



ORIGINAL ARTICLE

The political consequences of technological change that benefits low-skilled workers

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Abstract

Technological change often increases demand for high-skilled jobs, with low-skilled losers turning to the populist right in response. The political effects of technological change that increases demand for low-skilled workers are largely unknown. The growth of the salmon fish-farming industry in rural Norway improved the labor-market situation for low-skilled workers, and we find that support for the populist right-wing party increased in municipalities that benefitted from the industry growth. The electoral change is due to a right-wing shift on the economic, but not the cultural dimension. Our results support political economy frameworks that point to lower demand for state interventions after positive labor market shocks, but raise the question of in what contexts support for populism will decline.

Keywords: comparative political economy; comparative politics; political behavior; voting behavior

1 Introduction

A rich literature in economics has documented important labor market effects of rapid technological changes over the last few decades (Autor, 2015; Acemoglu and Restrepo, 2020, 2019). The literature shows that automation technology has displaced jobs and tasks previously performed by workers, improved the wages and employment prospects of high-skilled workers and that labor markets have become more polarized. While concerns about labor displacing technological change are not new, rapid developments have caused fears that we face a hard transition period before the labor market has adjusted to a new situation.

Recent work in political science has explored the political consequences of these labor market changes (Frey *et al.*, 2018; Anelli *et al.*, 2019; Gingrich, 2019; Gallego *et al.*, 2022b). Most work relates the weakened prospects of low-skilled workers to the rise of right-wing populism, by associating the development with the rise of anti-immigration sentiments and psychological feelings of social and political despair. Frey *et al.* (2018) find that labor market regions that have been more exposed to industrial robots are more likely to vote for Trump. They relate this result to Trump being an outsider candidate who wants to shake the status quo, something that resonates with losers of technological change. Anelli *et al.* (2019) measure exposure to robotization across European regions and find a positive effect on support for the Far Right. They point to a series of possible mechanisms, such as anti-establishment attitudes, attentiveness to “nostalgia rhetoric,” and the weakening of trade unions. Gingrich (2019) shows that compensation policies have limited moderating effect on the relationship between exposure to automation and vote choice. Research is not, however, restricted to the losers of technological change. Using individual-level

panel data, Gallego *et al.* (2022a) document a right-wing shift among winners of workplace digitalization, but, in contrast to the losers, they turn to the mainstream right, not the far right.

In this paper, we depart from studying technological changes that harm low-skilled workers or create high-skilled winners, and turns to low-skilled winners. During the 1990s, a series of technological advances, together with deregulation by the central government, rapidly improved the productivity of salmon fish farming in Norway. This development caused an increase in the demand for low-skilled workers in the areas suitable for salmon fish farming. The massive growth of the industry implied that it is today the most important industry in many rural municipalities, being the main employer of low-skilled labor. Thus, we study the consequences of a technological change that created new jobs and tasks for low-skilled labor rather than displacing it. The political effects of developments that complements low-skilled workers are largely unknown, and one contribution of the paper is to spell out the various theoretical mechanisms that might operate. We argue that a political economy framework suggests a right-wing shift as demand for redistribution and regulation declines, while a more sociologically oriented framework suggests that the populist right should decline, as the mechanisms referred to in the previous paragraph should be at least weakened when the situation of the low-skilled improves.

When theorizing about the possible effects of industry growth, we depart from the literature on technological change in two important ways. First, while the literature studies how individual workers respond to changes in their own economic situation (as in Gallego *et al.*, 2020), we examine effects at the community level since the industry growth transformed whole communities. We believe it is important to study such total effects. The downside is that we study the consequences of a bundle of mechanisms rather than identifying a technological innovation's direct effect (as in e.g., Anelli *et al.*, 2019). Second, we believe studying political effects over a long-run period is important. We argue that it is often implausible that political effects will follow immediately after labor market changes, at least if one posits, as the literature does, that party preferences, political sentiments, and political efficacy are important mechanisms in play. Our theoretical discussion is further guided by the question of to what extent we should expect the political effects of a positive shock to be identical to those of negative shocks (but with the opposite sign). Finally, we relate our paper to the literature on the political effects of booming resource extractive industries (Cooper *et al.*, 2018; Fedaseyev *et al.*, 2019; Sances and You, 2022), as this literature identifies a set of additional mechanisms for how local politics might change.

We examine the effects of the salmon industry on the labor market and political outcomes using instrumental variables methods, leveraging that some geographic locations are more suitable for salmon fish farming than others, for instance, because farms need protection from heavy weather. We find that the Progress Party, the populist right party in Norway,¹ improved its vote share in municipalities where salmon farms are located. This result is surprising since we document an improved position of the low-skilled workers in these municipalities over the period we study. Our results further show that the improved support of the Progress Party appears to be due to a right-wing shift in economic preferences in affected communities, but no effects on the values dimension of political competition. Our results are thus in line with a political economy perspective, where income growth dampens demand for government regulation (Dasgupta and Ramirez, 2021). The results raise challenging questions to the literature on populism, however, since support for the Progress Party has increased even though the sociological mechanisms used to explain support for populism are absent or even working in reverse. The growth of the Progress Party happened at the expense of the Center Party, which is the main advocate of the interests of rural areas. Thus, the strong local income growth in the salmon-producing municipalities appears to have removed the rural discontent that this party thrives on. Finally,

¹We use this term to describe the Progress Party since they combine a right-wing (stricter) immigration policy platform with frequent references to conflicts between the people and the elite in their political rhetoric. However, they are moderate compared to many populist right parties in Europe. See discussion below.

suggestive evidence from survey data indicates that electoral effects stem from community-wide changes in preferences rather than effects being concentrated among those most directly affected (the low-skilled population).

