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"Mój Prąd" Subsidy Pass-through and the Residential Photovoltaic Market in Poland

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With rising concerns about the effects of global warming and climate change, countries introduce policies aimed at greenhouse gases emission reduction. While large transnational instruments are put in place to drive carbon intensity of economy (e.g. EU's Emissions Trading System or Carbon Border Adjustment Mechanism), simultaneous efforts are focused on the changing general population preferences and stimulate the take up of green technologies by households. Among the latter, many governments introduce subsidy and rebate policies to reduce investment costs and increase demand for new environment-friendly products and solutions. To evaluate subsidy effectiveness, economic analysis often turns to the notion of incidence. Whereas public economics often discuss redistributive and equity aspects of incidence, in industrial organization studies, the analysis of pass-through (understood as the marginal impact of incentive changes on the net (post-incentive) price paid by consumers) sheds light on a wide range of topics, including the welfare effects of price-discrimination or the quantification of cartel damages. Commonly, the pass-through rates are thought to vary between 0 and 100%, yet the pass-through exceeding unity is theoretically possible. As laid out by Weyl and Fabinger (JPE, 2019), the theory of incidence tells us that markets characterized by various forms of imperfect competition exhibit over-shifting if demand is sufficiently convex. Therefore, empirical examination of pass-through is important as it not only informs about the redistributive consequences of the policy but can reveal the presence of market failures if over-shifting is detected.

The empirical context examined in this paper is the photovoltaic (PV) micro-installation subsidy. I study solar subsidy pass-through consumers face in the context of the "Mój Prąd" (Eng. "My Electricity") programme in Poland. This is a very popular subsidy programme that since its beginning in 2019 contributed greatly to the Polish photovoltaic prosumerism boom, where more than 400 thousand households began to produce solar electricity. During the policy's first four editions running from July 2019 to March 2023, more than two billion PLN (450 million EUR) of subsidies were allocated to over 400 thousand households, that installed around 2.3 GW of solar capacities on their roofs. The importance of the pass-through examination in this context lies primarily in the scale of the studied subsidy programme that attracted one-third of all new solar prosumer households between 2019 and the end of 2022. Moreover, in 2021 alone, about 113,000 solar jobs were created in Poland, establishing the country as the largest provider of solar jobs across the European Union. Therefore, the potential identification of market imperfections has significant consequences as it might be indicative of reduced welfare resulting from market power presence and it should interest and alarm the adequate competition regulation authorities and decision-makers.

Following the work of Pless and van Benthem (American Economic Journal: Applied Economics, 2019) I run the Ordinary Least Squares regressions (OLS) with the varying regional and time-fixed effects as well as a set of geographic, demographic, and market control variables (presented in detail in Section 4.) to investigate how the cost net of the allocated subsidy of solar system per kW of installed capacity changes with the size of received financial support. Using application-level data, I analyse 412,504 unique residential, prosumer PV micro-installations that were eligible to receive a subsidy from the "Mój Prąd" programme and were connected to the grid between July 2019 and the end of 2022. I identify subsidy over-shifting – a pass-through rate exceeding 100%. Moreover, having information on the installations' location I detect the regional heterogeneity in pass-through rates across 16 Polish województwa (the largest territorial units in Poland). The over-shifting is omnipresent (varying between 118% and 139%). The subsidy's pass-through to households is 137%. In other words, a 1 PLN increase in subsidies translates into a decrease in solar system prices of 1.37 PLN. While it suggests that the policy achieved its aim of reducing the costs of residential solar systems and stimulating the technology adaptation rate, this finding is also indicative of potential market imperfections appearing in the Polish residential solar market. To further reinforce this prognostic I estimated the demand elasticities with regard to the net cost levels depending on the varying, available subsidy amounts. My estimates suggest that demand is convex, which is a necessary condition to apply over-shifting identification as a litmus paper for market power detection. Moreover, the alternative circumstances that could explain over-shifting and not entail imperfect competition are also discussed but ruled out as not plausible in the context of the Polish residential solar market. Among those inapplicable different explanations are Giffen behaviour, decreasing marginal costs, or subsidy level manipulation. Whereas the first two are rarely observed in practice, the last one is hardly possible in the context of the "Mój Prąd" subsidy as the reported installation costs on which the allocated subsidy amount depends require proof in the form of invoice or receipt.

This paper contributes to the existing literature in several ways. Firstly, it is, to my best knowledge, the first empirical study of the role of the large "Mój Prąd" subsidy programme in the price reduction of residential prosumer PV systems in Poland. Secondly, the paper contributes to the limited but expanding set of empirical studies on subsidy incidence, particularly in the context of green technologies. This paper is also the first empirical study to investigate the pass-through of a solar subsidy in markets other than the United States. The over-shifting identification should warrant more scrutinous PV market studies in Poland as it is indicative of market power and imperfect competition. Moreover, the presence of regional, spatial heterogeneity in the pass-through rates further encourages and justifies the economic investigations of the regional variations in the PV market characteristics (e.g. market structure, markups, the experience of firms, etc.) in Poland. Lastly, it sheds some light on one of the largest PV markets in Europe, which is even more interesting considering Poland's current carbon dependency and the potential relevance of this study in other high-emitting, green transition pursuing economies context.