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Jolts at the ballot box: Electricity prices and voting in Swedish manufacturing communities

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ABSTRACT

This research examines the overlooked political implications of energy pricing on voting patterns in manufacturing communities, amidst increasing scholarly interest in the political ramifications of Western industrial decline. We focus specifically on the surge in electricity prices and their effect on electoral choices in manufacturing-dense regions in Sweden during the 2022 general elections. The rise in electricity costs holds particular significance given Europe's reliance on imported energy for competitive manufacturing, coupled with the existing constraints on energy supply. With energy prices being a direct threat to industries and influencing the competitiveness of manufacturing firms and job security, we argue that these factors could significantly influence voting behaviour in affected communities. Our findings show that areas with higher electricity costs witnessed a more robust performance by the incumbent Social Democratic Party, suggesting that economic insecurity may indeed spur greater demand for traditional left-wing policies, such as economic compensation.

1. Introduction

Scholarly interest in the political consequences of industrial decline across Western nations is growing. Many studies have focused on semi-skilled manual workers and their dissatisfaction with labour-reducing technology and import competition from countries with lower wages [1,2]. The lion's share of this research has explored manufacturing workers' grievances against mainstream parties and their growing support for the radical right. Meanwhile, traditional political economic theories maintain that the threat of de-industrialisation should increase manufacturing workers' demand for traditional left-wing policies, such as risk sharing and economic compensation [e.g. [3–5]]. Despite the current global energy crisis, the electoral impact of increasing natural gas and electricity prices has received less attention, even though it represents a direct threat to the European manufacturing sector. Since European industries depend on a steady flow of affordable energy to compete against manufacturing firms in low-wage economies, there is a major concern among policymakers that a constrained energy supply may lead to large-scale de-industrialisation [see [6]]. Europe is also a pioneer in the transition to carbon neutrality and the supply and price of energy is likely to remain high on the political agenda for the foreseeable future [7]. In light of this situation, the present study aims to investigate whether large shocks in the price of electricity affect voting choices in manufacturing communities.

In Europe, the price for final users of electricity, such as households and businesses, is determined by global supply and demand factors because energy commodities are traded freely on international commodity exchanges [see [8]]. The interconnectedness of the transmission grid means that countries with little consumption of fossil fuels, such as Sweden, pay a similar price for electricity as Central European countries with a higher reliance on natural gas [8]. Natural gas and oil prices have been extremely volatile in recent years. In fact, oil futures trading descended into negative territory during the Covid-19 pandemic as demand collapsed. However, oil prices and, more importantly, the price of natural gas multiplied after the full-scale Russian invasion of Ukraine and the following sanctions against Russian energy in the EU. While energy prices fell towards the end of 2022—attributed to unusually warm weather conditions, a decrease in EU spot gas prices, and the adequate replenishment of gas storage facilities across Europe—the energy crunch is likely to continue [9]. Increasing energy poverty could

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likely affect the debate regarding the green transition and election outcomes in many nations through higher electricity expenditures [10]. We believe that the effects of energy constraints on the nexus of the labour market, the competitiveness of manufacturing firms and growing insecurity in manufacturing communities deserve attention from political scholarship because the interplay of these factors may have a distinct impact on voting in affected communities.

Furthermore, the supply of energy plays a special role in field of economics. In fact, economists and historians associate the Industrial Revolution with an expansion of the energy supply, as energy consumption has been closely tied to overall economic growth in modern economics [11]. A constrained energy supply could in contrast cap industrial production, as complexity and innovation increase more rapidly when energy is abundant [12]. The manufacturing sector is set to be worst affected according to a large literature because rising or volatile electricity prices for final users reduce industrial production, investment and employment decisions in economic sectors where electricity is an important input good [13–17]. Increasing electricity prices not only reduces the competitiveness of many industries but also the demand for manual workers [18]. However, tougher energy constraints in terms of a limited supply also affect other businesses because jobs lost in the tradable sector, such as the production of machinery and industrial equipment for export, reduce the demand for non-tradable goods and services, such as logistics and construction, in surrounding areas [19,20]. In other words, electricity prices profoundly affect perceived levels of economic insecurity, which in turn is an important driver of political behaviour during the last decade [e.g. [21,22]].

Furthermore, considering that electricity prices will be high and volatile for a foreseeable future, it becomes important to investigate the influence of these electricity prices on voting behaviour in areas with high manufacturing density. Theoretically speaking, we believe there are two opposite perspectives on how voters in such areas may react. They can either blame the soaring energy prices on climate mitigation measures taken by mainstream parties and, therefore, turn to the populist right, which tends to also promise large price cuts on energy (*the populist thesis*). Alternatively, voters who face risks of unemployment and economic insecurity may see greater value in traditional left-wing policies that can mitigate their economic distress, such as social spending and active labour market policies, and, therefore, vote for the Social Democrats (*the compensation thesis*).

Empirically, we investigate the impact of increasing electricity prices on voting across the manufacturing dense areas in Sweden during the 2022 general election. Sweden serves as a good testing ground because electricity prices vary between the northern and the southern regions of the country. The southern parts of the country are more heavily affected by the price in natural gas in Central Europe due to internal constraints in the Swedish transmission grid and since most power producing facilities are located in the north. Thus, northern industries were largely not subject to increasing electricity costs between the 2018 and 2022 elections, while the price of electricity in the southern regions rose over 200%. This setup enables us to implement a shift-share instrumental variable design, wherein we interact the relative change in electricity prices with the local proportion of citizens employed in the manufacturing sector, thereby creating a potentially exogenous shock of economic insecurity.

2. Literature review

2.1. Electricity prices and economic insecurity

Energy commodities are generally considered more volatile than most openly traded input goods [e.g. [23]]. A contributing factor is the integration of energy markets; the final price of electricity is dependent on speculation in the international market rather than purely domestic market supply and demand [8,24,25]. Furthermore, compared to other types of energy, the price of electricity is much more volatile because electric power cannot be stored easily and because consumption and production are strongly related to changes in daily weather conditions [26]. Indeed, electricity prices often fluctuate dramatically within a day. The relationship between natural gas and electricity prices has received much attention during the past decade. This is mainly because many countries have switched to using natural gas for the production of electricity—instead of using other more greenhouse gas emission-intensive fossil fuels, such as oil and coal. Several studies have identified a robust positive relationship between prices of natural gas and electricity for final users in the United States and Europe [25,27–31]. This spillover effect implies that, although natural gas consumption in Sweden is almost negligible, the country still is highly vulnerable to the price of this commodity because of the integration with the European energy market [6,8,32].

