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Digitalization and the green transition: Different challenges, same policy responses?

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Abstract

How do citizens perceive labor market risks related to digitalization and the green transition, and how do these risk perceptions translate into preferences for social policies? We address these questions in this paper by studying the policy preferences of individual workers on how governments should deal with the two labor market challenges of digitalization and the green transition. Employing novel cross-country comparative survey data including a vignette experiment for six advanced postindustrial economies, we probe to what extent the different labor market challenges are associated with differences in preferences, distinguishing between support for social investment policies on the one hand and compensatory policies on the other. A first finding is that even though individuals perceive different levels of labor market risk due to the green transition and digitalization, their preferences for social policy responses do not differ systematically across the two risks. Instead, we find that social policy preferences are affected by individual-level and, to some extent, country-level contextual factors. Confirming previous work, higher perceived labor market risk is associated with more support for compensatory policies but less support for social investment.

Keywords: digitalization, green transition, knowledge economy, OECD countries, public opinion, public policy.

1. Introduction

Labor markets in advanced postindustrial democracies are undergoing large-scale transformations often attributed and related to significant socioeconomic changes such as globalization, technological change, and—more recently—the green transition toward carbon-neutral economies. Extant literature in labor market economics and related fields has assessed the relative impact of these socioeconomic transformations on outcomes such as employment, wages, and inequality (e.g., Autor et al., 2015). Building on this scholarship, more recent work in comparative political economy and political science explores the political consequences of large-scale labor market transformations (e.g., Busemeyer & Tober, 2023; Gallego & Kurer, 2022; Kurer, 2020; Kurer & Palier, 2019; Thewissen & Rueda, 2019).

Our paper contributes to and expands this second strand of literature. More specifically, ours is the first paper to the best of our knowledge that directly compares the political consequences of rapid technological change (henceforth referred to as digitalization for the purpose of this paper) and the green transition toward a carbon-neutral economy. Most papers in existing research single out individual labor market transformations while neglecting others. The few papers that compare different kinds of labor market transformations focus on the comparison between technological change and globalization (Autor et al., 2015; Milner, 2021). So far, there is very little work that studies the political consequences of the green transition directly, even though it is likely to have significant repercussions for labor markets in advanced postindustrial democracies in the coming years (International Labor Organization, 2018). Our paper provides a first step in analyzing these repercussions from the perspective of individual workers, focusing on their preferences for social policy in response to the two transformations. Our perspective is motivated by the notion that rapid technological change in the form of digitalization and automation as well as the green transition are likely to have stronger effects on labor markets in the

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coming decade than globalization as such—a notion which receives some initial support in the literature (Autor et al., 2015; Caselli et al., 2021).

A further contribution from a more methodological point of view is that we measure and analyze individual-level policy responses to digitalization and the green transition in different ways, using state-of-the-art experimental survey methods to increase confidence in the robustness of the findings. In a first study, we use a simple survey experiment (split sample) to manipulate the source of the labor market transformation (digitalization vs. green transition). In a second study, we employ a vignette survey design, which nudges respondents to prioritize different policy responses to a stronger extent than in the first study. This approach reveals that public support for social investment may be less robust than commonly assumed, in particular, but not only among those who are most concerned about labor market changes.

To examine to what extent digitalization and the green transition are associated with policy preferences, we employ novel cross-country comparative survey data for six countries (Germany, Japan, Poland, Spain, Sweden, and the United States). The data were collected in the summer of 2022 and includes a total of 19,800 respondents. The survey only covers the working-age population (between 18 and 65 years) as we are interested in the linkage between labor market experiences and policy preferences. The potential policy responses addressed in this paper range from regulatory and compensatory policies, such as increasing the generosity of social benefits, to social investment policies, such as expanding training and educational opportunities. In some of the countries singular policies that we study are already part of the conversation, with for instance the German government having adopted a national skill strategy in response to skill demands arising from the digital and green transition (German Federal Ministry of Labour and Social Affairs, 2023) or the Japanese government have agreed on a green growth strategy which entails large investments into research and development (Japanese Government, 2021). As the central independent variable, we use subjective measures of labor market risks associated with digitalization and the green transition, respectively. In terms of methods, we estimate Bayesian two-parameter ordered logistic item response theory (IRT) models, enabling us to differentiate between latent support for both compensation and social investment. As we discuss in greater detail in the theory section below, there are plausible reasons to expect differences in how digitalization and the green transition shape policy preferences. Our findings, however, indicate that even though individuals' risk assessments do vary between the two sources of risk, the effects on policy preferences are very similar. Our analysis also confirms previous research showing that high-risk individuals are more likely to support compensatory rather than social investment policies, which holds for both reactions to digitalization and the green transition. However, in the vignette study, we find that support for social investment policies drops relative to support for compensation, which might indicate that public support for the former is more brittle than often assumed. In the concluding section of this paper, we discuss the political implications of our findings more generally.

