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The Nexus Of Investment Efficiency And Green Finance In Indonesia: A Study Of Credit Dynamics And Financial Interdependence

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Abstract

This study aims to analyze the interdependence among financial investment, investment efficiency, green credit, and green finance within the context of monetary policy in Indonesia. Utilizing annual data from 2014 to 2023 and employing the Vector Auto Regression (VAR) approach, the study explores the dynamic relationships among these variables across short-, medium-, and long-term horizons. The findings reveal that in the short run, financial investment is influenced by both investment efficiency and green credit. In the medium term, the interdependence becomes more structured, with green finance emerging as an increasingly significant factor. Over the long term, green finance demonstrates a systemic influence on all variables, including investment efficiency and financial investment. These results suggest that monetary policy instruments integrated with green finance can enhance investment allocation efficiency and support the transition toward a sustainable economy. This research contributes both theoretically and practically to the advancement of Indonesia's green economy agenda.

Keywords: Financial Investment, Green Finance, Green Credit, Investment Efficiency

INTRODUCTION

Sustainable development is a long-term strategy aimed at improving the overall quality of life and societal well-being. In the Pacific region, this goal has been pursued through various ongoing national development projects (Banke & Chandra, 2021; Mulyani, 2017). The primary focus of these efforts is to drive economic growth at both the community and national levels, while ensuring environmental preservation. One of the emerging approaches supporting this agenda is green finance (Falcone, 2020). Green finance refers to financing mechanisms or credit allocations directed toward environmentally conscious ventures. Financial institutions such as banks are thus required to incorporate environmental considerations into their credit assessment processes, including evaluating how a business contributes to environmental sustainability and minimizes ecological harm (Ngo et al., 2021). Borrowers, in turn, are expected to adopt energy-efficient practices and meet the 3R criteria reduce, reuse, recycle as prerequisites for obtaining green financing (Yuliawati et al., 2017). Green credit policies play a strategic role in promoting investment in renewable energy sectors. By optimizing the allocation of credit resources, these policies help redirect capital flows to environmentally friendly industries, enhance the efficiency of financial services, and strengthen funding support for sustainable projects (Zhang, Wang, et al., 2021). As a financial innovation, green credit has rapidly evolved on a global scale. In countries like China, green credit guidelines have significantly influenced investment decisions and improved access to financing for the renewable energy sector, which often faces funding constraints (Anggraini et al., 2020).

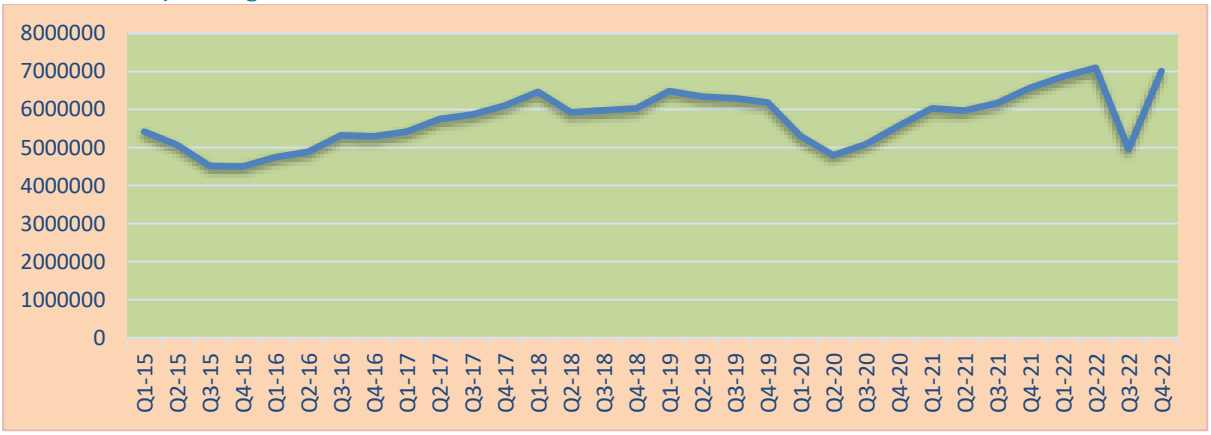

Figure 1. Green Finance Trends in Indonesia

Data from 2015 to 2022 illustrates that the development of green finance in Indonesia has been fluctuating over time. Significant downturns were recorded in the second quarter of 2020 and the third quarter of 2022, likely as a result of economic pressures stemming from the COVID-19 pandemic. As noted by Ngo et al. (2021), the financial sector's vulnerability during the pandemic required prompt and targeted policy interventions to maintain national financial stability. Green finance is closely linked to financial investment, as capital directed toward environmentally friendly projects plays a pivotal role in advancing sustainable development agendas (Karina, 2019). With increasing global awareness of environmental preservation, the demand for green financing is projected to rise across various sectors, including financial services (Yuliawati et al., 2017). In response, the Indonesian government has demonstrated strong commitment to sustainable development by issuing green investment instruments, which have seen growing market interest. The government has also actively promoted environmentally driven economic growth to attract investment into the domestic financial market (Yunus et al., 2023).