The impact of electricity prices on workers' voting behaviour in manufacturing communities begins with decision making at the firm level. Market participants generally dislike uncertainty because it is hard to form expectations about the future in uncertain environments. Large fluctuations in electricity prices are no exception, as rising energy expenditures affect investment, production, and employment decisions. However, uncertainty is not only associated with sudden price surges but also with uncertainty about the future price level of energy commodities [33,34]. Based on data from multiple countries and periods, non-financial firms——especially those in the tradable manufacturing sector that are uncertain about future energy prices——invest less and implement production cuts when prices are volatile [35–37]. Furthermore, rising electricity expenditures increase current costs and reduce profits, negatively affecting manufacturing firms' comparative advantage. However, the manner in which electricity prices affect the risk of unemployment in energy-intensive industries is not straightforward from a theoretical perspective.

Although some firms may substitute energy for labour when energy prices become high [e.g. [38,15]], the average effect on employment has been found to be negative in multiple countries [17,39]. Electricity demand is especially important because there are few real substitutes; it is difficult to run machinery directly on oil and coal. Deschenes [13] investigated the impact of electricity prices using within-state data from the United States and concluded that price hikes decreased the share of full-time employees. Bijnens et al. [14] found that European manufacturing firms employed fewer workers when electricity prices rose. Thus, the net effect of higher energy prices on employment can be divided into two parts: a general effect of energy prices on the aggregated output as higher prices put pressure on economic activity [e.g. [40]]; and a direct effect of electricity prices on manufacturing firms that cut production and employment plans.

When manufacturing firms cut production and stall employment plans, workers throughout the industry are negatively affected because human capital tends to be industry specific. Since each industry favours the skills that are vital to its products and services, workers become more valuable to the industry as they refine these skills over time [41–43]. Thus, manual workers in manufacturing risk a lower income trajectory if they search for a job in a different sector due to a skill mismatch [see [44,45], for review]. Dependency on industry-specific skills puts manual manufacturing workers at risk when electricity prices rise because they are only attractive (in terms of their skills) in distressed industries. Marin and Vona [18] found, for instance, that higher electricity prices reduced the demand for lower-skilled employees, such as manual workers in the manufacturing sector, while the demand for higher-skilled workers such as technicians remained high.

Finally, a declining manufacturing sector will have consequences for other sectors as well. The local employment multipliers imply that job openings in the tradable manufacturing sector generate opportunities in the non-tradable sector due to the impact of manufacturing jobs on local demand for goods and services [e.g. [20,19]]. Large multiplier effects have also been observed in residential areas where manufacturing workers live [46]. Against this background, we expect rising electricity

prices to result in increased economic insecurity in communities where a large share of the population is employed in the manufacturing industry. The question is then how such economic insecurity impacts the political preferences of voters in these communities. As brought up in the introduction, we believe there are two main theoretical perspectives to this question: voters can either express grievances against the mainstream parties and turn to populists, or they may demand economic compensation and therefore turn to the traditional left-wing parties. In the two following sections we elaborate on these two perspectives and start with the former populist perspective. Thereafter we introduce the Swedish case and discuss our theoretical expectations.

2.2. Economic insecurity and grievance against mainstream parties: the populist thesis

Although there are few published studies on the relationship between electricity prices, perceived insecurity and voting behaviour, there is a swelling literature on how modernisation and globalisation affect politics through their impact on the demand for semi-skilled workers in the middle of the income distribution. According to this logic, automation and globalisation cause the so-called 'post-industrial losers' to rally behind right-wing populists due to the risk of losing their jobs and relative social status. Some studies have focused on labour-reducing technology because robots decrease the demand for semi-skilled workers in the manufacturing process [see [2], for an extensive review]. Others have focused on the interconnectedness of the global economy because growing competition from low-wage nations reduces the competitiveness of well-paid manufacturing workers in the West [see [1], for an empirical summary].

The main argument in this literature is that global market integration has a net positive effect on welfare (greater profits, lower consumer prices etc.) but a negative effect on specific groups, such as manufacturing workers [see [47], for an extensive debate about globalisation and its threat to the liberal order]. This literature stream is of special relevance to the present study because energy market integration could have a positive effect in some sectors when energy and power producers are allowed to sell their outputs at higher prices, while imported price shocks in energy markets could negatively affect the competitiveness of the manufacturing sector. Importantly, while energy prices have increased globally, the price hike has been particularly strong in Europe, affecting disproportionally the competitiveness of European manufacturing [48].

Regarding the mechanism, a well-recognised hypothesis in the economic voting literature maintains that voters hold governments accountable for poor economic performance [49,50]. That is, economic voters opt for the challenger when their own utility—or the utility of people in their close context—falls below a certain threshold. Furthermore, the traditional literature on economic voting has shown that voters tend to act sociotropically, meaning that they mainly are concerned with macroeconomic figures, such as the unemployment rate, instead of personal financial losses. Recent studies have also suggested that workers hold mainstream parties responsible for the negative fallout from market integration because voters identify a general consensus in support of free trade among most established politicians [see [51]].

Thus, the Great Recession, which produced economic insecurity for workers across the globe, is considered a crucial catalyst for populist voting in many Western economies [52,53]. According to another set of studies, import competition decreases overall support for government parties because market integration with low-wage nations puts manufacturing jobs at risk [54,55]. In terms of fallout from international energy markets, increasing electricity prices may harm incumbent parties in a similar way because higher input costs reduce the competitiveness of manufacturing firms and generate incentives to move production to regions with lower and more stable prices.

Ever since Autor et al.'s [56] study, it has been common practice in economics to utilise the impact of increased competition from China, the so-called 'China shock', when studying the effect of market integration on aggregated political behaviour across regional labour markets. This approach involves investigating the behaviour and attitudes of residents in regions with falling competitiveness due to market integration with low-wage nations, and interpreting this phenomenon as a source of growing grievances and increasing electoral support for right-wing populists [e.g. [22,57–59]]. In terms of mechanisms, Steiner and Harms [60] found that voters in the United Kingdom who had been negatively affected by one aspect of globalisation became more critical of globalisation overall, and that residents in import-exposed regions became more nationalistic and hostile to market integration.