The rest of the paper is structured as follows. The next section presents the theoretical framework for how technological change can influence political behavior. We start by discussing how individual-level exposure to shocks can influence policy preferences and, thereby, electoral behavior, largely following standard models in the field. Then we make the case for studying long-term and community-level effects. Next we introduce the policy supply side and discuss how vote shares might be affected, and describe the growth of the salmon fish-farming industry (Section 3). Section 4 presents our data and empirical approach before we present the results in Section 5. Section 6 concludes.

2 Technological change and political behavior

2.1 The demand side

A natural starting point to understand the political effects of technological change is to turn to standard models of how the labor market situation shapes political preferences. In such models, political consequences are derived from how we expect political preferences to respond to changes in employment risk and income. Influential political economy models predict that higher employment risk will increase demand for left-wing economic policies (Iversen and Soskice, 2001; Moene and Wallerstein, 2001), a prediction which has much empirical support (Rehm, 2009), also in studies of responses to automation risk (Thewissen and Rueda, 2019; Busemeyer and Sahm, 2022). These models further predict that negative changes to earnings, given risk, will increase demand for policies that redistribute earnings (see also Meltzer and Richard, 1981).²

Thus, if using these political economy models as starting points, one should expect that technological changes that are labor replacing (i.e., they increase employment risk) will increase support for left-wing policy platforms. This, however, is not how most papers approach the issue. Instead, researchers tend to apply sociological frameworks that point to the role of status anxiety and relative social positions in shaping policy preferences (Gidron and Hall, 2017; Anelli *et al.*, 2019; Kurer, 2020). When facing declining economic prospects, the argument goes, political messages centered on preserving the status quo and instilling nostalgia about the past will resonate more. Political campaigns, like that of Trump, which attacks mainstream political and social elites, will be more appealing to those who feel marginalized. Policies that aim to lift traditionally underprivileged groups will be met with hostility, as it will further threaten their own social status. It is also argued that policies that aim to protect workers from other threats to their economic situation, like trade and immigration regulation, will become more attractive. The demand for policies that restore the status quo is high among those that express concerns about technological change, as they demand policies that slow down technological change rather than policies that compensate them (Gallego *et al.*, 2022a).

What then about the effects of positive changes? Using the standard political economy framework, one should expect the effects of positive and negative changes to be symmetric. Positive changes to income and employment risk should lower demands for redistribution and, for that reason, make low tax platforms more popular. Moreover, low employment risk will also lower the need for public social insurance, typically provided at more generous terms by the left.

The social tensions that sociological frameworks highlight as following economic decline will be absent when economic prospects improve. If the effects of positive and negative changes are symmetric, improved economic prospects imply declining support for populism. However,

²The effects of negative changes in earnings on support for public social insurance programs, typically offered in more generous forms by leftwing parties, are more controversial and depend on what assumptions one makes about risk aversion (Iversen and Soskice, 2001; Moene and Wallerstein, 2001).

left-wing platforms that emphasize the rights of underprivileged minorities and liberal immigration policies might not necessarily become more appealing to voters if economic prospects are good. One reason for this is the negativity bias in politics (Soroka *et al.*, 2019), which makes it easier to mobilize voters on negative changes to their social situation. High demand for low-skilled work might also reduce individual-level investments in education (Nyhus, 2020; Cascio and Narayan, 2022), making voters less interested in progressive policy platforms, given the strong relationship between education and support for progressive policies.

Perhaps the strongest case against a symmetry expectation, whereby a positive shock to the situation of the low-skilled works in reverse from the negative one studied in the literature, is found by taking into account that voters might have developed social and political identities attached to their education or skill level (Bornschieer *et al.*, 2021). In this argument, the increasingly salient cultural conflicts are partly a conflict across skill groups, where low-skilled voters have developed identities that align better with the messages of the populist right. If so, left-wing parties will not appeal to low-skilled voters even if they experience a positive development in the labor market. Thus, if this social identity conflict is sufficiently developed, it might attenuate the effect of income growth among the low-skilled, as materialist considerations do not directly drive their vote choice. Alternatively, suppose the drop in demand for redistribution pushes them to the right. In that case, it might influence party choice within the set of parties on the right, for instance toward populist right parties rather than mainstream conservative parties.

The theoretical reasoning we have applied so far is at the individual level, that is, we have analyzed how an individual voter responds to changes in her immediate circumstances. While individual-level theorizing dominates the field, several studies still examine empirical relationships at the local (aggregate) level (Frey *et al.*, 2018; Anelli *et al.*, 2019). Suppose one wants to identify effects of individual-level changes using data at the aggregate level. In that case, the affected workers need to be spatially concentrated, and individual-level effects must be sufficiently large (and the winners relatively few). This is particularly so since the literature tends to measure effects relatively close in time after the changes, implying that the effects have had limited time to manifest and spread beyond those immediately affected. While these conditions might describe the technological disruptions in the US labor market, it is less clear that this is the case in Europe (Dauth *et al.*, 2021).

In our case, the technological developments caused an industry growth that had community-wide effects (see below), thus it is necessary to examine the long-run effects at the local, community, level.³ We highlight consequences stemming from four developments as particularly important; unequal income growth, local vibrancy, compositional changes, and reliance on natural resource extraction. We discuss these in turn.

Higher relative demand for low-skilled workers over a long period will increase relative wages in the lower parts of the earnings distribution, implying more compressed earning distributions in the local labor market. This can affect local vote shares through several channels. When the lower-income classes become relatively richer, their ability to organize politically (in unions, parties, or interest organizations) as well as their political efficacy might improve (Korpi, 2006). Together, these effects should bring more low-income voters to the polls (Verba *et al.*, 1995; Finseraas, 2017). Social solidarity within the working class might also be improved, as the social status of low-income groups improves with lower income inequality, making it more tempting to identify as a low-wage worker (Shayo, 2009). Lower political polarization might follow.