In terms of investment efficiency, the quality of financial reporting is a crucial determinant. High-quality financial disclosures reduce the risk of investment misallocation by enabling informed decision-making (Anela & Prasetyo, 2020). Research by Herbert & Harto (2021) confirms that reliable financial reporting minimizes information asymmetry between managers and investors. This promotes capital allocation to projects with positive net present value (NPV) while discouraging investment in value-destroying initiatives. However, in practice, information asymmetry remains a persistent issue. Investors often lack complete access to internal corporate data, which contributes to investment inefficiencies (Kozlovzskyi, 2020). High-quality reporting not only lowers costs of capital but also limits the risk of underinvestment, overinvestment, and managerial opportunism (Eulaiwi et al., 2021; Herbert & Harto, 2021).

Moreover, firms as economic agents transform inputs such as raw materials, energy, and labor into goods and services. Inefficiencies in labor utilization can lead to significant economic costs in the form of excessive or insufficient labor investment (Cao & Rees, 2020). To enhance shareholder wealth, firms are expected to make strategic decisions, particularly in investment and financing, which directly affect firm value (Ramadhani & Zannati, 2018; I & Abdi, 2020). On a broader scale, the relationship between the financial system and the investment environment is central to a country’s development trajectory. Capital accumulation that supports strategic investment is a key pillar of economic growth. Irwin et al. (2019) and Matanda (2020) highlight the role of money markets, equity markets, and capital markets in providing investment instruments that foster national progress and bring countries closer to their sustainable development goals (SDGs). Therefore, integrating financial institutional quality, green monetary policies, and investment efficiency forms the foundation for a resilient and sustainable green economic strategy.

RESEARCH METHODS

The Vector Autoregression (VAR) model of order p for the four variables Financial Investment (FI), Investment Efficiency (IE), Green Credit (GC), and Green Finance (GF) can be written as the following system of simultaneous equations:

$$FI_t = \alpha_1 + \sum_{i=1}^{p} \beta_{11,i} FI_{t-i} + \sum_{i=1}^{p} \beta_{12,i} IE_{t-i} + \sum_{i=1}^{p} \beta_{13,i} GC_{t-i} + \sum_{i=1}^{p} \beta_{14,i} GF_{t-i} + \varepsilon_{1t}$$

$$IE_t = \alpha_2 + \sum_{i=1}^{p} \beta_{21,i} FI_{t-i} + \sum_{i=1}^{p} \beta_{22,i} IE_{t-i} + \sum_{i=1}^{p} \beta_{23,i} GC_{t-i} + \sum_{i=1}^{p} \beta_{24,i} GF_{t-i} + \varepsilon_{2t}$$

$$GC_t = \alpha_3 + \sum_{i=1}^{p} \beta_{31,i} FI_{t-i} + \sum_{i=1}^{p} \beta_{32,i} IE_{t-i} + \sum_{i=1}^{p} \beta_{33,i} GC_{t-i} + \sum_{i=1}^{p} \beta_{34,i} GF_{t-i} + \varepsilon_{3t}$$

$$GF_t = \alpha_4 + \sum_{i=1}^{p} \beta_{41,i} FI_{t-i} + \sum_{i=1}^{p} \beta_{42,i} IE_{t-i} + \sum_{i=1}^{p} \beta_{43,i} GC_{t-i} + \sum_{i=1}^{p} \beta_{44,i} GF_{t-i} + \varepsilon_{4t}$$

RESULT AND DISCUSSION

The initial step in this study involves testing the stationarity of the time series data. This test is crucial to ensure that the variables used do not contain trends or non-stationary patterns that could lead to biased model estimations. For this purpose, the Augmented Dickey-Fuller (ADF) unit root test, as developed by Dickey and Fuller, is employed. This method tests for the presence of a unit root by regressing the first-differenced form of the variable on its lagged level, including lagged differences, a constant, and a time trend component (Kuncoro, 2001).

