Public subsidies drive the green transitions

Rita Laura D'Ecclesia* Edward R. Lawrence† Robinson Reyes Pena‡
Kevyn Stefanelli§

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Long Abstract

Motivation. The energy transition is one of the defining global challenges of our time, reshaping the allocation of capital and the role of governments in supporting decarbonization. Across jurisdictions, subsidies and tax incentives represent central policy instruments to foster renewable investments and mitigate transition risks for companies. Yet, the effectiveness of subsidies is debated: while they can lower the cost of capital and encourage technological adoption, they may also generate distortions or uneven impacts across firm types, energy sources, and regulatory environments. Existing evidence highlights strong heterogeneity: in China, subsidies have proven particularly effective for SMEs and regions with high energy demand (Yang et al., 2019; Qi et al., 2022); in Europe, the stability of subsidy schemes is as important as their size, with retroactive policy changes reducing investments dramatically (Nicolini and Tavoni, 2017; Sendstad et al., 2022); in the US, tax credits have reduced GHG emissions but with mixed efficiency across technologies (Murray et al., 2014). This study investigates, in a comprehensive global setting, whether and how public subsidies translate into improved financial outcomes for energy companies and whether such effects vary across fossil, renewable, and nuclear firms.

*Department of Statistics, Sapienza University of Rome, Rome, 00185 Rome, Italy. E-mail: rita.decclesia@uniroma1.it

†Department of Finance, College of Business Florida International University, Miami, FL 33199, United States. E-mail: elawrenc@fiu.edu

‡Department of Finance, College of Business Florida International University, Miami, FL 33199, United States. E-mail: roreyes@fiu.edu

§Corresponding author. Department of Economics, Engineering, Society and Business Organization, Tuscia University, Viterbo, 01100 Rome, Italy. E-mail: kevyn.stefanelli@unitus.it

Objectives. We aim to measure the role of subsidies, both direct transfers and tax incentives, on firms' financial performance. We account for heterogeneity across energy subsectors (fossil fuels, renewables, nuclear). By adopting a multi-country perspective with fixed effects, we explicitly control for policy and cultural heterogeneity, allowing us to isolate the effectiveness of subsidies across institutional and cultural contexts.

Data and Sample. The sample includes all global public companies classified in the Energy sector under GICS. Firm-level data (2008–2024) are retrieved from Bloomberg and cover accounting, operational, and market indicators. Subsidy-related variables include effective tax rates, weighted average cost of capital (WACC), and reported government support. Explanatory firm-level controls include net financial performance (NFP), size (log of total assets), debt ratio, operating margin, and working capital ratio (WCR). Country- and year-fixed effects capture unobservable heterogeneity due to regulatory regimes and macroeconomic shocks.

Methodology. We estimate a panel regression of the form:

$$Ret_{i,t} = \alpha + \beta_1 X_{i,t} + \beta_2 Y_{i,t} + \beta_3 (X_{i,t} \times Y_{i,t}) + \mu_i + \tau_t + \varepsilon_{i,t},$$

where $Ret_{i,t}$ is the equity return of firm i in year t, $X_{i,t}$ includes financial and operational controls, and $Y_{i,t}$ proxies subsidies through WACC, tax rates, and direct support measures. The interaction term captures heterogeneous responses of firms depending on their financial characteristics. We further conduct robustness checks using alternative specifications (e.g., dynamic panel models, clustering by subsector) and sub-sample analyses by region and energy source.

Key Questions. The central question of this paper is whether financially successful green energy companies tend to proliferate in countries where state subsidies and tax incentives are more prevalent. In other words, we ask whether the green transition can realistically be achieved only through sustained public support, or if there are cases in which firms are able to perform competitively without relying on subsidies. To address this, we exploit financial statement information — such as effective tax rates, WACC reductions, and reported government support — as proxies for subsidy exposure. By doing so, we aim to test whether the presence or absence of subsidies determines the pace and feasibility of the green transition in the energy sector.

Preliminary Insights. Preliminary evidence indicates strong heterogeneity both across countries and over time. Subsidies appear effective in supporting green energy firms in some institutional contexts, while in others their impact is muted or offset by market turbulence. Cultural differences

also emerge: in countries where state intervention is traditionally accepted, subsidies more easily translate into firm-level performance improvements, while in more market-oriented environments their effectiveness is weaker. Timing matters as well: during periods of market stress and volatility — such as the recent energy price shocks — subsidies play a stronger stabilizing role, whereas in calmer periods market forces alone appear sufficient to sustain performance. Overall, results highlight that energy firms remain tightly bound to the dynamics of global markets, whose turbulence in recent years has amplified the dependence of the transition on state intervention.
Our findings suggest that subsidies are not a universal lever but a context-dependent tool. They can mitigate transition risks and encourage capital reallocation toward greener technologies, but their effectiveness hinges on cultural attitudes, policy stability, and timing within global market cycles. In some settings, firms can thrive independently; in others, the transition appears feasible only with sustained state support.

Contributions. This paper contributes by offering a global, firm-level assessment of subsidy effectiveness across diverse cultural and institutional contexts. We emphasize the dual dimension of space and time: the geography of subsidies and the timing of their effectiveness. Our analysis clarifies whether the green transition is structurally dependent on state support, or whether firms can in some contexts sustain it autonomously.

Policy and Investment Implications. For policymakers, the results highlight the importance of stable, credible subsidy schemes, particularly during turbulent market periods when firms are most vulnerable. For investors, understanding the conditional and country-specific nature of subsidy effectiveness is key to allocating capital strategically across markets and technologies. Ultimately, the study underscores that the transition is not uniform: it is shaped by policy design, cultural acceptance, and the volatility of energy markets.

Keywords: Energy subsidies; Financial performance; Renewable energy; Energy transition; Panel analysis.
JEL: G12; G38; Q42; Q48.

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