The local income growth further means that the local community will be vibrant and avoid the stagnation some rural communities have suffered over the last few decades. Local stagnation has been linked to the rise of right-wing populism (Jennings and Stoker, 2016). In Norway, the center-periphery conflict has a long tradition and is still strong (Jenssen, 2020). The salience of this

³Also individual-level effects will probably take some time to manifest since party preferences and political sentiments tend to be stable in the short run (see, e.g., Kustov *et al.*, 2021).

dimension among voters might decline when the rural–urban conflict is weakened, thereby harming rural and agrarian parties that have their basis in competition along this cleavage. More speculative, steady economic growth in an area over a long period might also influence beliefs about the importance of luck versus skills in explaining economic outcomes. For instance, research in behavioral economics finds that experiences with unemployment and social mobility influence fairness norms and that such views can be self-serving (see, e.g., Cappelen *et al.*, 2020), reducing support for economic redistribution. According to Bergsgard and Vassenden (2015), the popular local narrative in the region of Stavanger, the rich “oil capital” of Norway, is that their economic fortune is due to their own hard work, local pragmatism, and entrepreneurial spirit, and has “nothing” to do with the activities of the central government. Similar perceptions of local entitlement to natural resource incomes have characterized arguments against stricter taxation of the salmon fish-farming industry, thereby creating opposition to government interventions.

A local positive change to the labor market might also affect geographic mobility, with consequences for changes in the composition of the population across regions. In our case, low-skilled workers exposed to the positive change will be more likely to stay put, while low-skilled workers from elsewhere might move in. After the 2004 European Union (EU) enlargement, low-skilled labor immigration from countries like Poland and Latvia has gradually increased in industries like construction and food processing (Finseraas *et al.*, 2020). Moreover, in rural areas that suffer from declining populations, particularly from young people leaving, the population will be younger than in a counterfactual state with no change in the demand for low-skilled labor. The political consequences of such compositional effects pull in different directions. Still, we find below that immigration is the most important compositional change and discuss this as a possible mechanism for the political effects.

Finally, when considering community-wide effects, it is also necessary to take into account the specifics of the industry that causes the local income growth. In particular, salmon fish farming is a natural resource extraction industry, which might put additional effects in play. Several studies show that local communities that depend on natural resource extraction turn to the right to avoid economic or environmental regulations that might negatively impact the industry (Cooper *et al.*, 2018; Fedaseyeu *et al.*, 2019; Dasgupta and Ramirez, 2021; Sances and You, 2022). These effects are also highly relevant in our case, as there has been a continuing debate on whether to tax the industry harder and how strict environmental regulations should be. In the autumn of 2022, the coalition government of the Labour Party and Center Party suddenly announced the introduction of resource rent taxation of the salmon industry. As an indication of the importance of the industry, the decision dominated the public debate in the following weeks, and was, unsurprisingly, met with strong opposition from the industry and local politicians in municipalities that depend on the industry. Dasgupta and Ramirez (2021) argue that technological change that makes an industry more capital-intensive, which is the case for salmon fish farming, implies that rural communities develop a structural dependence on the industry, causing community-wide shifts to the right in order to curtail regulations of the industry.

2.2 Matching policy demand to policy supply

In order to derive expectations of electoral effects we need to map changes in political preferences to policy platforms of Norwegian political parties. Four parties are particularly relevant to study in our case: the Labour Party (Ap, mainstream left), the Conservative Party (H, mainstream right), the Center Party (Sp, main party on the center–periphery dimension), and the Progress Party (FrP, populist right party).

The Progress Party is the party that most resembles those populist right parties that previous research has identified as the electoral beneficiaries of low-skilled misery in the labor market. From the sociological framework, this party should not gain support in our case, since many of the sociological explanations that link declining labor market prospects at the bottom of the

skill- and income-distribution to right-wing populism, such as status loss and marginalization, is absent. However, from the political economy framework, one might expect the Progress Party to gain: the Progress Party is the main anti-taxation party in Norwegian politics and they oppose strict environmental and labor market regulations. Thus, if demand for government regulation, taxation, and redistribution declines, their platform will become more attractive. Moreover, in contrast to many other populist right-wing parties, the Progress Party has historically been pro-EU and pro-free trade due to a libertarian faction in the party. While the pro-globalization positions have gradually become internally contested over the last decade, due to a strengthening of a nationalist-conservative faction within the party, they should be considered to be pro-economic globalization during the period we study. The open trade position aligns with the interests of the salmon industry, and thus with communities that depend on it, as the industry needs easy access to export markets.

The Center Party is the main advocate for rural interests in Norwegian politics, with strong ties to the agricultural organizations. Discontent in rural areas against the continuing trend of centralization and withdrawal of public services from small, rural, communities is the main mobilization issue of the party. The party combines strong support for increasing central government redistribution from urban to rural areas with center-right policies on non-economic issues (immigration, minority rights, crime). To the extent that persistent income growth counters perceptions of being geographically and culturally left-behind, support for the Center Party will decline as a consequence. The Center Party is strongly opposed to the EU, which might weaken their support in communities dependent on export markets, but they also defends rural land-owners' right to reap economic benefits from the resources they possess, which resonates with rural entrepreneurs, including those in salmon fish farming.

As for the mainstream parties, the political economy and natural resource extraction frameworks suggest that the pro-redistributive stance of the Labour Party will make their platform less popular, while the Conservative Party's economic platform will become more popular. There are also important capital gains from the salmon industry, which might make the platform of the Conservative Party, but also that of the Progress Party, more attractive to capital owners in the electorate. The sociological framework suggest that all mainstream parties will gain when the economy expands, due to the less fertile grounds for political radicalization.