Variabel	Nilai ADF	Signifikansi 1%	Prob	Keterangan
Financial Investment (FI)	-8.784454	-3.554575	0.0000	Stasioner
Investment Efficiency (IE)	-8.785445	-3.545446	0.0000	Stasioner
Green Credit (GC)	-9.326575	-3.565751	0.0000	Stasioner
Green Finance (GF)	-9.264545	-3.57689	0.0000	Stasioner

Based on the results of the Augmented Dickey-Fuller (ADF) test presented in the table above, all variables in this study show stationary properties at the second level of differentiation (2nd difference). This is indicated by the ADF statistical value which is smaller than the MacKinnon critical value at the 1% significance level. Thus, the null hypothesis stating the existence of a unit root can be rejected, and all variables are considered stationary at that level. Since all variables have met the stationarity assumption, the analysis can be continued to the next stage in VAR modeling.

Table 3. Cointegrasi Johansen Test

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.253434	81.63434	95.74356	0.0032
At most 1*	0.084545	43.74454	69.64545	0.0563
At most 2	0.067563	27.83245	47.35578	0.7343
At most 3	0.052258	14.84423	29.75347	0.6334

The results of the cointegration test shown in the table above show that there are two equations that are significantly cointegrated at the 5% significance level. This indicates that the variables in the model have a stable long-term relationship. Thus, the assumption of the existence of a long-term equilibrium relationship between the variables analyzed can be accepted. This

finding strengthens the basis for using advanced models such as the Vector Error Correction Model (VECM) in capturing short-term dynamics without ignoring the long-term relationship between variables.

Table 4. IRF Test

Variabel	Jangka Waktu	FI	IE	GC	GF
Financial Investment (FI),	Short term	+	+	+	+
	Midle term	+	+	-	-
	Long term	+	+	-	-
Investment Efficiency (IE)	Short term	-			
	Midle term	-	+	-	-
	Long term	-	+	-	-
Green Credit (GC)	Short term	+	-	+	
	Midle term	+	-	+	+
	Long term	+	-	+	+
Green Finance (GF)	Short term	+	+	+	+
	Midle term	+	+	-	+
	Long term	+	-	-	+

The analysis used to see the response of other variables to changes in one variable in the short, medium or long term is the Impulse response function. The results of the VAR analysis reveal that in the short term, Financial Investment (FI) is highly responsive to changes in Investment Efficiency (IE) and Green Credit (GC). This aligns with the findings of Han et al. (2020), who explained that variations in capital allocation efficiency and access to green credit can instantly increase investment flows in emerging markets. Similarly, the results show that IE is significantly influenced by FI and GC, indicating that investment efficiency is highly sensitive to the sources of financing and the volume of investment in the short run. Wang & Zhi (2016) emphasized that developing countries like Indonesia often experience investment inefficiencies when not supported by targeted credit systems and early-stage project supervision.

Meanwhile, Green Finance (GF) in the short term depends on IE and GC, supporting the findings of Zhang et al. (2022) that initial green finance responses are strongly affected by project management efficiency and early incentives from environmentally-based credit systems. In the medium term, the influence of Green Credit (GC) on FI and IE indicates a consolidation of monetary policy towards green investment financing. A study by Chen & Li (2021) confirms that green credit developed within the national banking system can significantly promote investment efficiency in both the private and public sectors especially in developing countries with adaptive financial regulations.

Furthermore, IE begins to rely on Green Finance (GF), showing that the market is increasingly aware of the importance of medium-term sustainability-based financing. This is supported by Nguyen & Van (2020), who found that as green finance becomes more structured, its influence on the efficiency of investment projects particularly in the renewable energy sector intensifies. The result that GF is influenced by GC and IE in the medium term reflects the OECD (2021) conclusion that integration between credit schemes and project efficiency represents a key stage toward a mature green finance ecosystem.

In the long-term horizon, the VAR results confirm that Green Finance (GF) becomes the key variable influencing FI, IE, and GC simultaneously. This is consistent with Yao et al. (2022), who found that green finance has a long-term impact on the stability and sustainability of the financial system and strengthens investment structures in ASEAN countries. The dependency of IE on GC and GF indicates that efficiency is no longer determined solely by investment volume, but also by the quality of financing aligned with ESG (Environmental, Social, and Governance) standards. This corresponds to the World Bank (2019), which stated that long-term, efficient, and sustainable investment projects can only be achieved if supported by reliable green funding

sources and strong supervision systems. The long-term interdependence between GC and IE is also reflected in Liu et al. (2021), who found that synergy between green banking institutions and business actors is a driving force for the green economic transition in both Indonesia and China.