2. Literature review

2.1. Digitalization and automation

Technological change has been a central driving force of welfare state and political developments for a long time (Frey, 2019). Nevertheless, the rapid pace of recent technological change has fueled debates about whether 'this time might be different' due to the extremely fast pace of developments (Autor, 2022). Recent technological change encompasses quite diverse phenomena, such as intensified investments in information and communication technology, artificial intelligence (AI), the spread of industrial robots or the use of algorithms in decision-making. While acknowledging that each of these may have distinct effects on labor markets (see, for instance, Acemoglu & Restrepo, 2020; Dauth et al., 2021 on the impact of robots; Acemoglu et al., 2022 on AI), we use the broad term digitalization to refer to these developments in this paper.

There is by now a quite sizable literature on the labor market consequences of rapid technological change (see Busemeyer et al., 2023; Gallego & Kurer, 2022 for recent comprehensive reviews). Based on the seminal work by Autor et al. (2003), a number of contributions in labor economics have pointed to the "hollowing out" of employment prospects for middle-class workers in routine jobs in manufacturing and increasingly the service sector, enhancing labor market inequalities and job polarization in single countries (Autor et al., 2015; Autor & Dorn, 2013; Goos & Manning, 2007) as well as Organisation for Economic Co-operation and Development

(OECD) countries more generally (Goos et al., 2014; Graetz & Michaels, 2018; Michaels et al., 2014). More recent contributions have focused on particular aspects of technological change such as robot adoption (Acemoglu & Restrepo, 2019; Dauth et al., 2021) as well as the recent advances in AI and its consequences for employment (Acemoglu et al., 2022). Another strand of work tries to predict the future automation potential of employment and occupations (Arntz et al., 2016; Frey & Osborne, 2017). Even though the contributions in this evolving field have different views on the aggregate effects of technological change on employment, there is a consensus that technological change creates large changes in the labor market with adjustment costs often concentrated in middle-skilled workers.

Recently, scholarly interest in the political and social policy consequences of digitalization has grown significantly as well. Regarding the effect of technological change on voting behavior, a set of contributions has documented that losers of digitalization in OECD countries tend to vote for socially conservative and right-wing populist parties (Anelli et al., 2021; Im et al., 2019; Kurer, 2020; Kurer & Palier, 2019; Milner, 2021). As Gingrich (2019) found, compensation through welfare state policies only has a limited effect on curbing populist voting among those negatively affected by technological change. Some recent work has started to analyze the voting behavior of winners of digitalization and the transformation toward the knowledge economy more broadly, producing quite different findings for different countries (see, e.g., Gallego et al., 2022 for the United Kingdom; Schöll & Kurer, 2024 for Germany).

Furthermore, some attention has been paid to how digitalization-related labor market risks are associated with particular social policy demands. Initially, this literature has examined attitudes toward social policy by analyzing general preferences for redistribution, which has yielded mixed results. On the one hand, in their pioneering paper, Thewissen and Rueda (2019) find a positive association between automation risk and preferences for redistribution. On the other hand, other studies have found this correlation to be non-existent (Gallego et al., 2021; Zhang, 2019). Regarding more specific social policy preferences, a tentative consensus has emerged that individual automation risk is correlated with preferences for compensatory policies such as unemployment benefits, while adversely affected workers tend to oppose social investment-oriented policies such as retraining measures and education (Busemeyer et al., 2023; Busemeyer & Sahm, 2022; Busemeyer & Tober, 2023; Im, 2021; Kurer & Häusermann, 2022). Moreover, a few contributions have examined support for a universal basic income (UBI) as a potential solution to the negative employment effects of automation and digitalization with overall mixed findings (Chrisp & Martinelli, 2022; Dermont & Weisstanner, 2020; Guarascio & Sacchi, 2022).

2.2. The green transition

Compared to the impact of digitalization on labor markets, research on the effects of the green transition on labor markets is still rather scarce (Consoli et al., 2016). In recent years, a nascent literature in economics has concluded that the transition to a carbon-neutral economy in line with the Paris Agreement is predicted to lead to a net gain in "green" jobs in solar, wind energy and electric vehicles (EVs) industries (Bowen et al., 2018; Consoli et al., 2016; Curtis et al., 2023; Curtis & Marinescu, 2022; Rutzer et al., 2020; Vona et al., 2018). Nevertheless, the distributional consequences of the green transition in the labor market will be borne by workers in carbon-intensive fossil-fuel industries, the automotive and the agricultural sector (International Labor Organization, 2018; van Doorn & van Vliet, 2023; Vona et al., 2018).

