CAPACITY PLANNING OF SOLAR PV MANUFACTURING UNDER KNIGHTIAN UNCERTAINTY

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Overview

In the aftermath of the 2022 energy crisis, competitiveness, resiliency, and decarbonization are the centre of the European energy policy. As argued by the Draghi report, renewable capacities are a means to pursue those objectives simultaneously, as their production is cost-efficient, green, and decorrelated from geopolitical turmoil. A fast-paced renewable development seems more desirable than ever. However, concerns were raised regarding the long-term supply of renewable capacities as their supply chains are primarily located outside Europe. Because reshoring a supply chain is costly, there is a tension between accelerating renewable development to strengthen and decarbonize the power system and allocating resources to secure the long-term supply of renewable capacity.

Methods

In this paper, I investigate this trade-off between decarbonization, resiliency and efficiency to propose a coherent supply strategy for solar photovoltaic (PV) in France until 2050. Such a dilemma is steered by various uncertainty sources (environmental, technological, market, etc.) that cannot be forecasted objectively over the long term and whose probability measures are unknown. Therefore, I built a framework based on Knightian uncertainty to evaluate the different investment schemes and configurations for the supply of solar PV. In particular, three supply sources are considered: import, storage, and domestic manufacturing. Each investment scheme is assessed through its net present value in the different states of the world that occurs. The benefits of maintaining some domestic manufacturing capacity to foster innovation and pave the way for future competitiveness are also taken into account.

Results

The numerical estimation is performed for the French solar PV sector to 2050. The following illustrative graph shows the distribution of dominated and non-dominated configurations as a function of the initial stockpile and manufacturing capacities.
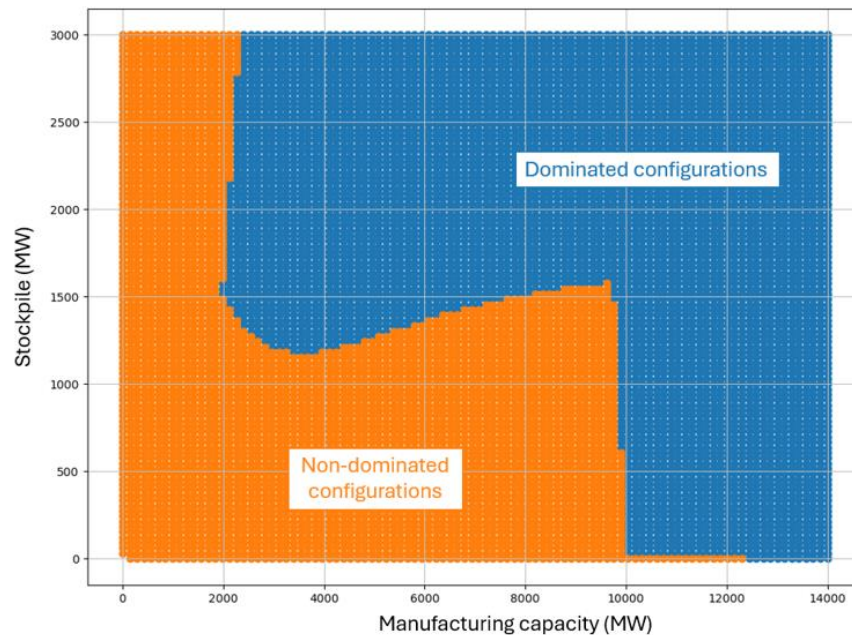

Figure 1: Illustrative graph

Conclusions

The results show that resiliency should be provided by stockpiles. Developing industrial activity should be motivated by innovation and future competitiveness. To help the domestic manufacturing sector, the results argue for a shift from public support emphasizing resilience to public support emphasizing innovation.