The results of the Vector Auto Regression (VAR) model estimation in this study reveal a dynamic interdependence pattern among the variables of financial investment (FI), investment efficiency (IE), green credit (GC), and green finance (GF). This relationship is not only present in the short term but also demonstrates structural interlinkages in the medium and long term. These findings are reinforced by consistent empirical literature. First, the results show that in the short run, financial investment (FI) is significantly influenced by investment efficiency (IE) and green credit (GC). This implies that financial investment decisions are primarily driven by how efficiently capital can be allocated and by the availability of green credit to support environmentally friendly initiatives. These results align with the studies of Han et al. (2020) and Wang & Zhi (2016), who highlight the critical role of investment efficiency and financial incentives in driving short-term investment behavior, particularly in developing economies.

Furthermore, in the short to medium term, investment efficiency (IE) is itself influenced by financial investment (FI) and green credit (GC). This relationship suggests that efficiency is not solely determined by internal corporate management but is also highly affected by the volume of incoming investments and access to green financing provided by financial institutions. Chen & Li (2021) support this finding, emphasizing that investment efficiency increases as access to green credit expands and regulatory support for sustainable investments improves. Across all time horizons short, medium, and long term green finance (GF) consistently responds to investment efficiency (IE) and green credit (GC). This indicates that the effectiveness of green finance is highly dependent on the quality of capital allocation and the strength of the green banking ecosystem that underpins it. This finding is corroborated by Zhang et al. (2022) and OECD (2021), who stress that a robust sustainable financial ecosystem can only develop when supported by real sector efficiency and an active green credit system.

Moreover, in the long run, green credit (GC) demonstrates significant dependence on IE and GF, reinforcing the understanding that the growth of green credit is inseparable from investment efficiency and the establishment of a mature green finance infrastructure. In this context, Liu et al. (2021) emphasize that expanding green credit distribution relies on an effective green finance regulatory framework and efficient fund utilization that enhances productive sector performance. Finally, in the long term, financial investment (FI) is significantly influenced by green finance (GF). This suggests that the overall quality of green financing determines the direction and sustainability of future financial investments. Yao et al. (2022) demonstrated that well-structured green finance attracts long-term investment flows, particularly when financed projects exhibit clear sustainability outcomes and transparent governance.

Overall, the VAR model results in this study affirm that a sustainability-based monetary and financial policy approach does not impact isolated sectors alone but instead shapes mutually reinforcing intersectoral linkages. Therefore, the formulation of green financial strategies must consider the simultaneity of effects among investment, efficiency, credit, and green financing to ensure long-term success in achieving sustainable economic development.

CONCLUSION

This study aims to analyze the dynamic interlinkages among financial investment (FI), investment efficiency (IE), green credit (GC), and green finance (GF) within the framework of monetary policy in Indonesia using the Vector Auto Regression (VAR) approach with annual data from 2014 to 2023. The estimation results indicate strong interdependence among the

variables in the short, medium, and long term. In the short term, FI is strongly influenced by IE and GC, indicating that investment market responses are highly sensitive to capital allocation efficiency and access to green credit. IE is also driven by the magnitude of investment and the intensity of green credit, highlighting the importance of early signals from monetary and green banking policies. In the medium term, the interconnections become more structured. IE begins to rely on GF, reflecting that investment efficiency is influenced by the maturity and quality of green financing. GC acts as a bridge between FI and IE, while GF shows increasing stability and consistency, signaling the institutional strengthening of green finance.

In the long term, GF emerges as the dominant variable simultaneously influencing FI, IE, and GC. This demonstrates the systemic power of green finance in shaping future investment directions and financial efficiency. The linkage between IE and both GC and GF also illustrates that efficiency is no longer determined solely by the volume of investment, but by the quality, sustainability, and accuracy of green finance allocation. Therefore, this study underscores that a sustainability-oriented monetary approach must consider the synergy among investment policies, real sector efficiency, and environmentally friendly financing. The interdependence model revealed through VAR provides a foundational framework for designing integrated green fiscal and monetary policy in Indonesia.

REFERENCES

Abdel Karim Mahmoud, K. (2022). The Moderating Influence of Ownership Structure on the Association between Financial Reporting Quality and Investment Efficiency: Evidence from Egypt. *The Moderating Influence of Ownership Structure on the Association*, *13*(4), 100–150. https://doi.org/10.21608/jces.2022.285182

Afridi, I. (2022). *Economic Policy Uncertainty and Investment Efficiency*. National University of Science and Technology.