Zooming in on the case of the coal phaseout, some studies have documented and explained the significant decline in employment in fossil-fuel industries over the last decades driven by concerns of (failing) economic productivity and, more recently, environmental concerns, necessitating government-mandated phaseouts (Brauers et al., 2020; Gürtler & Herberg, 2021; Heinisch et al., 2021; Kalt, 2021; Mayer et al., 2020; Oei et al., 2020). When it comes to the automotive industry, the transition from the internal combustion engine toward EVs yields mixed prospects for employment opportunities. This is because the lower need for workers for the assembly of EVs is expected to be at least partially offset by the increased production of individual components of EVs such as batteries or charging infrastructure (Singh, 2021). Nevertheless, the difference in skill profiles required for the manufacturing of EVs compared to cars with combustion engines makes substantial retraining of the existing workforce in the automotive sector necessary (Hagedorn et al., 2019). While the literature on the consequences of the transition to EVs is still in its infancy, a first study by Silva et al. (2023), who conducted focus group

interviews in affected cities in the American Midwest, reveals stark differences between the optimism of managers and community members and the scepticism by car workers about employment and prosperity prospects thanks to the EV transition.

There are a few studies analyzing the political consequences of the green transition, again focusing on how the transformation toward renewable energy might trigger opposition from affected individuals. A small set of contributions have examined the link between wind turbine and/or solar panel construction and electoral behavior with mixed findings (Comin & Rode, 2023; Mitsch & McNeil, 2022; Otteni & Weisskircher, 2021; Stokes, 2015; Umit & Schaffer, 2021; Urpelainen & Zhang, 2022). Moreover, a cluster of papers has connected employment losses due to the green transition to political behavior by analyzing the electoral implications of the decline in employment in the coal industry. While Egli et al. (2022) and Gazmararian (2023) document higher support for the Republican party in affected communities in the United States, Bolet et al. (2023) show that a just transition agreement for coal workers in Spain has led to electoral gains for the incumbent party in the subsequent election.

In light of the projected job losses in fossil-fuel industries due to the green transition, a number of contributions have pointed to the crucial role of skills and retraining (Bowen et al., 2018; Curtis et al., 2023; Curtis & Marinescu, 2022; Im et al., 2023; Sato et al., 2023; van Doorn & van Vliet, 2023). While the existing studies come to different conclusions about the exact gap in education or skills between "brown" and "green" jobs—which might also be due to the fact that they use different methodologies for their classification of brown and green jobs—the most recent evidence by Curtis et al. (2023) suggests significant barriers to job transitions between these different types of jobs. Being the first to also consider workers in EV production, they find that currently, fewer than 1% of brown workers in the United States succeed in transitioning to a green job. This is in line with scholars pointing to the importance of retraining those in brown industries in order to facilitate the transition to other, potentially green, jobs (Sato et al., 2023; van Doorn & van Vliet, 2023; Zaussinger et al., 2023).

Concerning the consequences of the green transition for social policy, there is a small but growing interest in better understanding the linkages between environmental and social policies focusing on so-called "eco-social" policies (Armingeon & Bürgisser, 2021; Fritz et al., 2021; Fritz & Koch, 2019; Gugushvili & Otto, 2023; Jakobsson et al., 2018; Johansson & Koch, 2020; Koch & Fritz, 2014; Kono, 2020; Otto & Gugushvili, 2020; Sivonen & Kukkonen, 2021; Spies-Butcher & Stebbing, 2016). Most research in this area focuses on the interlinkages between individual-level attitudes toward environmental and social policies, coming to mixed conclusions about the relationship between support for social policy and environmental protection. Furthermore, Gaikwad et al. (2022) examine preferences for compensating fossil-fuel workers at risk of job loss in the United States and India. They distinguish between individual-level compensation policies versus community-based compensation schemes, but not between different kinds of individual-level compensation policies as we do in this paper.

To sum up, our paper builds on but significantly extends previous research. In general, there is still little research on how the green transition affects individual-level support for different kinds of policy responses. There is more work on this topic in the area of digitalization. However, to the best of our knowledge, this is the first paper that directly compares the political consequences of these two labor market transformations for the formation of individual-level policy preferences. Existing scholarship tends to focus on either of the two challenges, even though they are strongly related when regarded from the perspective of labor market participants. Comparing the potentially varying impact of these two challenges on preferences allows us to address the broader question of how individuals perceive and process different types of labor market transformations—a question which we will discuss in greater detail in the following section.