We reason that the underlying mechanisms of increasing economic insecurity in manufacturing dense areas due to falling competitiveness are similar for both a China and an *Electric* shock. From this outset, we would expect rising electricity prices, stemming from turmoil in energy markets, to cause grievances against mainstream parties, especially in manufacturing communities.

This argument aligns well with studies that find anti-establishment parties benefit from higher energy prices and the green transition. Atkins [61], for instance, highlights how populist movements in the UK are impacting renewable energy transitions by linking net-zero policies to the cost-of-living crisis and advocating for natural gas fracking, framing decarbonisation as undemocratic. Stegemann and Ossewaarde [62] discuss the complexities within the European Union's (EU) approach to sustainable development, particularly focusing on the concept of green growth. The EU promotes this concept as part of its broader sustainability agenda. However, there is growing frustration among its member states regarding the EU's integrative policies, which has led to the rise of counter-hegemonic, anti-EU populism. Historical evidence also suggests that the first wave of neo-nationalism in Europe came in the aftermath of the oil crisis in the 1970s [63]. Finally, Brännlund and Peterson [10] shows more precisely that support for the radical right increases in low-income areas when the cost of heating rises.

2.3. Economic insecurity and left-wing voting: the compensation thesis

International market shocks do not always result in support for anti-establishment parties, as challenging labour market conditions can enhance the appeal of traditional left-wing policies among workers in distressed sectors. In simple terms, left-wing parties are more likely to address unemployment issues because their constituents are disproportionately affected by a weak labour market, leading them to allocate more resources towards policies targeting the unemployed and at-risk workers [64]. Such policies include expansion of Active Labour Market Policies (ALMPs), more generous income support for the unemployed and compensation to workers adversely affected by the green transition.

Many scholars argue that ALMPs offer a response to the labour market challenges brought about by de-industrialisation and globalisation in Western economies [e.g. [65]]. These policies include measures such as training programmes and upskilling of displaced workers to make them qualified for good quality jobs, as well as subsidised employment and work incentives [66]. While both right and left-wing governments may increase spending on ALMPs, the left are inclined to prioritise measures geared towards the unemployed and labour market insiders [64,67]. Therefore, the ALMPs advocated by the left may become more attractive to manufacturing workers when electricity prices rise, because such policies would improve the opportunities for affected workers to get a good job outside of the manufacturing sector.

Another crucial factor to consider is welfare policy because the demand for social spending is said to increase with economic insecurity [e.g. [21,4]]. Embedded liberalism posits, for instance, that support for globalisation remains strong when free-market capitalism is coupled with robust national welfare policies [68]. From this perspective, the

willingness to accept policies that may have negative impacts on groups like manufacturing workers increases when accompanied by economic compensation [54]. Market integration has been argued to amplify the demand for government intervention since open economies become more vulnerable to events in other nations, introducing instability into domestic business cycles [see [69], for a discussion]. Therefore, a sufficiently high level of social spending, and in particular on unemployment insurance, can make workers and legislators more willing to endorse increased market integration, even in the face of potential welfare losses [70–72].

Furthermore, the impact of microeconomic factors, such as economic insecurity, is contingent upon social policies, institutional settings, and government partisanship [73,74]. It is commonly found, for example, that the reward and punishment mechanism weakens when spending on the unemployed is high [75,76]. In a similar vein, Helgason and Mérola [77] argue that perceived economic insecurity affects exposed workers in two ways. On the one hand, workers who feel insecure about potential income shortfalls are more likely to vote against the government and support left-wing parties due to their increased demand for welfare compensation. Consequently, voters become cross-pressured when there is a left-wing government in office, which in turn reduces voter turnout. On the other hand, if mainstream governments have failed to adequately compensate workers for the negative repercussions of market integration, workers instead turn to right-wing populists [78].

The compensation hypothesis also applies to the effects of the green transition. Left-wing parties often adopt a more stringent stance on climate change, which exerts greater pressure on traditional industries [79]. Right-wing populists are, in contrast, less inclined to support climate change mitigation and the transition away from fossil fuels due to skepticism or denial of anthropogenic climate change [80,81]. Insecure workers may find such policies appealing when the price of electricity rises due to domestic measures. However, recent research has shown that industrial workers are facing increasing pressure from both de-carbonisation policies and automatisation, which may increase support for compensatory 'just transition' measures that support manufacturing workers who are potentially negatively affected by the green transition [82]. Hence, external energy shocks may generate a heightened demand for compensation and retraining, which will increase the benefit of a left-wing vote for distressed manufacturing workers.

Therefore, voters' initial response to rising electricity prices, which diminishes the competitiveness of industries and the value of manufacturing skills, may be the penalisation of mainstream parties in power by voting for radical right-wing alternatives. This is because trade protectionism and support for fossil fuels could provide relief by reducing input costs for manufacturing firms and preserving jobs. However, MacArthur and Matthewman [83] challenge the conventional negative perceptions of populism and protectionism and suggest that while often viewed pejoratively, populist movements can represent legitimate grievances and can be integral to the political landscape. Protectionism is from this perspective not an outright rejection of international exchange but a response to the neoliberal economic model that prioritises profit over socio-ecological relationships. Thus, political parties who provide traditional left-wing policies under times of distress could benefit from higher electricity prices because economic insecurity can be mitigated by the presence of labour market policies that target traditional insiders, social spending, as well as compensatory just transition measures, such as facilitating employment in new sectors and re-skilling. Moreover, winning over the votes of insecure workers may be more challenging for the populist right if their anti-globalisation policies lack credibility, especially when they form alliances with traditional market liberals. Hence, increased economic insecurity brought on by higher electricity prices could instead benefit traditional left-wing parties under such conditions.

3. Swedish manufacturing, the electricity market and the 2022 Swedish general election: institutional background and theoretical expectations

Sweden is similar to many other Western nations in that its industrial sector has declined significantly since its heydays. The size of the Swedish manufacturing sector peaked in the early 1960s, and the number of employees and the size of the sector as a share of GDP have decreased ever since. Many traditional industries in Sweden, such as the shipbuilding industry in the western and the paper industry in the northern part of the country, were forced to shut down or go through extensive rationalisation due to foreign competition after the 1970s. Nevertheless, Swedish manufacturing has remained essential to the Swedish economy, with a share of GDP of approximately 20% during recent years [84]. The sector is energy-intensive and stands for about 35% of the total Swedish electricity consumption [85]. The manufacturing firms have also enjoyed a comparative advantage for a long time because electricity prices were much lower in Sweden than in many other European nations [86,87]. However, the integration of the transmission grid, a growing reliance on wind power, and the decision to become part of the joint Nordic spot market for electricity in 1996—Nord Pool—have made Swedish electricity prices increasingly sensitive to demand and supply factors of world markets.