3 The growth of salmon fish farming

Salmon fish farming was introduced in Norway in the early 1970s, but the major growth in the industry happened from the 1990s as the central government issued an increasing number of salmon-farming concessions and deregulated the industry. Olaussen (2018) estimates that production has doubled ten times since 1992 and doubled since 2005. This increase in production co-existed with an increase in the world price of salmon from 2001. Globally, aquaculture has been the fastest-growing food production industries, and Norway ranks as the second major fish exporter (behind China).

The industry produces salmon at a value of 60 billion NOK⁴ (6 billion EUR) and has created about 6000 jobs (Olaussen, 2018). The growth of the industry has made it into one of the most important industries in rural areas. The major reason for the growth in fish-farming productivity was technological development (Nilsen, 2010; Asche *et al.*, 2013; Kumar and Engle, 2016). Advancements in selective breeding programs, disease containment (vaccines), and feeding processes have been important, together with a massive growth in pen size and quality, which meant that economies of scale were better exploited. This has been followed by considerable increases in investments, profits, and stock market values of the industry. As the industry has matured, the number of firms and owners have declined, and capital intensity increased.

⁴Value on the buyer's side.

One important aspect of the industry that we leverage in the empirical analysis is that profitable fish farms cannot be established anywhere (Nyhus, 2020). Salmon growth is maximized at particular temperatures, as the water cannot be too warm, and nitrite and carbon dioxide concentrations are important for salmon growth and health. Moreover, farms should be shielded from heavy weather, large waves, and ice for efficient production. There are also problems with pollution and the escape of salmon from the farms, which means that farms should not be located close to rivers that are important for the wild salmon population, as the mixing of the two is a severe threat to the wild salmon stock.

Salmon fish farming is the main employer of low-skilled workers in many municipalities and constitutes more than ten percent of the employment in some municipalities (NOU, 2019: 37). Nyhus (2020) shows that industry fluctuations influence the high-school graduation rate in the salmon-producing communities, as it becomes profitable to take jobs in salmon production when the industry is booming. While the average hourly earnings in the industry were lagging that of manufacturing in the mid-1990s, it was higher in 2017 (NOU, 2019: 37). The education level of employees is lower and increases more slowly than in the rest of the Norwegian economy, illustrating that the industry relies on low-skilled labor. The main manual tasks are slaughtering, filleting, and sorting of salmon, work that are conducted in production halls, where cleaning of facilities and equipment is also required. In addition, there is some need for workers to conduct manual tasks in the breeding process. While the main role of technological change was to increase the demand for low-skilled workers, it did also change the task profile of low-skilled workers (Afewerki *et al.*, 2023). This happened because of technological innovations in disease containment, the fight against the spread of salmon lice, preventions of salmon escape from the pens, and new and more efficient breeding technology, that changed the tasks in the job. The innovations made workers more productive and hence better paid, but despite the innovations, the number of employees increased.

In contrast to papers that identify the specific effects of a technological innovation, such as industry robots (Anelli *et al.*, 2019), the industry's growth was caused by a set of technological changes but also partly by changes in regulations. Regulation of the industry has three key dimensions. First, there is a centralized system of allowances to operate salmon fish production, which determines both locations and size of the production. The industry growth would not have happened without new allowances being granted. Second, production faces environmental regulations to reduce escapes from farms, improve fish welfare, and decrease the use of antibiotics in the production. Finally, while the industry faces the general taxation of businesses, there have been debates on whether it should face special resource rent taxation, similar to oil and hydrogen power production, since its profits are partly based on natural resource extraction.

Political disagreements on industry regulation have largely followed a left-right axis in the manner described above. Specifically, left parties and the Center Party have supported regulations to prevent some industry firms from becoming too large. In addition, these parties have supported industry regulations intending to promote regional development. Parties on the right have advocated for liberal regulations and a larger role for the market, which appeals to the industry. However, with a small caveat, as the industry is divided between larger and smaller firms, with the latter having more sympathy with allowance regulations than the former. On taxation, only parties to the left of the Labour Party supported the introduction of an aquaculture resource rent tax during the period we study. In summary, on all aspects of regulation, parties to the left of Labour are unappealing from the industry perspective, also because these parties oppose the EU. In contrast, parties to the right, particularly the Conservative Party, have a bundle of policies that is appealing.

4 Research design

We use the growth of the salmon fish-farming industry to identify the political effects of technological change that increased the demand for low-skilled labor. A natural starting point is an

empirical model of the following form (e.g., Autor *et al.*, 2013):

$$\Delta Y_i = \beta \text{SALMON}_i + \gamma \mathbf{X}_i + \alpha_c + \epsilon_i \quad (1)$$

where ΔY_i is the difference in vote shares from t_1 (1993 election) to t_2 (2013 election) in municipality i , SALMON_i is a binary indicator of whether there are salmon fish farm(s) located in the municipality over the same period, \mathbf{X}_i is a vector of controls, measured at t_1 , while α_c are county-fixed effects. The vector includes demographic controls (population size, share above 65 years of age, and share below 21 years of age), geographic controls (size of the municipality, kilometers of mainland coastline), and share of the population involved in the oil industry in 1990. Since we posit that changes in the labor market is an important channel, we use the same specification to examine effects on labor market outcomes. In the main analysis we compare municipalities with and without salmon fish farms, but we also present results where we use changes in the size of salmon production. Since the industry grew in all municipalities with salmon fish farms, we believe the simple comparison between the two groups of municipalities is justified and more relevant than one were we use the variation in intensity of the industry within these municipalities.