3. Theoretical discussion

To recap, we investigate the following research questions in this paper: First, to what extent do individuals' demands regarding governmental action differ between different labor market transformations? Are individuals more likely to demand more policy action in the case of the green transition than digitalization or vice versa? Second, as a related point, do individuals demand different *kinds* of policy responses depending on the labor market transformations? Third, to what extent do individual-level factors such as risk exposure, income, educational background, and ideological views shape policy demands? Fourth, to what extent are the existing associations

shaped by country-level contexts, particularly different welfare state regimes? And fifth, how do preferences for social policy behave in a more constrained choice setting? These research questions are important both from academic and political perspectives. In terms of research, our paper provides a better understanding of the linkages between different kinds of structural labor market change and preference formation. From a more political perspective, the interesting question is whether policymakers should pursue similar policies in response to different labor market transformations or whether it is more adequate (from the perspective of public opinion) to use the same policy instruments.

Concerning the first question, the central issue in this regard is whether individuals are generally more or less supportive of government action in response to the above-mentioned labor market challenges. From a theoretical perspective, there are plausible reasons for both views. On the one hand, several factors distinguish the labor market impact of the green transition from the labor market impact of digitalization. First, both differ in the way they transform labor markets, as the green transition leads to the displacement of whole sectors, such as the phasing out of coal and other fossil fuels and the phasing in of renewables (Bowen et al., 2018; Consoli et al., 2016; Curtis et al., 2023; Curtis & Marinescu, 2022; Rutzer et al., 2020; Vona et al., 2018). In contrast, the transformation induced by digitalization occurs within occupations through the displacement of routinizable tasks (Arntz et al., 2016; Frey & Osborne, 2017). Therefore, in the case of digitalization, the individual's occupational background and the tasks she performs at work are of greater importance. In contrast, in the case of the green transition, the effects are more concentrated in particular economic sectors (renewables vs. fossil fuels) and potentially different subnational regions with particularly high concentrations of fossil-fuel and renewables industries. Second and relatedly, while both transitions produce winners and losers, those created by the green transition tend to be geographically concentrated, while this is not the case for digitalization (Hanson, 2023; Im, 2024). As argued by Rodríguez-Pose and Bartalucci (2023), urban areas will profit more from the green transition than rural areas. This is because green investments will mostly benefit urban knowledge hubs, while rural areas where fossil-fuel industries are concentrated will have to bear the cost of adjustment. On the other hand, rural areas should benefit from job creation in solar and wind industries as they have more land available for the construction of these facilities. Individuals could perceive these differences in individual exposure, which might lead to differences in preferences for policy action in response to the two transformations.

A further mechanism that might affect overall levels of support for government action independent of individual exposure is variation in the political salience of these issues. The green transition is directly linked to the issue of climate change, which has become a very politicized and salient issue both among policymakers as well as the wider public (European Commission, 2023b; Lüth & Schaffer, 2022; Marquardt & Lederer, 2022). Climate change might also be perceived as an existential threat (Arıkan & Günay, 2021), which is less the case for digitalization (Pew Research Center, 2022). Kemmerling and Zepeda (2022) and König and Wenzelburger (2019) show that the impact of digitalization on labor markets is not a very salient issue in political discourses (see also Gallego & Kurer, 2022; Wu, 2022 for a similar argument). Higher salience in the case of the green transition and the perception of climate change as an existential threat might be associated with feelings of greater urgency and, hence, more support for government action. However, higher salience could also be associated with more polarized attitudes in the case of the green transition.

A third potential explanation for expected differences between the two challenges is that individuals have different expectations regarding the role of the state in managing the green transition or the digital transformation. More specifically, citizens could assign a more significant role to governments in managing the green transition compared to digitalization, as the latter could be perceived to be more the responsibility of firms and employers (Busemeyer, 2022). By contrast, governments have been active in managing environmental issues for many decades, which has inspired a whole strand of literature on the "environmental state" (Duit, 2016; Duit et al., 2016).

On the other hand, individuals might not clearly distinguish between different kinds of labor market transformations when thinking about policy responses. One reason for this might be that individuals do not systematically differentiate between different sources of labor market risk but rather perceive a more general exposure to accumulated economic risk, which is likely to be related to other forms of economic vulnerability. Furthermore, individual-level support for government action could be less strongly influenced by exposure to labor market

transformations but rather by other individual-level and contextual factors such as ideology or educational background. There might also be cognitive limitations in how individuals process and perceive different kinds of labor market risks. In sum, it is an open empirical question whether the overall level of governmental policy action varies in response to different kinds of labor market transformations.

Hypothesis 1a (H1a): Individuals are not equally supportive of government policy action in response to the labor market transformations induced by the green transition and digitalization. Given the high salience of climate change and the attribution of mitigation policies to government action, we expect more support for government action in the case of the green transition compared to digitalization.

Hypothesis 1b (H1b): Individuals are equally supportive of government policy action in response to the labor market transformations induced by the green transition and digitalization.

