

Table 5. Error Correction Model

Dependent Variable: D(LCO2)				**Dependent Variable: D(LCOAL)**				
Deterministics: No constant and no trend (Case 1)				**Deterministics: No constant and no trend (Case 1)**				
Variable	**Coefficient**	**t-Statistic**	**Prob.**	**Variable**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
COINTEQ*	**-0.282607**	**-7.531067**	**0.0000**	**COINTEQ***	**-0.147378**	**0.032076**	**-4.594618**	**0.0001**
D(LCO2(-1))	0.566981	6.367773	0.0000	D (LCOAL (-1))	0.625034	0.088126	7.092506	0.0000
D(LCRUDEOILP)	-0.000662	-0.045608	0.9643					
D(LCRUDEOILP (-1))	-0.016073	-1.065506	0.3047					

D(LCRUDEOILP (-2))	0.055055	4.9281	0.0002
D(LFD)	-0.272338	-2.906419	0.0115
D(LFD (-1))	0.230908	4.078829	0.0011
D(LFD(-2))	0.156354	3.105079	0.0078
D(LGDP)	-0.139185	-0.765814	0.4565
D(LGDP(-1))	1.006056	4.918438	0.0002
D(LGDP(-2))	0.369519	1.779795	0.0968
D(LGDP(-3))	1.602589	5.089606	0.0002
D(LSHCOM)	0.077523	4.18094	0.0009
D(LSHCOM(-1))	-0.127369	-6.596425	0.0000
D(LSHCOM (-2))	-0.075798	-6.014504	0.0000

CONCLUSION AND EVALUATION

Financial development serves as a crucial driver of gross domestic product (GDP) in emerging economies, influencing energy consumption and worsening environmental degradation. Furthermore, the relationships among financial development, stock markets, and commodity prices are frequently discussed within the energy finance literature. This study examines the effects of macroeconomic and financial indicators on sustainable development goals concerning environmental factors and consumption in China. Specifically, we investigate the impact of GDP, financial development, the Shanghai Composite Index, and crude oil prices on coal consumption and CO_2 emissions in China from 1990 to 2022. Two different Autoregressive Distributed Lag (ARDL) models are employed to conduct this study.

The findings reveal that crude oil prices, financial development, and GDP positively influenced coal consumption in China during the study period. Conversely, financial development and the Shanghai Composite Index from the previous year are associated with increased CO_2 emissions in the long run. These results could be due to growing energy demand caused by economic expansion, which in turn increases coal usage. As financial development advances, it may stimulate greater industrial activities, further intensifying the demand for coal as an energy source. The effect of the Shanghai Composite Index on CO_2 emissions could reflect the performance of key industries related to energy production and consumption, with market trends shaping environmental outcomes. Additionally, the previous year's financial development may encourage long-term investments in energy-intensive sectors, contributing to the rise in emissions.

The results of the error correction model provide significant insights into the adjustment dynamics of CO_2 emissions and coal consumption in response to economic variables. The error correction coefficient for CO_2 emissions is -0.282607, indicating that approximately 28.26% of any short-run imbalance between CO_2 emissions and their independent variables—namely GDP, financial development, crude oil prices, and the Shanghai Composite Index—is corrected annually. In contrast, the error correction coefficient for coal consumption is -0.147378, signifying that approximately 14.74% of any short-term imbalance between coal consumption and its long-run equilibrium is corrected each year.

REFERENCES

Acheampong, A. O., Amponsah, M., & Boateng, E. (2020). Does financial development mitigate carbon emissions? Evidence from heterogeneous financial economies. *Energy Economics*, *88*, 104768. https://doi.org/10.1016/j.eneco.2020.104768

Adebayo, T. S., Kirikkaleli, D., Adeshola, I., Oluwajana, D., Akinsola, G. D., & Osemeahon, O. S. (2021). Coal consumption and environmental sustainability in South Africa: the role of financial development and globalization. *International Journal of Renewable Energy Development*, *10*(3), 527-536. https://doi.org/10.14710/ijred.2021.34982

Adebayo, T. S. (2023). The trade-off between environmental sustainability and economic growth through coal consumption and natural resources exploitation in China: New policy insights from wavelet local multiple correlations. *Geological Journal*, *58*(4), 1384-1400. https://doi.org/10.1002/gj.4664

Aleman, E., & Sendich, E. (2021). *EIA International Energy Outlook 2021 - U.S. Energy Information Administration (EIA)*. https://www.eia.gov/outlooks/ieo/IIF_China/index.php.