In this specification, it can be shown that β is the standard difference-in-differences estimate. \mathbf{X}_i controls for confounding time trends in the outcome that are correlated with salmon production, while α_c accounts for county-level trends and ensures that identification is from within-county variation in the variables. Still, one might be concerned that β picks up selection to salmon production. For instance, it might be that availability of capital to invest in the industry was higher in some municipalities for unrelated reasons, which might cause a right-wing shift over time irrespective of the salmon industry. Or it could be that the salmon industry growth just happens to be correlated with secular value changes, which might cause a left-wing shift that is unrelated to the industry growth.⁵ To improve identification, we therefore leverage that fish farms are more likely to be located where there are islands to protect them from wind and waves. We do so by replacing SALMON_i in Equation 1 with $\widehat{\text{SALMON}}_i$, which is the prediction from the following (first-stage) regression:

$$\text{SALMON}_i = \beta^1 \text{ISLANDS}_i + \gamma^1 \mathbf{X}_i + \alpha_c^1 + \epsilon_i^1 \quad (2)$$

ISLANDS_i , the instrumental variable, is the kilometers of island coastline. The idea is that salmon production is more likely the more kilometers of island coastline the municipality has because islands provide cover for adverse weather events that make salmon production less profitable (Nyhus, 2020). Keep in mind that \mathbf{X}_i includes geographic controls to help with identification (see below).

The two main assumptions for ISLANDS_i to identify the effect of salmon fish farming is $\beta^1 \neq 0$ (non-zero first stage) and $C(\text{ISLANDS}, \epsilon) = 0$ (exclusion restriction). The assumption of a non-zero first stage is tested in Table A4, and the variation that drives the first stage is displayed in Figure A1. We find that β^1 is, as expected, positive and significant ($p < 0.001$). Municipalities with more island coastline are more likely to have salmon fish farms. Moreover, the relationship between the instrument and salmon fish farming appears to be sufficiently strong to not suffer from weak instrument bias. The F -statistic is 34, which is above the Stock–Yogo and the Montiel–Pfluger bias values. Furthermore, we report the Anderson–Rubin confidence interval in all estimations since it has correct coverage also if instruments are weak (Andrews *et al.*,

⁵A comparison of estimates in Tables 1 and A3 shows a left-wing bias in the ordinary least squares (OLS) estimates and that our IV estimates are slightly larger than the OLS estimates (in absolute terms). The differences in estimates can also be because the IV models identify the local average treatment effect and not the average treatment effect, which is the target estimate of the OLS model.

2019). In addition we report two sensitivity statistics (Cinelli and Hazlett, 2020, 2021), which suggests that any omitted variable needs to be very strong for the first stage to be invalid (see the Appendix for details).

The exclusion restriction says that the only channel from the instrument to the outcome (conditional on the controls) is through salmon fish farming. This assumption cannot be tested, and might be a strong one in our case. The main concern is that the island coastline variable picks up a spurious trend in the outcomes. We attempt to address this concern by including controls picking up time-invariant county characteristics, demographic trends, and the potentially confounding effect of activities related to the oil industry. Moreover, we include controls for municipal size and kilometers of mainland coastline. These variables are correlated with island coastline and will pick up growth of other industries that rely on the coastline. This means that identification is explicitly from island coastline, which should increase the plausibility of the exclusion restriction. Below, and in the Appendix, we discuss and report additional examinations of the exclusion restrictions, including results when we add a second instrument (Table A13) and when we use an alternative, but in our view less suitable, shift-share approach to construct an instrument for salmon production (Table A15).

We also make sample restrictions to improve comparisons (i.e., the counterfactual). We restrict the sample to municipalities with a coastal line so that all municipalities in the sample has a non-zero probability of producing salmon. We further restrict the sample to counties with at least one municipality in the treatment and comparison groups. This has no practical consequences for the IV estimates since we include county-fixed effects, but it ensures that descriptive data and illustrative figures more accurately relate to the variation we use in the estimations. Finally, we restrict the sample to municipalities that did not merge or change borders during the period to reduce measurement error. These restrictions leave us with 108 municipalities in the treatment group and 101 municipalities in the comparison group. Table A2 shows that the municipalities in these two groups were on average quite similar in 1993.⁶

4.1 Data

We combine data from several data sources. We use the Directorate of Fisheries' Aquaculture register to identify salmon-producing municipalities, administrative register data produced and delivered by Statistics Norway to construct labor market outcomes, and the data set of Fiva *et al.* (2020) to get municipal level vote shares in parliamentary and local elections. In addition, we use data from the Comparative Manifesto Project (CMP) (Budge *et al.*, 2001) to measure party positions on different relevant policy dimensions, as described below. The Appendix includes additional information on the data sources.

5 Empirical results

5.1 Labor market outcomes

We first establish that the growth of salmon fish farming had important effects on the labor market. We estimate that average earnings in the salmon fish-farming municipalities was about 12 percent stronger over the period 1993–2015, that is, an annual growth of about 0.5 percent (see first column, Table A5). The income growth is, however, not equal across the wage distribution, but much larger in the bottom of the distribution. Earnings at the 25th percentile increased three times more than at the 75th percentile, which results in a significant decline in earnings

⁶In Table A1 we further compare our sample of municipalities to those *not* in our sample. The main difference is that average population size is smaller in our sample, but this difference is driven by some large cities (like Oslo) that are not included in our sample, as the median population size is only slightly larger in the excluded municipalities (4416 versus 4114).

Table 1. 2SLS estimates. Outcomes are vote shares and turnout.