A second and related question is whether individuals form different preferences regarding the *kind* of policies in relation to the nature of the challenge. In this paper, following large parts of the literature (Bonoli, 2013; Garritzmann et al., 2022; Hemerijck, 2012, 2017), we distinguish between support for social investment policies on the one hand and compensatory or protective social policies on the other. Social investment policies refer to "policies that aim to create, mobilize, and/or preserve human skills and capabilities […] in order to address social risks" (Häusermann et al., 2022, p. 60), commonly associated with investments in education, further training, active labor market policies, and research as well as the expansion of policies which improve opportunities to reconcile employment and family life. Compensatory policies refer to policies which increase the generosity of social transfers, such as unemployment insurance schemes, sick pay, or disability pay. To this, one can add protective regulatory policies which shield workers from the negative side effects of labor market transitions, such as the expansion of public employment schemes or working time reduction policies (see, e.g., Busemeyer et al., 2023 for a similar approach).

It could be argued that workers might respond to digitalization or the green transition with different policy demands. This might be due to the aforementioned differences in how the two transformations affect jobs. More specifically, digitalization often requires a significant degree of "upskilling" on the job, that is, improving individual skill sets in order to remain competitive in the job, opening up perspectives for individuals to stay in their current job in case they are able (and willing to) invest in further training. In contrast, as argued above, the green transition instead goes along with changing relationships between whole economic sectors. Hence, the prospects of being able to "upgrade" one's skill set while staying on the current job could be less sanguine in the case of the green transition compared to digitalization, implying that individuals rather demand compensation instead of social investment. In short, a plausible expectation regarding variegated policy responses is that individual workers should be more likely to demand social investment policies in the case of digitalization and compensatory policies in the case of the green transition.

A contrasting perspective is again to expect little meaningful differences in response to different kinds of labor market challenges. In other words, individual-level policy responses to labor market challenges could be driven more by other individual-level and contextual factors rather than the nature of the labor market challenge in question. For instance, material self-interest has been shown to matter for policy preferences both in the context of climate policy (Beiser-McGrath & Bernauer, 2023) as well as technological change (Busemeyer & Tober, 2023). Furthermore, despite posing substantially different challenges to labor markets, the fundamental economic logic of the green transition and digitalization in promoting the "creative destruction" of some job opportunities in exchange for the expansion of other types of employment is quite similar. Hence, it is also plausible to expect little differences in how different labor market transformations affect social policy preferences. Independent of individual-level determinants, the overall support for different kinds of policies might vary in the general population. Social investment policies are generally widely supported by large majorities, whereas the support for compensatory policies is typically somewhat lower, more polarized and variable depending on particular types of compensatory policies (unemployment insurance vs. pensions, cf. Busemeyer & Garritzmann, 2017a).

Hypothesis 2a (H2a): Individuals prefer social investment policies in response to digitalization and compensatory policies in response to the green transition.

Hypothesis 2b (H2b): Individuals have similar preferences regarding social investment policies and compensatory policies as responses to the green transition and digitalization.

The latter discussion connects well to our third research question mentioned above, namely the importance of other individual-level determinants of the formation of preferences and their interaction effects with different kinds of labor market transformations. In this regard, we can build on and make use of an extensive literature on welfare state attitudes (for recent overviews, see Busemeyer, 2023; Kumlin et al., 2021). A first factor to consider is subjective perceptions of individual labor market risk (Rehm, 2009). Previous research on the labor market impact of digitalization shows that individuals who perceive themselves at higher risk are more likely to demand compensatory social policies rather than social investment (Busemeyer & Tober, 2023). Second, highly educated individuals are expected to be more supportive of social investment policies. In contrast, low-skilled workers in more precarious employment should be more likely to favor compensatory policies (Garritzmann et al., 2018). A similar effect has been observed for high-income individuals, who should have higher support for social investment policies, although the association is less strong than in the case of education (Garritzmann et al., 2018). Third, individual ideological predispositions should be related to policy preferences as well. Previous work on public support for social investment policies has demonstrated the importance of using a two-dimensional measure of ideology (Garritzmann et al., 2018), which distinguishes between an economic and a social values dimension (Hooghe et al., 2002). Unfortunately, due to the limitations of our survey data, we are forced to use a unidimensional measure of ideology. For this measure, the expectation is that left-wing individuals are generally more in favor of more support from the government via social policies, both for compensatory and social investment policies.

Similar to the above, there are plausible reasons to expect commonalities or differences in how individual-level factors play out concerning the different labor market challenges (digitalization vs. green transition). We refrain from formulating differentiated hypotheses for each possible combination here and rather treat the issue as an open empirical question. On the one hand, it might well be the case that the association between individual-level factors and policy preferences does not vary across labor market transformations if the latter does not strongly influence the formation of preferences by itself. On the other hand, it is also plausible to expect some differences. For instance, subjective risk perceptions might matter more in the case of the green transition for those directly affected as there is less leeway for upskilling in existing jobs compared to the digitalization challenges.