Ali, K., Jianguo, D., & Kirikkaleli, D. (2024). Driving toward a greener future: green logistics, financial innovation, and environmental sustainability in China—evidence from novel Fourier approaches. *Environment, Development and Sustainability*, *26*(5), 13303-13323. https://doi.org/10.1007/s10668-023-04199-5

Apergis, N., & Payne, J. E. (2014). Renewable energy, output, CO2 emissions, and fossil fuel prices in Central America: Evidence from a nonlinear panel smooth transition vector error correction model. *Energy economics*, *42*, 226-232. https://doi.org/10.1016/j.eneco.2014.01.003

Aswani, J., Raghunandan, A., & Rajgopal, S. (2024). Are carbon emissions associated with stock returns?. *Review of Finance*, *28*(1), 75-106. https://doi.org/10.1093/rof/rfad013

Awosusi, A. A., Adebayo, T. S., Rjoub, H., & Wong, W. K. (2022). How do financial development and renewable energy affect consumption-based carbon emissions?. *Mathematical and Computational Applications*, *27*(4), 73. https://doi.org/10.3390/mca27040073

Chang, C. L., Ilomäki, J., Laurila, H., & McAleer, M. (2020). Causality between CO2 emissions and stock markets. *Energies*, *13*(11), 2893. https://doi.org/10.3390/en13112893

Chen, G., Wei, B., & Zhu, R. (2022). The impact of environmental subsidy on the performance of corporate environmental responsibility: Evidence from China. *Frontiers in Environmental Science*, *10*, 972328. https://doi.org/10.3389/FENVS.2022.972328/BIBTEX.

Dai, Z., Zhang, X., & Yin, Z. (2023). Extreme time-varying spillovers between high carbon emission stocks, green bond and crude oil: Evidence from a quantile-based analysis. *Energy Economics*, *118*, 106511. https://doi.org/10.1016/j.eneco.2023.106511

Dilanchiev, A., Umair, M., & Haroon, M. (2024). How does causality impact the renewable energy, carbon emissions, and economic growth nexus in the South Caucasus Countries? *Environmental Science and Pollution Research*, 1-17. https://doi.org/10.1007/s11356-024-33430-7

Duan, R., & Guo, P. (2021). Electricity Consumption in China: The Effects of Financial Development and Trade Openness. *Sustainability 2021, Vol. 13, Page 10206*, *13*(18), 10206. https://doi.org/10.3390/SU131810206.

Gu, F., Wang, J., Guo, J., & Fan, Y. (2020). How does the supply and demand of steam coal affect the investment in the clean energy industry? Evidence from China. *Resources Policy*, *69*, 101788. https://doi.org/10.1016/j.resourpol.2020.101788

Gyimah, J., Yao, X., Tachega, M. A., Hayford, I. S., & Opoku-Mensah, E. (2022). Renewable energy consumption and economic growth: New evidence from Ghana. *Energy*, *248*, 123559. https://doi.org/10.1016/j.energy.2022.123559

Houser, T. (2014). How China's Resource Quest Is Changing China | The National Bureau of Asian Research (NBR). *Asia Policy*, *18*(2), 1–6. https://www.nbr.org/publication/how-chinas-resource-quest-is-changing-china/

Ji, Q., & Zhang, D. (2019). How much does financial development contribute to renewable energy growth and upgrading of the energy structure in China?. *Energy Policy*, *128*, 114-124. https://doi.org/10.1016/j.enpol.2018.12.047

Jiang, Z., Dong, X. & Yoon, S.M. (2025). Impact of oil prices on key energy mineral prices: Fresh evidence from quantile and wavelet approaches. *Energy Economics,* 145, 108461. https://doi.org/10.1016/j.eneco.2025.108461

Kirikkaleli, D., & Umar, M. (2024). Do resource efficiency and energy productivity matter for environmental sustainability in the G7?. *Energy & Environment*, https://doi.org/10.1177/0958305X241260073

Li, G., & Wei, W. (2021). Financial development, openness, innovation, carbon emissions, and economic growth in China. *Energy Economics*, *97*, 105194. https://doi.org/10.1016/j.eneco.2021.105194

Liu, H., & Song, Y. (2020). Financial development and carbon emissions in China since the recent world financial crisis: Evidence from a spatial-temporal analysis and a spatial Durbin model. *Science of the Total Environment*, *715*, 136771. https://doi.org/10.1016/j.scitotenv.2020.136771

Nkoro, E. & Uko, A.K. (2016). Autoregressive Distributed Lag (ARDL) Cointegration Technique: Application and Interpretation. *Journal of Statistical and Econometric Methods*, 5, 63-91.