	Progress Party	Conservative Party	Center Party	Labour Party	Non-socialist	Turnout
<i>Second stage</i>						
Salmon	0.026** (0.013)	0.011 (0.015)	-0.068*** (0.023)	0.022 (0.018)	-0.018 (0.020)	0.021* (0.011)
AR CI lb	0.001	-0.020	-0.125	-0.011	-0.063	0.000
AR CI ub	0.056	0.044	-0.029	0.064	0.021	0.047
Cragg-Donald F	34	34	34	34	34	34
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	209	209	209	209	209	209
Mean of Y	0.14	0.11	-0.17	-0.01	0.04	0.02

Dependent variables are changes from the 1993 election to the 2013 election.

Note: Standard errors in parentheses. FrP, H, Sp, Ap: vote shares for FrP (Progress Party), H (Conservative Party), Sp (Center party), Ap (Labour Party). Non-socialist: total vote share for the non-socialist parties. Turnout: as a share of eligible voters. AR CL lb (ub): Anderson-Rubin confidence interval, lower (upper) bound.

***p < 0.01; **p < 0.05; *p < 0.10.

inequality. There is no effect on the unemployment rate, see the last column in Table A5, as unemployment is generally low across the sample and does not change much over this period.

In the Appendix we examine compositional changes of the population. We find negligible effects on level of education and age composition, but find that the share of foreign-born residents have increased about four percentage points more in the salmon municipalities. This reflects an influx of labor immigrants to these municipalities (Friberg and Midtbøen, 2018; Stachowski and Rasmussen, 2021). We return to this result below, as a possible explanation for the vote share results we present next.

5.2 Party vote shares

Moving to the political outcomes, we find significant effects of salmon fish farming on change in support for two parties (see Table 1 and Figure A3), namely the Progress Party and the Center Party. The Progress Party had a much higher vote share in 2013 compared to 1993 in most municipalities, but the pre-post difference was on average almost three percentage points larger in the salmon-producing municipalities. This result is surprising in light of the populism literature, which, as discussed above, links the growth of populism/anti-immigration parties to declining labor market prospects of low-skilled workers (e.g., Colantone and Stanig, 2018; Anelli *et al.*, 2019). Instead we find a stronger growth in support for the Progress Party in municipalities where low-skilled workers' relative situation has improved. This result is the first indication that the political economy and natural resource extraction frameworks that emphasize declining demand for economic and government regulations fit the data better than the sociological frameworks that are popular to explain the growth of populism. However, a pure political economy framework cannot explain why voters turn to the Progress Party rather than the mainstream Conservative Party. This choice is better explained by cultural identity (as in Bornschier *et al.*, 2021), as low-skilled voters do not identify with the mainstream right.

The second finding is that the Center Party, the main advocate for increasing central government transfers to the rural areas, performs poorly in the salmon-producing municipalities. The estimated effect is large, amounting to about seven percentage points. The left-behind narrative fueling rural discontent presumably resonates less with the situation and interests of voters in the thriving municipalities, thereby reducing the appeal of the Center Party's rhetoric and political platform. This explanation is consistent with the literature on the revolt of left-behind rural communities (Jennings and Stoker, 2016), but operating in reverse: when the key causal driver (declining economic prospects) is absent, the effect (increasing support for the Center Party) is also absent.

The negative effect can also reflect the Center Party's anti-EU/anti-free trade position, which goes against the economic interests of the salmon fish-farming industry. Note that the Center Party did exceptionally well in the pre-period election (1993) and had much lower support in all municipalities in 2013. The massive support for the Center Party in 1993 was because the upcoming EU referendum in 1994 dominated national politics in that election. Rural areas strongly opposed the EU, and the Center Party was the main party on the anti-EU side of the debate. We get some additional support for this possible mechanism in Table A16, which shows strong negative effects on outcomes that measure change in the total support for parties opposing Norwegian membership in the EU.

The negative Center Party estimate in Table 1 partly reflects the unusually large support for the Center Party in 1993 (the baseline). Still, all conclusions remain if we replace the 1993–2013 comparison with averages over two pre- and two post-elections to smooth out election-specific effects (see Table A7). The negative effect on Center Party vote share is much lower when we use two pre- and post-elections, but the results in Table A7 nonetheless strengthen the impression that the Progress Party gained and the Center Party lost vote shares as a consequence of the growth of the salmon-farming industry. Estimates for these two parties remain significant in these regressions. In contrast, the estimates for the other parties move closer to zero if we compare them to estimates in Table 1.⁷

The positive effect on turnout is also worth mentioning. The effect is not large, about two percentage points ($p = 0.06$), but points to a small mobilization effect, consistent with improved resources among the low-skilled. Curiously, the increase in support for the Progress Party and the decline in support for the Center Party is consistent with Finseraas and Vernby (2014), which finds that a reform of early voting that brought more low-educated voters to the polls in treated municipalities increased support for the Progress Party (and the Labour Party), at the expense of the Center Party. Thus, mobilization of low-skilled workers appears to be an additional mediator. However, in light of the size of the effect on turnout, and the fact that abstaining voters are heterogeneous in their political preferences, turnout is unlikely to be a very important mechanism.

In line with our reasoning above, we want to flag that our results reflect long-term effects. In the Appendix, see Table A17 and the accompanying text, we estimate short-run effects using first differences models, which leverage all election period changes in vote shares over the period 1993–2013. While point estimates are in the same direction as in Table 1, the short-run effects are not significant. Thus, the effects we identify in Table 1 reflect slow-moving mechanisms that take time to influence election outcomes.

5.3 Ideological dimensions

One limitation of studying vote shares is that we study parties in isolation without considering the ideological distances between parties, which can conceal important ideological shifts in the electorate. An increasingly common approach is therefore to use information from sources like the CMP (Budge *et al.*, 2001) to measure the ideological positions of parties (e.g., Barth *et al.*, 2015; Colantone and Stanig, 2018). These measures can then be used as weights for the vote shares, and one can then create summaries of ideological sentiments at different time points and geographical areas.