Hypothesis 3: Individual-level factors, in particular individual labor market risk, are expected to mediate the effect of labor market transformations on social policy preferences (interaction effects between individual-level factors and labor market transformations).

Furthermore, regarding our fourth research question, we expect differences across countries regarding the aforementioned associations. These country differences may arise due to several reasons, such as variation in the share of employment which is threatened by automation (Arntz et al., 2016) and in the carbon intensity of production (OECD, 2024) as well as differences in the national discourse regarding both challenges. However, we focus on existing welfare state arrangements as drivers of between-country differences. We expect them to be the most salient reference points for respondents when considering social policy responses to the green transition and digitalization. Hence, we posit that a country's existing welfare state context (i.e., its overall generosity as well as the relative balance between social investment and compensatory policies) should matter for an individual's social policy preferences. As the survey data used in this paper covers six countries with different welfare state regimes and political economies, we can—at least to some extent—examine the question of how and to what extent existing policies and institutions shape attitudinal patterns on the micro level as is argued in policy feedback theory (Busemeyer et al., 2021; Pierson, 1993; Weaver, 2010; Wlezien, 1995), even though we cannot engage in sophisticated quantitative analyses of cross-country differences given the low number of cases.

A first question in this context, which we approach merely on the level of descriptive statistics below, is whether perceptions of individual labor market risks related to digitalization and the green transition vary across countries. Here, we expect that individuals residing in less developed and more residual welfare states should generally be more concerned about these labor market risks and also be more worried about their overall effects on the economy. As a side note, we analyze risk perceptions as the dependent variable in related work, hence we cannot go into much detail here. Second, regarding preferred policy responses, we expect—building on previous research regarding policy feedback for welfare policies in response to technological change (Busemeyer & Tober, 2023)—self-undermining feedback effects to be more common. According to this logic, individuals should be more likely to demand policy responses which complement existing institutional arrangements rather than those that simply reinforce them. For instance, individuals residing in more residual welfare states should be more likely to demand expansive government action compared to individuals residing in generous welfare states, who could be more sceptical of increased government involvement. Regarding particular dimensions of welfare state regimes, individuals in welfare states with a strong focus on social investment should, according to this argument, demand more policy action in the realm of compensatory policies and vice versa for individuals residing in welfare states with a strong compensatory dimension.

Hypothesis 4a (H4a): Individuals residing in more residual welfare states are more likely to demand both social investment and compensatory policies in response to labor market transformations.

Hypothesis 4b (H4b): Individuals residing in welfare states with a stronger focus on compensatory policies should exhibit higher support for social investment policies, whereas individuals in welfare states with a strong emphasis on social investment should be more likely to demand compensatory policies.

Finally, we briefly discuss the implications of different ways of measuring policy preferences. In the first empirical study of this paper (discussed further in the next section), we measure individual-level support for different policy responses while experimentally manipulating the nature of the labor market challenge that these policies are supposed to address. This research design provides a direct comparison of policy responses to different labor market challenges. Its downside, however, is that overall support for policy action might be overestimated as individuals are not forced to prioritize between different policy responses. Previous research has shown that this leads to an overestimation of support for social investment policies in particular, since investing in education and training is broadly supported across different societal strata (Busemeyer & Garritzmann, 2017b). As these policies often entail a trade-off between short-term costs and long-term benefits, patterns of support change significantly when respondents are confronted with these trade-offs. If forced to choose, individuals then rather tend to prioritize policies with short-term payoffs or avoid making short-term sacrifices in exchange for long-term gains (Bremer & Bürgisser, 2023; Bremer & Busemeyer, 2022; Busemeyer & Garritzmann, 2017a; Busemeyer & Tober, 2023; Häusermann et al., 2019; Neimanns et al., 2018).

In this paper, we do not test trade-off preferences directly (but see Busemeyer & Tober, 2023 for social policy preferences in response to technological change). Instead, by employing a vignette survey design (see below for details), we nudge respondents to prioritize more subtly. The vignette describes a hypothetical policy package (a government fund) that could be set up to deal with either digitalization or the green transition. This policy package includes different types of social investment and compensatory policies. There is also the possibility that the package only consists of either type of policy. We then measure how each component of the vignette affects support for the hypothetical fund. In line with the aforementioned literature, we expect that including compensatory policies in policy packages boosts overall support for a package, whereas including a social investment policy should have a smaller effect because of the more long-term nature of these policies. This expectation is also supported by a growing literature on public opinion toward policy packaging which argues that including compensatory items in a policy package increases the overall support for the policy even if it contains additional costly items (Bergquist et al., 2020; Fesenfeld, 2022; Givoni et al., 2013; Häusermann et al., 2019; Wicki et al., 2020).