Established during the 1990s, Nord Pool is an auction market in which the price is set at the point where supply and demand bids meet. This mechanism bases the price on the cost of the last produced megawatt hour (MWh), i.e. the marginal cost of the most expensive generating unit at any given time. Since power production in many European countries relies on natural gas, market forces make Sweden highly exposed to the price of this commodity, even though its gas consumption is minuscule. This relationship is especially apparent when markets are in distress [8].

Furthermore, Sweden was divided into different price or bidding zones in 2011: SE1 to SE4 (see Fig. 1a). The logic behind this division is that there are certain weak spots in the transmission grid, and policymakers wanted to incentivise electricity production where it was needed most. Nevertheless, for a long time, all manufacturing firms in Sweden enjoyed a similar comparative advantage because the price was the same across all bidding zones. However, as shown in Fig. 1b, prices started to diverge sharply during the second half of 2021, following Russia's threatening rhetoric and military build-up next to the Ukrainian border. While the average prices in the northern zones remained rather low and relatively stable, the prices in the southern zones became extremely volatile and surged to previously unseen levels just before the Swedish general election in September 2022. This made the price of electricity and the differences between the northern and southern zones a highly salient topic to most firms and voters during the last weeks of the election campaign.

The large differences in price growth were caused by several contributing factors. There is a lack of production resources in southern Sweden, as the majority of hydro- and wind power production units are located in the north. Furthermore, the Swedish transmission grid has become integrated with Europe in the south but is constrained between the southern and northern parts of the country, thus creating two partly separate markets. Moreover, the decision to shut down nuclear plants in southern and central Sweden[2] reinforced this trend and prices in the south became comparable with Germany, rather than with prices in the northern parts of Sweden. That is, businesses in southern Sweden lost some of their competitive advantage after the 2018 election because the price paid in those zones reflected the marginal cost of the last produced

[2] Barsebäck, with two reactors, has been closed since 2005, while Oskarshamn reactors 1 and 2 were closed in 2016–2017. Ringhals reactors 1 and 2 were closed in 2019–2020. In total, Sweden has since 1999 gone from twelve to six operational nuclear reactors.

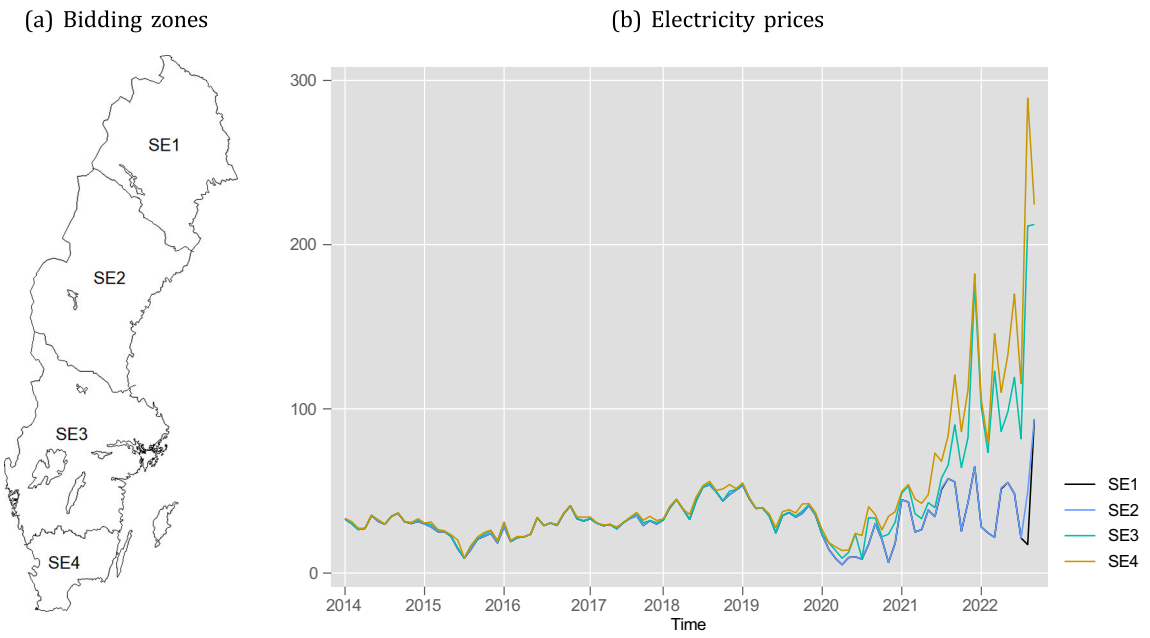

Fig. 1. Electricity prices across the different bidding zones.
Note: Monthly price data in Euros per MWh. A more detailed map, including the electoral precincts, is available in the Supplementary Appendix, Section 1.2.

MWh in gas-dependent countries in Central Europe.

The purpose of the present study is to investigate changes in voting preferences in treated (high prices) and untreated (low prices) manufacturing dense areas after the price of electricity diverged between the northern and southern regions. Swedish voters are not unlike voters in other European nations in that they tend to punish governments for poor economic performance that affects their personal finances or the macroeconomy [88,89]. Brännlund and Peterson [10] found that Swedish households punish mainstream parties when their electricity expenditures rise during the winter months. According to this logic, right-wing populists may gain support among employees in energy-intensive industries that are affected by higher electricity prices, because these prices may be attributed to climate policies implemented by mainstream parties. This logic is expected to be particularly strong in Sweden because workers in the manufacturing industry are already more likely to vote for the Sweden Democrats, a right-wing populist party [90].

