Investment in Oil Industry and Renewable Energy: Crowding-in or Crowding-out effect?

Samar S. Mohamed, Alexandria University, +20 1111580845, samar.eco23@gmail.com

Overview

Seeking to meet the Paris agreement goal of limiting global warming and achieve net-zero emissions by 2050, many countries around the world work on reducing GHG emissions to net zero by 2050. Generally, energy transition a way from fossil fuels to renewable energy is considered pivotal to fulfil net-zero emissions goal and some economies has been working on such transition even before the agreement. This transition led to an approximately ninety-fold increment in global renewable energy installed capacity – as a proxy for investment in the sector- during the period 2000-2021, while world oil refining capacity- as a proxy for investment in oil industry- hardly grew by 25%, during the same period (BP Statistical Review, 2022).

However, these statistics don't mean that expanding renewable investment has driven oil industry growth to slow down, as other factors should be taken in consideration, as oil prices, differences among developing and developed countries in energy consumption patterns, the initial share of each resource in the world total energy production. Besides these factors, recent technological developments in Carbon Capture, Utilization and Storage (CCUS) technology to produce blue and even aqua hydrogen[1], would be a key to reduce the refining industry's carbon footprint. Another important factor is the continuous advancements in electrical vehicles (EV), which expected to improve EV competitiveness against fuel vehicles as a way to minimize carbon emissions, consequently, it would diminish demand for oil in the transportation sector, which used to mainly depend on oil products.

The aim of this paper is to investigate whether both of renewable energy sources and oil industry may crowd-in or crowd-out each other. Consequently, the analysis takes in account additional variables, besides production capacity in both of renewables (RE) and oil refining industry. Other variables are gross domestic production in constant $ (GDP), as a proxy of demand for energy; switching rate in electricity generating (SWT) from oil & coal to cleaner resources, i.e. renewables, nuclear energy and natural gas, as a proxy of energy transition, greenhouse gas emissions level (GHG), energy efficiency level (EF), and oil prices (OP).

Accordingly, this study is supposed to contribute to the prevailing works of literature by analysing and measuring the relationship between oil as a fossil fuel and renewables from investment scope rather than the consumption one, taking in account the potential role of oil prices role, and recent technological advancements in VE and CCUS. Another contribution is the comparative analysis of the investigated relation between developing and developed economies.

This paper is organized as follows: a review of literature on the study's topic is provided in section 2, methodology and data are described in section 3, econometric results are presented in section 4. Section 5 discusses empirical findings. Finally, conclusions and policy recommendations are proposed in section 6.

Methods

In this study two panel models are employed, the first to examine the impact of investing in oil sector on investing in RE, the second model examines the vice-versa relationship. Each model is applied on two panel sets, developed and developing economies, selected countries are chosen based on two criteria: energy total consumption, and energy production capacity, as the chosen countries are considered among the world's top economies in both criteria, and each panel set includes 10 countries. Models are estimated on annual basis, covering the period from 2000 to 2021, in a log-log form.

Stationarity tests are conducted to determine the variables integration orders, results show that variables are integrated in different orders-i.e. I(0) and I(1) - therefor, ARDL cointegration approach introduced by (Pesaran et al., 2001) is the most appropriate approach. The coefficient of the error correction term is negative and significant in the two models, and for each panel set, thus, a long-run relationship between variables is existing. In addition, a modified version of Granger causality approach proposed by Toda & Yamamoto (1995) is applied to investigate causality between variables.

[1] Aqua hydrogen is a new method to extract hydrogen from both conventional and shale oil, the extracted form of hydrogen doesn't emit CO2, similar to green hydrogen, but at lower costs (Yu et al., 2021)

Results

For the first model, long-run estimates emphasise the negative impact of investing in oil industry on investing in RE sector, for both panel sets. Yet, the effect on RE sector in developing countries is larger than the effect in the other group. In addition, short-run coefficients vary among oil importing and oil exporting countries, especially in the developing countries panel set. Other significant variables in this model are OP and GHG, both are positively influence RE in both panel sets- except for OP in developing countries- noticing that GHG in developed countries model, has the greatest impact on RE compared to other variables. On the other hand, SWT has a positive significant impact in the developed countries panel set, while it has a tiny impact in the other set. Other variables – EF & GDP- show insignificant effects in both panel sets. Error correction term value indicates that the speed of adjustments to long-run equilibrium in developing countries is faster than in the developed.

For the second model, while renewable sector significantly affected oil industry in both panel sets, a crucial difference noticed between results, as RE negatively affect investing in oil industry in developed countries, contrary to its effect on oil industry in developing countries. Another worth mentioned difference between the two groups, that OP positively affect oil sector in developing countries, which is contrasting with the insignificant impact in the other panel set. Predictably, SWT has negative, though mild, influence on oil industry in both groups, but it seems to has a bit larger impact in case of developed countries. For EF, results show that it negatively influence oil industry in both panel sets, and has the greatest impact on oil industry investment compared to other variables, in case of developed countries. Finally, Toda-Yamamota causality test asserted the bi-directional causality from renewable energy to oil industry, in both panel sets, while the causality runs from oil industry to renewable energy in developing countries only.

Conclusions

The findings suggest that for the world's top energy consuming countries-either developed or developing economies- investment in oil industry causes a crowding-out effect on investing in renewables sector, noting that this effect tends to be larger in oil producing countries in general. On the other hand, investments in renewables sector crowding-out investment in oil industry in developed countries, contrary to its impact in developing countries, where it crowding-in investments in oil industry. This contradiction is due to the difference between the two groups in economic structure and energy consumption patterns, as discussed in the full paper.

The study concludes that switching toward cleaner resources has a significant negative but tiny impact on investment in oil industry, this because such a switch – till now- is mainly affect the electricity generating energy mix, which oil products share is very small, however, the ongoing technological advancement in EV would accelerate demand for clean electricity generating, but at that time the impact on oil industry is expected to be a larger effect, as it would threatens oil products share in transportation sector, the main source of global demand for oil.

Increasing GHG emissions level is consisedered the dominant factor that accelerates investments in renewables and put pressures on investing in oil sector in developed countries – which mostly are oil importing countries. However, recent developments in CCUS technology would give a life back for fossil fuels, including oil. This technology would be a game changer, especially for low-cost oil producing countries.

The positive effect of oil prices on oil industry investments- in developing countries- may be a warning alarm for energy security in case of relatively low prices, especially that renewables production capabilities still low compared to other fossil fuels, at least in the middle term. This conclusion sheds light again on the crucial role of CCUS technology, which helps to accomplish low-carbon energy transition, as a more practical approach than transiting away from fossil fuels.

References

- BP, bp Stastistical Review of Worl Energy, 2022, 71st edition, available online: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html
- Pesaran, M.H., Shin, Y. and Smith, R.J., 2001. Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), pp.289-326.
- Toda, H. Y and T. Yamamoto (1995). Statistical inferences in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, 66, 225-250.
- Yu, M., Wang, K. and Vredenburg, H., 2021. Insights into low-carbon hydrogen production methods: Green, blue and aqua hydrogen. *International Journal of Hydrogen Energy*, *46*(41), pp.21261-21273.