Hypothesis 5: In a more constrained setting, individual support for social investment policies decreases while support for compensatory policies remains high.

Table 1 Overview of hypotheses

Hypothesis	Empirical expectation
H1a	*Support for government social policy action*: green transition > digitalization
H1b	*Support for government social policy action*: green transition = digitalization
H2a	*Ratio of support for compensation to support for social investment*: green transition > digitalization
H2b	*Ratio of support for compensation to support for social investment*: green transition = digitalization
H3	*Effect of individual labor market risk on social policy preferences*: green transition ~ digitalization
H4a	*Policy demand in residual welfare states*: compensation = social investment
H4b	*Policy demand in compensatory welfare states*: compensation < social investment *Policy demand in social investment welfare states*: compensation > social investment
H5	*Effect of constrained setting on level of policy support*: compensation = social investment ↓

Summarizing our empirical expectations, Table 1 reflects the theoretical openness with which we approach the comparison between the green transition and digitalization. We argue above that support for government social policy action could be higher in the context of the green transition than in the context of digitalization or similar (H1a and H1b), and the same could hold for the ratio of support for compensation policies to support for social investment policies (H2a and H2b). In addition, we remain open about the question of whether the effect of individual labor market risk (and other individual-level factors) on social policy preferences could vary across the two areas (H3). More concretely, we expect that individuals in residual welfare states demand both compensation and social investment (H4a), whereas the demand for social investment policies should be stronger in welfare states with high existing levels of compensation and the demand for compensation should be stronger in welfare states with already high levels of social investment (H4b). Finally, our last hypothesis posits that support for social investment declines in a constrained choice setting, with support for compensation remaining high (H5).

4. Empirical approach

In this section, we introduce novel and original survey data on individual-level policy preferences in response to digitalization and the green transition as labor market challenges. Moreover, we provide details on statistical modelling, the definition of central dependent and independent variables as well as the design of the vignette study.

4.1. Data

In this paper, we draw on novel data from a recently completed survey project funded with financial support from the cluster of excellence "The Politics of Inequality" (DFG EXC 2035). The overall goal of the survey was to understand how citizens in various countries think about the impact of digitalization and the green transition on their country's society and labor market. The survey was commissioned by the authors of this study and conducted by the research firm Kantar Public, which fielded the survey in June and July of 2022 in the following six countries: Germany, Japan, Poland, Spain, Sweden, and the United States. The sample consists of 3300 individuals per country (19,800 in total). Respondents were sampled based on quota targets for gender, age, and education in order to match the structure of the underlying population universe. We only include individuals from the

working-age population (individuals aged between 18 and 65) as these individuals are more directly affected by labor market transformations than the elderly or the young.

While all being advanced capitalist economies, these countries not only represent different welfare state regimes but also differ in how advanced they are in terms of the implementation of the green transition and the digital transformation (IMD, 2022; Wolf et al., 2022). Additionally, there is variation as to which of the policies that we include in our survey are already being discussed or have been adopted by the countries in our survey. In addition to the German and Japanese examples mentioned in the introduction, the German and Polish governments rely on compensatory policies such as early retirement for workers affected by the coal phaseout (German Federal Ministry of Finance, 2023; Todorović, 2024). Moreover, the proposal of a job guarantee is widely discussed in the United States (Porter, 2021), while the governments of Spain and Sweden focus on expanding vocational training and higher education in response to existing skill gaps (European Commission, 2023a, 2023c). All in all, even though the number of countries in our study is insufficient to test these cross-country differences systematically, the variety of national contexts nevertheless allows us to probe the generalizability of our individual-level findings.

4.1.1. Social policy preferences

In the split-sample design, we measure social policy preferences based on this survey question: *How strongly do you agree or disagree with the following policy responses to the labor market transition due to [digitalization and automation/the green transition to a climate-neutral economy]?* Half of the sample received the variant on digitalization and automation, the other half the question wording on the green transition. Respondents were then presented with the same series of potential policy responses to the two labor market challenges, of which four are compensatory (protective) measures and another four are social investment policies. These policies capture a plausible range of policy options discussed in the literature on policy preferences cited above.

The compensatory measures are:

- expanding subsidized employment in the public sector;
- reducing working hours;
- paying out subsidies to firms that suffer most from labor market transitions; and
- increasing unemployment benefits.

In turn, the social investment policy responses are:

- promoting higher education and lifelong learning;
- increasing public spending on research;
- investing more in labor market measures that facilitate transitions between jobs;
- improving access to vocational training.