Anela, F. L., & Prasetyo, A. B. (2020). the Effect of Ownership Structure on Investment Efficiency (Case Study in Non Financial Firms Listed on Indonesia Stock Exchange in 2015-2017). *ACCRUALS (Accounting Research Journal of Sutaatmadja)*, *4*(01), 66–76. https://doi.org/10.35310/accruals.v4i01.407

Banke, R., & Chandra, C. (2021). Mewujudkan Perdamaian Melalui Sustainable Development Goals United Nations. *Law Pro Justitia*, *VI*(2), 62–77. https://ejournal-medan.uph.edu/index.php/lpj/article/view/620

Bakhtiar Efendi, (2023). Efektivitas Kebijakan Makroprudensial Terhadap Stabilitas Sistem Keuangan Di Indonesia: Bakhtiar Efendi. Jurnal Kajian Ekonomi dan Kebijakan Publik (JEpa) 4 (2), 72-78

Cheng, X., & Wang, Y. (2023). The Influence of the Party Committee's Participation in Governance on the High-quality Development of State-owned Enterprises—Intermediary Effect based on Investment Efficiency. *Proceedings of the 2022 International Conference on Mathematical Statistics and Economic Analysis (MSEA 2022)*, 1011–1016. https://doi.org/10.2991/978-94-6463-042-8_144

Herbert, J., & Harto, P. (2021). The Effect of Financial Reporting Quality and Family Ownership on Investment Efficiency With Audit Quality as Moderating Variable (Empirical Study on Manufacture Firms Listed on Indonesia Stock Exchange in the Year of 2015-2019). *Diponegoro Journal of Accounting*, *10*(1), 1–12. http://ejournal-s1.undip.ac.id/index.php/accounting

Hu, G., Wang, X., & Wang, Y. (2021). Can the green credit policy stimulate green innovation in heavily polluting enterprises? Evidence from a quasi-natural experiment in China. *Energy*

Economics, *98*, 105134. https://doi.org/10.1016/j.eneco.2021.105134

Hung, N. T. (2023). *Green investment, financial development, digitalization and economic sustainability in Vietnam: Evidence from a quantile-on-quantile regression and wavelet coherence*. Technological Forecasting and Social Change. https://doi.org/10.1016/j.techfore.2022.122185

I, M. A., & Abdi, M. (2020). Financial Investment dan Financial Leverage terhadap Financial Perfomance Perusahaan Consumer Goods. *Jurnal Manajerial Dan Kewirausahaan*, *2*(4), 935. https://doi.org/10.24912/jmk.v2i4.9874

Irwin, K. C., Gilstrap, C. M., Drnevich, P. L., & Tudor, C. M. (2019). From start-up to acquisition: Implications of financial investment trends for small- to medium-sized high-tech enterprises. *Journal of Small Business Strategy*, *29*(2), 22–43.

Khedmati, M., Sualihu, M. A., & Yawson, A. (2020). CEO-director ties and labor investment efficiency. *Journal of Corporate Finance*, *65*(October 2018), 101492. https://doi.org/10.1016/j.jcorpfin.2019.101492

Koengkan, M., Miguel, N., & Silva, B. (2023). Energy Economic Development in Europe. In *Energy Economic Development in Europe* (Issue March). https://doi.org/10.3390/books978-3-0365-7112-6

Kumajas, L. I., Saerang, D. P., Maramis, J. B., Dotulong, L. O. H., & Soepomo, D. (2022). Kontradiksi Sustainable Finance: Sebuah Literatur Review Contradictions of Sustainable Finance: a Literature Reviw. *1034 Jurnal EMBA*, *10*(2), 1034–1041.

Lia Nazliana Nasution, R Fadillah, A Zulfa, (2024). Green Economic Transformation in Driving Green Economic Growth in Indonesia. 1St International Conference Epicentrum of Economic Global Framework.