However, unlike in previous elections, the Sweden Democrats aligned with market liberal parties to challenge the left-wing government during the 2022 election. Closer ties with the traditional right also meant that a vote for the Sweden Democrats became a vote for traditional right-wing policies. The right-wing opposition blamed soaring energy prices on the government's ambitious climate policies, the shut down of nuclear power plants and high taxes on electricity. The opposition also promised large price cuts on gas and diesel, which also had reached record-high prices levels after the full-scale Russian invasion of Ukraine. The Sweden Democrats made the most extensive pledges of drastic price cuts and particularly targeted voters in rural areas where there are few alternatives to car travel. The ruling Social Democratic government instead blamed the crisis on Russian aggression and promised to preserve social spending and increase financial support for firms and households in the most affected areas. The government promised to spend 6 to 9 billion Euros to mitigate the economic damage from higher electricity prices. The offer from the largest traditional right-wing party (The Moderate Party) was smaller in the range of 1 to 1.5 billion Euros. On the final days of the campaign, the Social Democratic government also proposed to make Swedish electricity prices less sensitive to the price of European natural gas futures.

The 2022 general election had two clear winners: The Social Democratic Party and the Sweden Democrats. However, we reason that the two parties had success in different parts of the country. While we believe that voters throughout the country should have had an interest in punishing the government for the generally soaring energy prices, southern voters had to balance this interest against worries about how the specifically high prices on electricity would affect the manufacturing industry in their communities. That is, in more manufacturing-dense areas that risked plant closures and large lay-offs as a result of falling competitiveness, we expect southern voters to turn to the Social Democrats, who cater social spending and more generous labour market policies for core manufacturing workers. Conversely, northern voters were largely unaffected by the soaring electricity prices and people in manufacturing communities in the north did not have to worry about potential adverse effects on manufacturing industries. Therefore, these voters could base their vote choice on other considerations and may have been more attracted by the promises by the Sweden Democrats of large price cuts on fuel, in particular as the northern parts of Sweden are much more rural and sparsely populated. To summarise, we on the one hand hypothesise that voters in manufacturing-dense communities in the south, which were hit by soaring prices of electricity, to increase their support for the Social Democrats. On the other hand, we expect voters in manufacturing-dense areas in the north, which were much less affected by the turmoil on the electricity market, to be more prone to turn to the Sweden Democrats.

4. Data and variables

Data on political outcomes are available at electoral precinct level i, which is the smallest area available for election outcomes in Sweden. There are about 6000 electoral precincts in Sweden, and each usually contains 1000 to 2000 eligible voters. However, urban precincts within larger cities usually contain more voters. We focus on changes in voting between the 2018 and 2022 election in the main analysis because electricity prices first began to diverge between the north and the south after the 2018 election. However, we also run a instrumental variable design on the 2002 to 2018 period in Section 1.3 in the Supplementary Appendix. We have collected data on all political parties represented in the Swedish parliament, including the ruling Social Democratic Party (SAP) and the smaller parties in the left/green bloc: the Left Party, the

Green Party and the Centre Party. We also gathered information on the right-wing opposition parties: the conservative Moderate Party, the Liberals, the Christian Democrats and the populist Sweden Democrats (SD).

Based on the literature and the institutional setting, we expect a relative stronger performance of the Social Democrats in manufacturing-dependent precincts located in the regions that experienced sharp increases in the price of electricity (treated precincts). This is because manufacturing workers and their families are expected to benefit more from the Social Democratic policy package when manufacturing industries are struck by economic insecurity. Thus, we are mainly interested in changes in the vote share for the Social Democratic Party between 2018 and 2022 but we present the empirical result for all political parties in Fig. A.2 in Section 1.3 in the Appendix. We define the main dependent variable as the difference in the vote share for the Social Democratic Party between 2018 and 2022:

$$\Delta\ Vote\ SAP_i = (Vote\ share\ SAP_{i2022}) - (Vote\ share\ SAP_{i2018}) \quad (1)$$

We are interested in investigating the impact of higher electricity prices on political outcomes across electoral precincts with low and high employment rates in energy-intensive industries in the main analysis. Following the literature on electricity prices and employment, we focus on the share employed in manufacturing industries. We derive this share by calculating the number of citizens employed in different industrial sectors in November 2018 using the Swedish Standard Industrial Classification (SNI), which is based on the EU NACE Rev. 2 standard for classifying economic activities. According to this classification, the manufacturing industry includes a large number of different sub-sectors related to, for instance, machinery, metal work and timber industries, whereas mining is excluded. The five largest manufacturing sub-sectors in terms of their contribution to GDP in Sweden 2018 were, in order of magnitude, production of motor vehicles, machinery, chemicals, metal products and paper [84].

We calculate the manufacturing share by dividing the number of workers employed in the manufacturing sector by the total adult population in the electoral precinct. If a person has multiple employers, the code is based on the job that generated the largest wage income in November 2018. The code is defined on the basis of the industrial sector of the person's workplace rather than the firm or employer, and each workplace has a specific industrial sector code in the official Swedish records. Fig. 2 presents the distributions of our dependent variable and our main indepent variable.

4.1. Empirical specification

Eq. (2) presents our main empirical specification which follows the logic of a difference in difference design:

$$\begin{aligned}\Delta Vote\,SAP_i = {} & \alpha_i + \beta_1 \Delta Price_{jt} \times Manufacturing\ \ share_{i2018} \\ & + \beta_2 Manufacturing\ \ share_{i2018} + \beta_3 \Delta Price_{jt} + \beta_4 \mathbf{X}'_{i2018} + \gamma_{jlm} + \epsilon_{it}\end{aligned} \quad (2)$$

The left-hand side of Eq. (2) represents the change in support for the Social Democratic Party between 2018 and 2022 in electoral precinct *i*. The main independent variable, depicted on the right-hand side of the equation, aims to capture the decreasing comparative advantage of firms and workers in the expensive bidding zones in the south. To generate this variable, we multiply the growth in regional electricity prices for each bidding zone *j* between 2018 and 2022 by the share of employed citizens in the manufacturing sector in each precinct. We use readily available data on electricity prices from the Nord Pool spot market. With these data, we calculate the relative growth (in per cent not percentage points) in electricity prices between January to September 2018 and January to September 2022 for all four bidding zones.[3] All constitutive terms, i.e., the share of workers, price growth, and the multiplicative term, are included in the regression. Thus, our strategy is to compare voting outcomes between treated manufacturing precincts with high electricity prices in the south to untreated manufacturing precincts in the north. In other words, we aim to estimate the difference in the change in support for the Social Democrats between 2018 and 2022 in manufacturing communities, depending on whether these communities were struck by a sharp increase in electricity prices. This difference is captured by β_1.