Pesaran, M. H., Shin, Y. & Smith, R. J. (1996). Testing for the 'Existence of a Long-run Relationship, *Cambridge Working Papers in Economics 9622*, Faculty of Economics, University of Cambridge.

Sadorsky, P. (2010). The impact of financial development on energy consumption in emerging economies. *Energy policy*, *38*(5), 2528-2535. https://doi.org/10.1016/j.enpol.2009.12.048

Schonhardt, S. (2023, January 30). China Invests $546 Billion in Clean Energy, Far Surpassing the U.S. | Scientific American. https://www.scientificamerican.com/article/china-invests-546-billion-in-clean-energy-far-surpassing-the-u-s/.

Shahbaz, M., Khan, S., & Tahir, M. I. (2013). The dynamic links between energy consumption, economic growth, financial development and trade in China: fresh evidence from multivariate framework analysis. *Energy economics*, *40*, 8-21. https://doi.org/10.1016/j.eneco.2013.06.006

STATISTA. (2024). *China: GDP growth rate 2029*

https://www.statista.com/statistics/263616/gross-domestic-product-gdp-growth-rate-in-china

Tang, C. F., Tan, B. W., & Ozturk, I. (2016). Energy consumption and economic growth in Vietnam. *Renewable and sustainable energy reviews*, *54*, 1506-1514. https://doi.org/10.1016/j.rser.2015.10.083

Useche, S. A., An, J., Makarova, I., Buyvol, P., Cai, J., Chen, Q., & Zhang, Z. (2024). Balancing Environmental Sustainability and Economic Development: Perspectives from New Structural Economics. *Sustainability 2024, Vol. 16, Page 1124*, *16*(3), 1124. https://doi.org/10.3390/SU16031124.

Xu, Y., & Ding, Z. (2024). Sustainable growth unveiled: exploring the nexus of green finance and high-quality economic development in China. *Frontiers in Environmental Science*, *12*, 1414365. https://doi.org/10.3389/FENVS.2024.1414365/BIBTEX

Wei, P., Li, Y., Ren, X., & Duan, K. (2022). Crude oil price uncertainty and corporate carbon emissions. *Environmental Science and Pollution Research*, *29*(2), 2385-2400. https://doi.org/10.1007/s11356-021-15837-8

Wolde-Rufael, Y. (2010). Coal consumption and economic growth revisited. *Applied Energy*, *87*(1), 160-167. https://doi.org/10.1016/j.apenergy.2009.05.001

Wu, R., Qin, Z., & Liu, B. Y. (2022). A systemic analysis of dynamic frequency spillovers among carbon emissions trading (CET), fossil energy and sectoral stock markets: Evidence from China. *Energy*, *254*, 124176. https://doi.org/10.1016/j.energy.2022.124176

Yıldırım, E., Saraç, Ş. & Aslan, A. (2012), Energy consumption and economic growth in the USA: Evidence from renewable energy, *Renewable and Sustainable Energy Reviews*, **16**, issue 9, p. 6770-6774. https://doi.org/10.1016/j.rser.2012.09.004

Zaghdoudi, T., Tissaoui, K., Maaloul, M. H., Bahou, Y., & Kammoun, N. (2023). Asymmetric connectedness between oil price, coal and renewable energy consumption in China: Evidence from Fourier NARDL approach. *Energy*, *285*, 129416. https://doi.org/10.1016/j.energy.2023.129416

Zhang, X., Shi, X., Khan, Y., Khan, M., Naz, S., Hassan, T., ... & Rahman, T. (2023). The impact of energy intensity, energy productivity and natural resource rents on carbon emissions in Morocco. *Sustainability*, *15*(8), 6720. https://doi.org/10.3390/su15086720

EXTENDED ABSTRACT

GENİŞLETİLMİŞ ÖZET

FİNANSAL GÖSTERGELER ÇİN'DE KAYNAK TÜKETİMİNE VE ÇEVRESEL SÜRDÜRÜLEBİLİRLİĞE NE KADAR KATKIDA BULUNUYOR?

