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Driving the circular economy through public environmental and energy R&D: Evidence from SMEs in the European Union

Pablo Garrido-Prada, Helena Lenihan, Justin Doran, Christian Rammer, and Mauricio Perez-Alaniz

Synopsis

Circular Economy (CE) describes a circular production-consumption model that maximises the utility of products, components, and materials across their life cycle. Encouraging firms' transition to a CE is paramount for curtailing the environmental degradation caused by human activity. However, some firms, especially small and medium-sized enterprises (SMEs), typically face many constraints affecting their transition to a CE, associated with limited skills and financial resources. Drawing on firm-level data and country-level data for 10,618 SMEs across the 26 European Union (EU) members and the UK, our study provides critical insights regarding public environmental and energy R&D (PEERD) driving SMEs to (i) adopt CE activities and (ii) invest in CE activities.

Introduction and Background

Encouraging firms' transition towards a Circular Economy (CE) is paramount for bringing production and consumption processes in line with sustainable development goals. CE requires firms to develop and adopt innovative technologies and business models, as well as more CE-oriented organisational cultures. Firms, especially SMEs, typically suffer from critical constraints related to a lack of financial resources, proper technology, and/or technical expertise, which can impede their transition to a CE. Governments in many countries have responded to this challenge by supporting firms with grant programmes, training, and technology consulting. To be effective, these dedicated support measures need to be linked to a better understanding of how environmental and energy systems can be transformed towards a higher degree of sustainability.

Public environmental and energy R&D (PEERD) can play an important role by providing firms with much-needed scientific technologies to develop their skills, resources, and awareness related to CE. However, our understanding of how PEERD helps firms, particularly SMEs, to overcome the challenges faced when transitioning to a CE remains limited. Existing literature on PEERD has, to date, mainly focussed on macro, regional, and sector perspectives; and not on SMEs. This is a limitation given that SMEs constitute the vast majority of firms in most economies, especially in the EU where around 99 percent of firms are SMEs. Our study focuses on understanding the factors underpinning SMEs' transition to a CE, and how PEERD contributes to these activities. In this way, our study contributes critical insights towards generating an understanding of how PEERD can support SMEs to transition towards a sustainable economy.

Issues and Questions Considered

In our study, we address the following key question: How does public R&D investment in the areas of environment and energy increase

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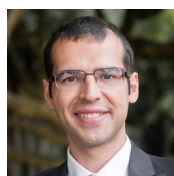
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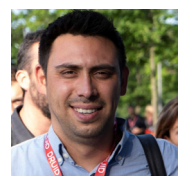
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SMEs' (1) likelihood of implementing Circular Economy activities, and (2) investments in Circular Economy activities? Public environmental R&D refers to activities such as the generation of scientific knowledge related to solid waste, the protection of the atmosphere, air, climate, water, and pollution control. Energy R&D includes the generation of scientific knowledge related to energy-efficient processes for energy production, distribution, and consumption. Together, public environmental and energy R&D (PEERD) focus on the central R&D components related to the main dimensions of the Circular Economy (CE).

Our study specifically focuses on five critical CE activities, as follows: i) re-planning energy usage to minimise consumption, (ii) using renewable energy, (iii) minimising waste by recycling or reusing waste or selling it to another company, (iv) re-designing products and services to minimise the use of materials or use recycled materials, and; (v) re-planning the way water is used to minimise usage and maximise re-usage. PEERD can encourage firms to adopt CE activities in two main ways. The first way is by generating the necessary scientific and technological knowledge to facilitate the implementation of CE activities. This is because PEERD can offset some of the limitations impeding CE activities amongst SMEs by, for example, standardising knowledge, concepts, practices, and objectives that firms use for implementing CE approaches. The second way is by enabling the creation of new standards and regulations, thereby shaping the overall institutional framework where firms operate.

Moreover, PEERD can encourage firms to invest more in CE activities by creating spillovers for knowledge generation and technology adoption. Firms can build on the public knowledge generated by PEERD, and invest in CE activities to develop commercial applications that can enable new competitive advantages. However, PEERD can also substitute private investment in the CE, as SMEs may require lower investments to implement CE activities, in part due to the necessary knowledge having already been generated. By providing free knowledge, PEERD may negatively impact SMEs' perceived financial rewards of investing in the CE.

Methodology

Our study uses a novel multi-level database constructed by merging firm-level data from the Flash Eurobarometer 441 with country-level data on Public Environmental and Energy R&D (PEERD) from Eurostat. Country-level data pertained to the period from 2004 to 2015, while firm-level data covered the period from 2013 to 2015. The data permitted observing

the levels of PEERD and how this impacted the adoption of Circular Economy (CE) activities, and the associated investment by 10,618 SMEs across 26 EU members states, and the UK. A multi-level probit regression model was used to analyse the impact of PEERD on firms' adoption of CE activities. The impact of PEERD on firms' investments in CE was examined by using an ordered probit regression model.

Outcomes and Findings

Our study finds that Public Environmental and Energy R&D (PEERD) stocks increase SMEs' likelihood of implementing Circular Economy (CE) activities. We interpret this result as PEERD generating spillovers that aid SMEs' implementation of CE activities. These spillovers may take various forms. One possible spillover mechanism may arise from high levels of PEERD producing a large number of specialised researchers and engineers from which SMEs can profit in their CE implementation efforts. Another channel could be based on more tailor-made and more affordable CE technologies for SMEs, if a country engages more broadly in the development of new environmental and energy technologies.

Moreover, our study finds a negative relationship between the stock of PEERD and the investment intensity in CE of SMEs that have implemented CE activities. High expenditure in PEERD lowers the amount SMEs invest when implementing CE activities. We interpret this as PEERD substituting for SMEs' own financial efforts when implementing CE through positive knowledge spillovers. Therefore, PEERD may act as an indirect subsidy which frees resources in CE active SMEs, that can be used for other productive investment.

In light of the above, our study generates critical evidence validating Public Environmental and Energy R&D (PEERD) as a mechanism to encourage SMEs' transition to a Circular Economy (CE). We demonstrate that PEERD can enable SMEs to develop CE capabilities. Furthermore, we show that by reducing the needs of SMEs to dedicate financial resources for CE activities, PEERD can accelerate their transition to a CE. This is particularly important, as SMEs typically avail of fewer resources in comparison to large-sized firms when it comes to implementing CE activities.

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