We use CMP to construct three measures (see the Appendix for details). The first is the standard left-right scale constructed by Budge *et al.* (2001), which pools together economic left-right issues and social liberal-conservative issues. The second variable measures the economic leftism of parties (Lowe *et al.*, 2011), while the third variable taps “second dimension” value conflicts between liberals and conservatives. We derive the ideological sentiment across municipalities by weighting the vote shares with the ideological measures.

⁷In Tables A8 and A9 we show that conclusions are similar if we use two alternative operationalizations of salmon fish farming that are based on the size of salmon fish-farming concessions granted to producers in each municipality.

Table 2. 2SLS estimates. Outcomes are ideological dimensions.

	Left scale	Leftist economics	Value progressivism
<i>Second stage</i>			
Salmon	-0.106 (0.203)	-0.013** (0.006)	0.004 (0.005)
AR CI lb	-0.545	-0.027	-0.006
AR CI ub	0.299	-0.002	0.014
Cragg-Donald F	34	34	34
County FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
N	209	209	209
Mean of Y	-0.78	0.14	0.03

Dependent variables are changes in the ideological sentiment scores from the 1993 election to the 2013 election.

Note: Standard errors in parentheses. AR CL lb (ub): Anderson-Rubin confidence interval, lower (upper) bound.

***p < 0.01; **p < 0.05; *p < 0.10.

We find a right-wing shift on the composite left scale, see the first column in Table 2, but the estimate is imprecisely estimated. The two next columns reveal that this is because this variable pools together economic and non-economic issues. While salmon-producing municipalities move to the right on economic issues, ideological sentiments on the value progressivism scale do not change differently in salmon and non-salmon-producing areas. Thus, while previous work shows that technological shocks that are negative for low-skilled workers move affected communities to the right on non-economic issues (e.g., Anelli *et al.*, 2019), we find that positive changes move communities to the right on the economic dimension.⁸ Note that these results are not inconsistent with the drop in support for anti-EU parties in Table A16, as left-wing critique of EU as a free market, neo-liberal project has always been an important part of the Norwegian EU debate.

The insignificant effect on the value progressivism scale goes against one possible interpretation of the positive effects on the vote shares of the Progress Party, namely that the labor immigration to salmon-producing municipalities (Table A6) caused the right-wing shift by producing social tensions or changing immigration preferences. There are several additional reasons why we do not believe that labor immigration is an important mediator. First, European labor immigration was not a salient political issue during the period we study. Moreover, while qualitative research suggests that ethnic hierarchies in the industry appear after the EU enlargement (Friberg and Midtbøen, 2018; Stachowski and Rasmussen, 2021), so that labor immigrants are doing the less attractive tasks in the production, there are few signs of social tensions related to labor immigration in these communities (Stachowski, 2020). Moreover, we find small and statistically insignificant coefficients if we regress the change in the political outcomes against the change in foreign-born share, suggesting that these variables are not strongly related in our sample. Finally, and perhaps most importantly, we find no effect on an outcome that measures local willingness to settle refugees in the municipality, a decision that Norwegian municipalities decide politically in their local councils (see Table A16 and the accompanying text for details on the analysis). If voter sentiments changed in an anti-immigration direction, this should pop up in this analysis as local decisions directly influence immigration to the municipality.

5.4 Robustness estimates

How robust are these estimates? One way to assess robustness is to calculate the partial R^2 statistics and robustness values (Cinelli and Hazlett, 2020, 2021) of the reduced form estimates like we did above for the first-stage estimate. Since the IV estimate is the ratio of the reduced

⁸A further possibility is that the industry growth caused political polarization. To examine this, we constructed polarization measures based on the CMP data and vote shares (see Stanig (2011) and the Appendix for details). We find small and insignificant estimates on these outcomes (Table A10).

form and the first stage, a zero reduced form estimate implies that also the IV estimate is zero. The partial R^2 and the robustness values for the reduced form estimates for Progress Party, Center Party, and Leftist economics are 0.02/0.14, 0.06/0.23, and 0.03/0.15, respectively (see Table A12). For the Progress Party and Leftist economics, the partial R^2 estimates are lower than for the share of young people in the municipality (one of the control variables), which means that an unobserved variable that is as strong as this control would account for the reduced form estimate. The existence of such an unobserved variable is not unthinkable, thus one should interpret these results with some caution. For the Center party, the partial R^2 is above the strength of share of young people, which means that this estimate is more robust to possible confounders.

5.5 Individual-level estimates

Individual-level data are needed to examine whether community-wide changes in political preferences drive the results or if the results are mainly caused by a right-wing shift among the directly exposed workers.⁹ In the Appendix, see Table A11 and accompanying text, we present a set of results based on individual-level survey data that suggests that effects are at the community level: while we can reproduce estimates that somewhat resemble those in Table 1 with individual-level data, the estimates are in most cases quite similar if we estimate on the full sample of respondents or restrict the sample to low-skilled workers. Our interpretation is that in the long run, the whole community is influenced by the industry (Dasgupta and Ramirez, 2021) and that transformative effects at the community level are more important than effects on those directly exposed. The individual-level estimates provide one more piece of evidence consistent with a right-wing shift on the economic dimension, as there is a relative increase in discontent with taxes in the salmon municipalities. However, unequal selection to the survey across municipalities and levels of education might bias these estimates.