Giriş ve Çalışmanın Amacı

Dünyanın ikinci büyük ekonomisi olan Çin, sanayi faaliyetleriyle kaynak tüketiminde önemli bir rol oynamaktadır. Bu durum, hem yurt içi hem de uluslararası pazarlar üzerinde çevresel etkilerle birlikte karmaşık bir dinamik oluşturmaktadır. Çalışma, finansal gelişme, gayrisafi yurtiçi hasıla (GSYİH), Şangay Bileşik Endeksi ve ham petrol fiyatları gibi makroekonomik ve finansal göstergelerin, Çin'de kömür tüketimi ve karbondioksit (CO_2) emisyonları üzerindeki etkisini incelemeyi amaçlamaktadır. Araştırma, bu göstergelerle enerji tüketimi arasındaki ilişkilerin karmaşıklığını ve çevresel sürekliliğe etkilerini ele alarak, hızlı ekonomik büyümeyle ilgili çevresel sorunlara ışık tutmayı hedeflemektedir.

Kavramsal ve Kuramsal Çerçeve

Enerji tüketiminin özellikle gelişmekte olan ülkelerde üretim süreçlerinin temel bir unsuru olduğu bilinmektedir. Çin, enerji tüketiminin %90'ını fosil yakıtlardan karşılamaktadır ve kömür, hava kirliliğinin ve sera gazı emisyonlarının başlıca kaynağı olarak öne çıkmaktadır. Çalışma, enerji tüketimi, finansal gelişme ve ekonomik büyümeye ilişkin literatürü temel alarak bu faktörlerin uzun vadeli etkilerini tartışmaktadır. Önceki çalışmalar, finansal gelişme ve ekonomik büyümeyle enerji kullanımı arasında anlamlı ilişkiler bulunduğunu ortaya koymuştur.

Bu çerçevede, şu hipotezler geliştirilmiştir:

- H1: CO_2 emisyonları = f (GSYİH, Finansal Gelişme, Şangay Bileşik Endeksi, Ham Petrol Fiyatları)
- H2: Kömür Tüketimi = f (GSYİH, Finansal Gelişme, Şangay Bileşik Endeksi, Ham Petrol Fiyatları)

Yöntem ve Bulgular

1992-2022 dönemini kapsayan bu çalışma, ARDL modeli kullanarak hem kısa hem de uzun vadeli dinamikleri incelemiştir. Tüm değişkenler logaritmik dönüşümle analize dahil edilmiş ve serilerin durağanlığı çeşitli birim kök testleri ile değerlendirilmiştir. Bulgular, ham petrol fiyatları, finansal gelişme ve GSYİH'nin kömür tüketimini olumlu yönde etkilediğini; finansal gelişme ve Şangay Bileşik Endeksi'nin ise uzun vadede daha yüksek CO_2 emisyonları ile ilişkili olduğunu göstermiştir. Hata düzeltme modeline göre, CO_2 emisyonlarındaki kısa vadeli dengesizliklerin yaklaşık %28,26'sı her yıl düzeltilirken, kömür tüketimindeki dengesizliklerin %14,74'ü uzun vadeli dengeye dönmektedir. Bu bulgular, enerji tüketim sistemlerinin istikrarlı olduğunu ve finansal gelişme ile enerji kullanımının çevresel etkilerini azaltacak politikaların önemini vurgulamaktadır.

Sonuç ve Öneriler: Çalışma, finansal gelişmenin ekonomik faaliyetleri artırarak enerji talebini yükselttiğini ve bu durumun çevresel bozulmayı körüklediğini ortaya koymaktadır. Finansal gelişme, sanayi faaliyetlerini ve kömür tüketimini arttırırken, Şangay Bileşik Endeksi'nin emisyonlar üzerindeki etkisi de piyasa dinamiklerini yansıtmaktadır. Çin, yenilenebilir enerji yatırımlarında önemli ilerlemeler kaydetmiş olsa da, ekonomik büyümenin enerji tüketiminden ayrıştırılması yönününde stratejik politikalar gereklidir.

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