The main identifying assumption in a traditional difference-in-difference design is the parallel trend assumption. Therefore, we assume that precincts with high and low manufacturing shares across the bidding zones had similar voting trends before electricity prices began to diverge after the 2018 election. We add several control variables for the precincts to vector $\mathbf{X}'_{i2018}$ in order to factor out differences in observable characteristics between the precincts in 2018. We posit that the parallel trend assumption is more likely to hold conditional on the situation found in the precincts *before* electricity prices diverged between bidding zones. We include the share of students, unemployed, and migrants as well as average age, labour income, and years of education for the population. Detailed descriptions, summary statistics, and data sources of these variables can be found in Section 1.1 the Supplementary Appendix. We investigate the plausibility of the parallel trend assumption in Table A.3 in Section 1.3 in the Supplementary Appendix by using lagged changes in the vote share for the Social Democratic party and the Sweden democrats. These tests illustrate, that our main independent variable (β_1) does not correlate with past changes in voting even without these controls.

Moreover, we note that the sharp geographical boundaries of the bidding zones may invite a regression discontinuity design. However, the present study focuses on the conditional effects of electricity prices on the local labour market's dependency on manufacturing jobs, not the general effect of high prices on voting. Regression discontinuity designs are less well-suited for testing interactions and may encounter precision issues. Still, we have the possibility to add fixed effects at different levels in order to make sure that we draw inference from precincts that are located close to each other. For instance, a fixed effect at the bidding-zone level *j* would factor out unobserved heterogeneity across the north and the south because it ensures that we compare precincts that lie within the same bidding zone. However, such fixed effects would restrict the identifying variation to differences in the manufacturing share because all precincts within the same zone face the same price growth.

We also consider introducing labour market fixed effects. Local labour markets *l* are intended to portray the functioning of the labour market within geographically distinct areas, which are relatively independent from external influences in terms of labour supply and demand. These labour markets evolve over time; new ones are formed, and others vanish, driven by commuter flows and there are 68 labour market regions in our sample. These fixed effects can be useful as the independent variable does not account for any differences in energy intensity across firms. We exploit the stability of the energy requirement for producing certain goods between 2018 and 2022 and the geographical clustering of manufacturing industries across the labour markets. To put it simply, many manufacturing industries within a local labour market exhibit similarities due to shared constraints. Thus, by introducing labour market fixed effects, we can eliminate average differences, such as energy intensity between industries located in different parts of Sweden. Another benefit is that the bidding zones' borders cut through some of these regions so labour market fixed effects allow us to utilise variation from precincts with similar industries but differing electricity prices to a greater degree.

We also apply municipality fixed effects *m*, which are much smaller units (precincts are nested within municipalities and municipalities are nested within labour markets) and Sweden consists of 290 such municipalities. Adding fixed effects at this level allows us to factor out local unobserved industry characteristics because we now compare

[3] Elections in Sweden are held in September every fourth year.

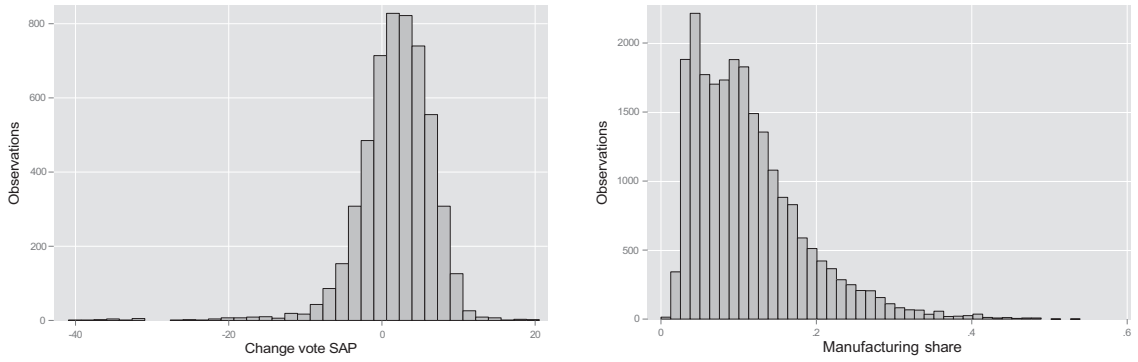

Fig. 2. The distribution of the main variables.
Note: The figures show the distribution of the dependent variable to the left and the share of workers employed in the manufacturing sector to the right.

neighboring precincts. Nevertheless, the borders of bidding zones passing through very few municipalities mean that most of the variation will still be derived from the manufacturing share. Thus, to further corroborate our research design, we conduct an ancillary test by narrowing our sample to precincts within a 50 km radius of the bidding zone border. This approach facilitates comparison between geographically proximate precincts exposed to different electricity prices. Detailed information about the areas incorporated in these tests can be found in the figure A.1 found in Section 1.2 in the Supplementary Appendix.

For the test applying the 50 km restriction, we use the same empirical specification as Eq. (1), but with one significant modification. Instead of including fixed effects at the zone, municipality, or labour market level (γ_{jml}), we introduce a border zone fixed effect (γ_b). This effect is denoted by dummy variables indicating whether the precinct is within a 50 km distance from a border between two bidding zones. Specifically, we have three dummy variables: one for precincts along the border between zone 1 and 2, another for precincts along the border between zone 2 and 3, and a third for precincts within 50 km of the border between zone 3 and 4. While this step considerably reduces the sample size, it ensures that the identifying variation focuses on even more comparable precincts with different price growth.

To summarise, our study bears clear similarities to studies on import competition and populist voting. However, we postulate that the growth in electricity prices, rather than trade shocks from China, should have a greater influence on voting through the mechanism of perceived labour market insecurity in precincts with a higher share of manufacturing workers. Still, it is crucial to note that the present study lacks an observable first stage for the studied period 2018 to 2022 due to data scarcity. Nevertheless, we posit that higher electricity prices produce uncertainty in manufacturing-dependent communities for three reasons: (1) the established relationship between electricity prices and production, investments and employment decisions in the manufacturing sector [14]; (2) the established relationship between manufacturing jobs and total economic activity at the residential level [46]; (3) we show in Section 1.3 in the Supplementary Appendix using a traditional shift-share analysis on the period 2002 to 2018 that local labour markets tend to be negatively affected by higher electricity prices. More precisely, we illustrate that higher electricity prices produce industrial decline, lower wage growth and a decrease in employment in manufacturing dense precincts.