5.6 Assessing the exclusion restriction

Our research design builds on the assumption that the exclusion restriction holds, that is, there is no direct channel from the instrument to the outcomes. We realize that this assumption is strong. Above we attempt to make the assumption plausible by modeling the outcomes in first differences and including controls for possibly confounding trends. In the Appendix, we further assess the assumption in two ways.

First, we conduct a sensitivity check of the main specification. The logic of the sensitivity check is that if the exclusion criteria hold perfectly, the reduced form relationship between the instrument and the outcome should be zero in a sample where there is no first stage. If the only channel from the instrument to the outcome runs through the endogenous variable, then the reduced form will be zero when that channel does not exist (Conley *et al.*, 2012; van Kippersluis and Rietveld, 2018). In our case, we can leverage that in southern Norway, the water is too warm for salmon fish farming to be efficient. There are no salmon fish farms in this region, thus there is no first-stage relationship between islands and salmon fish farms. But since there are islands, we can still derive reduced form estimates. While these estimates are very noisy since we have only 30 municipalities with coastline in this region, the reduced form estimate has the opposite sign in this sub-sample (see Table A14). The fact that estimates have the opposite sign in this sample is reassuring and suggests that our main estimates do not pick up the influence of other industries that might be important in similar geographic contexts.

Second, we add a second instrument exploiting that since 1973, many rivers have been granted protected status through legal regulation. This regulation makes fish farming less likely in fjords

⁹The effects can also be partly driven by the type of workers moving to a booming local labor market. However, this seems unlikely in light of the compositional analysis in Table A6.

with protected rivers (see the Appendix for details) and can therefore serve as a second instrument. We find similar second-stage estimates using two instruments together (see Table A13).

6 Conclusion

Most political science research on technological change has studied the political responses to labor-replacing technological change. This is understandable since many theoretical mechanisms link such labor market changes to important political developments (Frey *et al.*, 2018; Anelli *et al.*, 2019). However, to get a more comprehensive understanding of the effects of technological change, we also need to study winners (Gallego *et al.*, 2020). In this paper, we expand the literature on technological change by considering the effects of developments that created more demand and new tasks for low-skilled workers, thereby improving their labor market situation.

We argue that one can apply either a political economics framework or a sociological framework to understand the political effects of technological change in the labor market. From a political economics framework, one should expect that positive developments in a local labor market will reduce support for left-wing platforms that redistribute income (Thewissen and Rueda, 2019). Moreover, since the growth of the industry transformed whole communities and made them reliant on an industry based on natural resource extraction, regulative policies that limit the operations of the industry will become less popular (Cooper *et al.*, 2018; Dasgupta and Ramirez, 2021; Sances and You, 2022). We point to several characteristics of party competition in Norway that imply that the type of change we study might cause more support for the Progress Party at the expense of the Center Party. However, if we apply the sociological framework of social status that dominates the literature, one should not expect the Progress Party to gain. This is because the relative income growth of the low-skilled workers should make them less responsive to anti-elite messages and other rhetoric often used by populist right-wing parties to attract low-skilled workers (see Gidron and Hall, 2017). The causal mover in these explanations is absent when the relative status of the low-skilled improves.

We document important labor market effects of salmon fish farming, most importantly a strong income growth for low-skilled workers in municipalities with salmon fish farms. Following these salmon-producing municipalities over a long period, comparing them to municipalities that, for geographic reasons, were less suitable for fish farming, we find that the political economy/natural resource frameworks better fit the data for our case. The Progress Party improved its vote share, while support for the Center Party decreased substantively. We further find that the effects reflect changes on the traditional left-right (economic) dimension rather than the cultural (second) dimension, consistent with the political economy framework. What this framework is unable to fully explain, however, is why the mainstream Conservative Party is not benefitting. Here, cultural identity might play a role, as the political identity of low-skilled voters might not be aligned with that of the Conservative Party (e.g., Bornschieer *et al.*, 2021).

When comparing our results to the existing literature on the politics of technological change, it is, however, important to highlight that the shock we study deviates from the type of shocks that are often studied in the literature, such as the growth of industry robots (Anelli *et al.*, 2019). While technological innovations were key for the industry growth, it was also shaped by regulation policy, and characteristics of the industry, such as being a natural resource extraction industry, are important aspects of the development. Moreover, the results are more comparable to studies of long-run effects at the community level, not short-run, individual-level effects.

Nonetheless, our results underscore the importance of understanding the particularities of party competition in the specific context when studying the political effects of developments in the labor market. For instance, our results might have been different if the Progress Party had better resembled the opposition to open markets and economic globalization that characterize populist right parties in many other European countries. The misfortune of the Center Party points in this direction. If so, the support that the Progress Party has gathered in these areas

might be lost if the more nationalist faction of the party gains influence. The party is also the most restrictive on environmental regulations, which has surely been important in our context. Moreover, from a comparative perspective, the Progress Party is moderate compared to most other European populist right-wing parties. This might imply that mainstream conservative parties would be the main beneficiaries of such developments in countries where populist right-wing parties are more radical. However, this will probably depend on the particularities of the cultural cleavage in the particular context (Bornschieer *et al.*, 2021). The external validity of our results is perhaps largest for countries where the populist right-wing party has a background in anti-taxation movements and appeals to segments of the lower middle class, such as the “petty bourgeoisie.”

Our paper shows that populist right-wing parties, like all other parties, can have bundles of policy positions that make them successful in various political contexts. A too strong emphasis on the nationalist-conservative positions of these parties and how they appeal to labor market losers has the risks that one misses important drivers of their success. In particular, we urge future research to study the role of opposition to stringent environmental regulations of important industries, as such parties usually stand out in this dimension of politics.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/psrm.2024.5>. To obtain replication material for this article, please visit Replication Link <https://doi.org/10.7910/DVN/I7KF6S>.

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