Lifang Li a, Lexin Qiu a, Fangming Xu b, X. Z. (2023). *The impact of green credit on firms' green investment efficiency: Evidence from China*. Pacific-Basin Finance Journal. https://doi.org/10.1016/j.pacfin.2023.101995

Ngo, T. Q., Doan, P. N., Vo, L. T., Tran, H. T. T., & Nguyen, D. N. (2021). The influence of green finance on economic growth: A COVID-19 pandemic effects on Vietnam Economy. *Cogent Business and Management*, *8*(1). https://doi.org/10.1080/23311975.2021.2003008

Rusiadi, M Yusuf, A Adivia.(2024) Mampukah Circular-Economy Mendukung Green Building dan Green Sustainable Development di ABRIC Coutries?. Jurnal Ilmiah Mahasiswa Perbankan Syariah (JIMPA) 4 (1), 81-90

Rusiadi, A Adivia, M Yusuf. (2024). The impact of the green economy on sustainable development in the ABRIC countries. International Conference on Humanity Education and Society (ICHES) 3 (1)

Shahab, Y., Ye, Z., Riaz, Y., & Ntim, C. G. (2019). Individual's financial investment decision-making in reward-based crowdfunding: evidence from China. *Applied Economics Letters*, *26*(4), 261–266. https://doi.org/10.1080/13504851.2018.1464643

Shihan Li, Qingfu Liu, Lei Lu, K. Z. (2022). *Green policy and corporate social responsibility: Empirical analysis of the Green Credit Guidelines in China*. Journal of Asian Economics. Journal of Asian Economics

Song, M., Xie, Q., & Shen, Z. (2021). Impact of green credit on high-efficiency utilization of energy in China considering environmental constraints. *Energy Policy*, *153*(February), 112267. https://doi.org/10.1016/j.enpol.2021.112267

Soundarrajan, P., & Vivek, N. (2016). Green finance for sustainable green economic growth in india. *Agricultural Economics (Czech Republic)*, *62*(1), 35–44. https://doi.org/10.17221/174/2014-AGRICECON

Vargas-Hernández, J. G., Rakowska, J., & Vargas-González, O. C. (2022). Green Economic Development as the Framework for Green Finance and Green Investment. *Economic and*

Regional Studies / Studia Ekonomiczne i Regionalne, *15*(3), 304–322. https://doi.org/10.2478/ers-2022-0021

Wang, H., Wang, W., & Alhaleh, S. E. A. (2021). Mixed ownership and financial investment: Evidence from Chinese state-owned enterprises. *Economic Analysis and Policy*, *70*(31411911101), 159–171. https://doi.org/10.1016/j.eap.2021.02.006

Wu, H., & Kang, Q. (2020). *Research on the Impact of Research and Development Input on Investment Efficiency in DEA*. *11*(2), 21–27. https://doi.org/10.9790/5933-1102072127

Wu, X., Sadiq, M., Chien, F., Ngo, Q. T., Nguyen, A. T., & Trinh, T. T. (2021). Testing role of green financing on climate change mitigation: Evidences from G7 and E7 countries. *Environmental Science and Pollution Research*, *28*(47), 66736–66750. https://doi.org/10.1007/s11356-021-15023-w

Xin An, Yue Ding, Y. W. (2023). *Green credit and bank risk: Does corporate social responsibility matter?* Elsevier Logo Journals & Books Finance Research Letters. https://doi.org/10.1016/j.frl.2023.104349

Xin, B., & Gao, F. (2023). Can Green Credit Trigger Net-Zero Entrepreneurship? *Sustainable Production and Consumption*, *40*(February), 488–502. https://doi.org/10.1016/j.spc.2023.07.021

Xinhui Huang, A. T. (2022). *Labor investment efficiency and cash flow volatility*.

Yanping, W., Zhengqiang, F., Pan, P., & Ronghua, L. (2020). *"One belt, one road" investment efficiency, global expansion of China's economy*. *XXIX*, 541–552. https://doi.org/10.24205/03276716.2020.860

Zhang, C., & Zheng, N. (2020). The financial investment decision of non-financial firms in China. *North American Journal of Economics and Finance*, *53*(March), 101215. https://doi.org/10.1016/j.najef.2020.101215

Zhang, K., Li, Y., Qi, Y., & Shao, S. (2021). Can green credit policy improve environmental quality? Evidence from China. *Journal of Environmental Management*, *298*(June). https://doi.org/10.1016/j.jenvman.2021.113445

Zhang, K., Wang, Y., & Huang, Z. (2021). Do the green credit guidelines affect renewable energy investment? Empirical research from china. *Sustainability (Switzerland)*, *13*(16), 1–17. https://doi.org/10.3390/su13169331

Zhang, S., Wu, Z., Wang, Y., & Hao, Y. (2021). Fostering green development with green finance: An empirical study on the environmental effect of green credit policy in China. *Journal of Environmental Management*, *296*(March), 113159. https://doi.org/10.1016/j.jenvman.2021.113159