5. Main results

Table 1 showcases the primary findings of the study. The dependent variable represents the change in the vote share for the Social Democratic Party in per cent, while the main independent variable is an interaction term between the relative growth in electricity prices between 2018 and 2022 (a one unit increase represents a 100% increase in prices) and the proportion of individuals employed in the manufacturing sector.

Column 1 presents a model without any fixed effects but includes controls for observable characteristics prior to the divergence in electricity prices in 2018. These controls encompass the proportion of students, unemployed individuals, and migrants, along with average age, labour income, and average years of education for the population. The results indicate that the Social Democratic Party performed relatively

Table 1
Electricity prices and the manufacturing vote.

	1	2	3	4	5
Δ Price	−0.145*	–	−0.321	−0.254	−1.052**
	(0.399)	–	(0.462)	(0.667)	(0.480)
Manufacturing share	−21.44***	−24.44***	−18.85***	−21.77***	−11.97**
	(3.570)	(5.331)	(4.814)	(6.479)	(5.741)
Δ Price X Manufacturing share	6.720**	8.491***	6.830***	7.258**	5.591**
	(1.805)	(2.480)	(2.056)	(3.375)	(2.592)
Constant	−27.04***	−27.47***	−22.66***	−24.09***	−41.29***
	(3.920)	(6.471)	(6.344)	(5.936)	(10.98)
N	5237	5237	5237	5235	765
Controls	Yes	Yes	Yes	Yes	Yes
Price-zone effects	No	Yes	No	No	No
Labour market effects	No	No	Yes	No	No
Municipality fixed effects	No	No	No	Yes	No
Border-zone effects	No	No	No	No	Yes

Robust Standard errors in parentheses clustered at the municipality level column 1–4.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

poorly in untreated manufacturing precincts in the north, as evidenced by the negative and significant coefficient for the manufacturing share. This coefficient signifies the hypothetical difference in the change in support for the Social Democrats between a precinct with zero manufacturing share and a precinct where everyone is employed in manufacturing when the price growth is zero (the price growth in SE1 and SE2 was −0.07 and 0.016 respectively). For instance, in a precinct that experienced no price growth, with the mean level of manufacturing employment (0.107), the Social Democrats lost an average of 2.2 percentage points in support between 2018 and 2022, keeping the observable characteristics constant.

Conversely, the coefficient for price growth represents the impact of a 100% increase in electricity prices when the manufacturing share is zero, but this is relevant only for one observation in our sample. The primary finding, however, is represented by the positive and significant coefficient for the interaction term, suggesting that the Social Democrats performed relatively better in manufacturing-dependent precincts located in bidding zones with larger increases in electricity prices. The estimate is positive and significant at the 99% level. The coefficient for the interaction term further suggests that the difference in the effect of doubling the electricity price between districts with no manufacturing industry and districts where everyone is employed in the manufacturing industry is 6.7 percentage points, when we account for the impact of observable control variables in 2018.

This coefficient maintains its significance and remains positive even after incorporating fixed effects at different levels. For instance, in column 2, we introduce fixed effects at the bidding-zone level. This implies that we utilise variation across precincts within the same bidding-zone. By doing so, we retrieve a stronger estimate of 8.5, but it's important to remember that the variation now stems from differences in the manufacturing share, because precincts within the same zone face the same price level. Therefore, we introduce labour market fixed effects in column 3. This allows us to exploit some variation between precincts with different price growth within the same labour market region. Using these fixed effects reduces the estimate of the interaction term to 6.8, but it remains significant at the 99% level. A similar result emerges when we apply municipality fixed effects in column 4. Now, we compare precincts that are in relatively close proximity because municipalities are much smaller compared to the labour market regions. However, although the border zone cuts through some municipalities, the size of this group is smaller compared to column 3.

In the last column, we focus instead exclusively on the effects observed in precincts located within a 50 km distance from the borders of the electricity bidding zones, as described in the methods section. Instead of employing municipality fixed effects, we utilise dummy variables for precincts close to one specific border. By employing this model, we can capture the variation across precincts that are located close to each other but experience different changes in electricity prices. The estimate of the interaction term between price growth and the manufacturing share is 5.6 in size and is only significant at the 95% level, but this is expected given the much smaller sample size.

Fig. 3 demonstrates how the interaction between price growth and the manufacturing share impacts the support for the Social Democrats. The upward-sloping line in the figure indicates that in price-affected precincts, the Social Democrats increased their support more the larger the manufacturing sector. At the average size of employment in manufacturing, 0.11, a doubling of the electricity prices implies a slight increase in the support of the Social democratic government of 0.5 percentage points, although the point estimate is not significant. However, from a manufacturing share of 0.17, there is a significant positive effect of the price hike on voting for the Social democrats. In communities where a more substantial share of the population works in manufacturing—for instance twice the average, 22%—the support for the Social Democrats increased with 1.3 percentage points between 2018 and 2022. These findings are consistent with the hypothesis put forth, suggesting that mainstream left-wing parties can attract support from the manufacturing vote in the face of rising electricity prices.

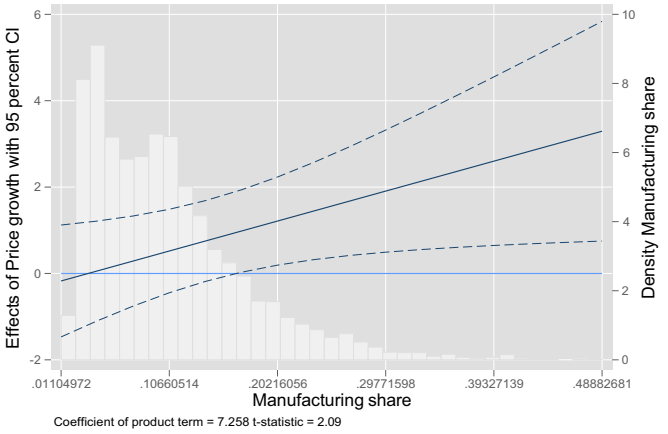

Fig. 3. Marginal effects.
Note: This figure presents the marginal effect of a 100% increase in electricity prices on voting for the Social Democrats, while varying the manufacturing share with 95% CI. The figure is based on Model 4 in Table 1.

To substantiate our argument further, we present additional analyses in Section 1.3 in the Appendix. We test if the result is driven by precinct border changes between 2018 and 2022 and we examine whether the result is driven by voting trends. These tests do not contradict our main result. We also show that the interaction effect between price growth and the manufacturing share is negative for the Sweden Democrats. In other words, the Sweden Democrats performed worse in price-hike affected manufacturing precincts in the south—compared to the non-affected precincts in the north. Furthermore, we demonstrate in the Appendix Section 1.3 the robustness of the effect using a traditional shift-share design that accounts for linear trends in voting and various observable confounders. The results indicate that the influence of electricity prices on voting remains consistent throughout the 2002 to 2018 period. These findings suggest that the Social Democrats gain support in manufacturing-dependent districts when electricity prices increase, regardless of their incumbent status.

Further analysis of potential unobserved confounders at the regional level is essential, particularly for our comparative study of manufacturing precincts in the northern versus southern regions. For instance, the 2022 general election highlighted a significant increase in criminal activities, predominantly in the southern regions, which have historically aligned with the Sweden Democrats. This surge adversely impacted the ability of local businesses to attract skilled labour. Notably, the election signified a major shift in voter preferences, with the Sweden Democrats encroaching upon the Social Democrats' vote shares in the northern regions, a change possibly linked to the expansion of gang violence into these areas.

A critical unobserved variable at the precinct level is the balance between household savings and debts. The electoral response to job loss risks may vary accordingly: in regions with substantial household savings, the response could be muted, whereas in urban areas in the south with higher mortgage rates due to elevated house prices, the response could be more pronounced. The significance of household balance sheets lies in the fact that manufacturing workers with savings might continue to support local businesses despite potential job uncertainties, while those burdened with significant debts might significantly cut back their spending to manage mortgage payments. A limitation of our study is the lack of recent data, as the Swedish wealth register was operational only from 1999 to 2006. To address the influence of these and other unobserved confounders, we utilized the Oster [95] method, as detailed in Section 1.4 in the Appendix. However, these results suggest that the bias from unobserved variables likely increase the impact of the main independent variable on voting behaviour.

6. Discussion and conclusion

Electricity prices entail important implications for the economy and voting behaviour. We have focused on the effect of the current energy crisis on manufacturing workers, since growing costs and volatility can cause economic insecurity through factory shutdowns and layoffs. Recent literature has essentially proposed two implications for voting behaviour. First, according to the populist thesis, increasing electricity bills shift manufacturing voters towards the populist far right, which presents itself as the antithesis of the incumbent mainstream parties and promises to hinder further de-carbonisation efforts. Second, according to the welfare compensation thesis, volatility in electricity prices induces greater demand for social insurance and budges voters towards traditional left-wing parties that promise compensatory welfare mechanisms to protect against rising prices [3,82]. In contrast to Brännlund and Peterson [10], who investigate the impact of household expenditures, the purpose of the present study was to examine the impact of perceived economic insecurity brought on by turmoil in international energy markets.

We employed a dependent variable that represented the difference in the vote share for the ruling Social Democratic Party in Sweden between 2018 and 2022. We found that the Social Democratic Party consolidated its support in manufacturing hubs in the south where electricity prices reached much higher. We also observed that the Sweden Democrats, the far-right populist party, performed relatively better in election precincts with a higher manufacturing share in northern Sweden, which were less affected by price volatility. However, support for the Sweden Democrats fared worse across manufacturing precincts in central and southern Sweden, which had the highest electricity expenses during the 2022 election. Hence, the present study's findings are more in line with the compensation thesis than the populist thesis, since manufacturing voters in areas affected by high electricity prices were more likely to shift their vote in favour of the Social Democrats than the Sweden Democrats. In other words, high electricity prices led to greater support for the ruling Social Democratic Party among pressured manufacturing voters instead of the opposition, i.e. the far-right Sweden Democrats.

We studied the impact of higher electricity prices on electoral behaviour during a period in which the Social Democratic party not only stood for the preservation of social spending but also promised a massive compensation package to firms in distress. Thus, this study also provides policy implications on economic compensation to manufacturing voters who are affected simultaneously by both globalisation and decarbonisation [91,92]. Previous research has shown that voters tend to support costly climate and energy policies when compensatory measures, such as worker healthcare, pensions and income compensation, are implemented [93,94]. However, unlike prior survey studies, we were able to pinpoint a specific group that is potentially affected by the energy transition and show the impact of an external shock on its voting behaviour. An interesting trade-off emerged from our findings. On the one hand, direct cash handouts to struggling households and businesses could save governments from electoral defeats when rising electricity prices put pressure on economic activity. On the other hand, handouts could stall the green transition because such subsidies reduce incentives to decrease energy consumption in the long term.

A final question that needs to be discussed is the extent to which our results can be generalised to other contexts. Firstly, it is important to emphasise that the effects observed in this study are largely based on anticipated economic insecurity rather than actual labour market outcomes. The high electricity prices at the time of the 2022 election had not yet impacted the economy, but the concern for potential cutbacks was significant. Therefore, it is entirely possible that actual labour market outcomes could benefit right-wing populists, as we are currently witnessing in Germany with the noticeable tailwind for the AFD. Another point worth mentioning is that the Sweden Democrats are already a well-established party among Swedish industrial workers, which could potentially lead to a ceiling effect since there are fewer new votes to won over within this group. Future studies will reveal whether traditional left-wing parties can continue to gain votes due to higher electricity prices, or if right-wing populists will dominate this issue.

Hence, the main limitation of this study concerns the external validity of the findings. We studied a shock in electricity prices brought on by events unfolding in international energy markets. Some of the price increases stemmed from government policies in EU member states and some from the 2022 Russian invasion of Ukraine. Thus, it remains uncertain whether the findings can be extrapolated to settings in which price increases stem from domestic policies only. Therefore, future studies should use cross-national data to investigate the external validity of our results. A second limitation concerns the promise of a massive compensation package for businesses and households that the Social Democratic Party made during the 2022 election campaign. The broad scope of this pledge makes it hard to pinpoint the exact mechanism which turned manufacturing workers to the Social Democrats. Future studies should strive to use individual-level survey data to differentiate the impact of different policies, such as support to business, social spending and direct cash handouts.

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CRediT authorship contribution statement

Anton Brännlund: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jan Amcoff:** Visualization, Data curation. **Marcus Österman:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Data curation. **Lauri Peterson:** Writing – review & editing, Writing – original draft, Conceptualization. **Håkan Brännlund:** Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no conflicts of interest pertaining to this research.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.erss.2024.103419.

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