Respondents indicate whether they (1) *strongly disagree*, (2) *disagree*, (3) *neither agree nor disagree*, (4) *agree*, or (5) *strongly agree* with each policy proposal.

4.1.2. Explanatory variables

Moving on to the core explanatory variables, the survey measures individual, that is, egotropic, labor market risk perceptions associated with digitalization and the green transition by using the following question: *Now please think about how these developments might affect you personally. How concerned are you that you might become unemployed in the next 5 years as a result of [digitalization and automation/the green transition to a climate-neutral economy]?* In response, survey participants state whether they are (1) *not at all concerned*, (2) *slightly concerned*, (3) *moderately concerned*, (4) *very concerned*, or (5) *extremely concerned*. Unlike the question about policy responses, these questions were asked to the whole sample.

Figure 1 plots the percentage of individuals who expect high individual employment risk (those who are *very* and *extremely concerned*) across countries. Over the entire sample, we find that roughly 18% report high subjective risk from digitalization and roughly 21% perceive the same level of risk from the green transition (the difference is statistically significant according to a Wilcoxon rank-sum test). When we compare high-risk perceptions associated with digitalization with those associated with the green transition, perceived individual risk appears to be higher in the case of the green transition than in the case of digitalization in all sampled countries (results of

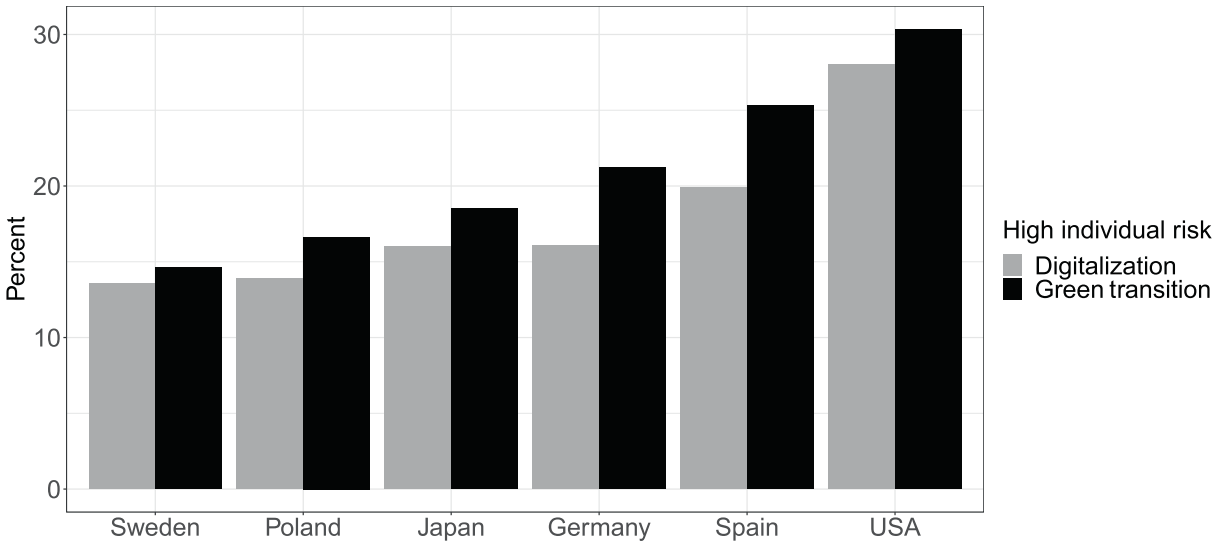

Figure 1 Percentage of high individual risk perceptions across countries

Wilcoxon rank-sum tests suggest that the difference is statistically significant in all countries except Sweden and the United States). This might be due to the higher political salience of the issue of climate change compared to digitalization, making individuals more aware of the potential consequences of the green transition. The figure also shows cross-country differences which provide some evidence for differences along welfare state lines. While the reported risks are highest in the liberal market economy of the United States, they are considerably lower in the generous welfare state of Sweden. These cross-country differences are more pronounced than differences within countries, which confirms previous work arguing that political discourses about and policy responses to digitalization (and, by extension, the green transition) are strongly shaped by institutional contexts that vary across countries (Lloyd & Payne, 2019; Marenco & Seidl, 2021; Thelen, 2019). Thus, to some extent, risk perceptions across different sources of risk seem to be correlated within countries, but there are also notable differences between individuals.

Three additional theoretically important explanatory variables are education, income, and ideology. We measure education with a three-level categorical variable based on the International Standard Classification of Education (ISCED), where low education implies educational attainment up to lower secondary education (ISCED levels 0–2), medium education has postsecondary nontertiary education as its upper limit (ISCED levels 3–4), and high education includes all kinds of tertiary education (ISCED levels 5–8). To capture income, we use a subjective measure of how respondents state to live on their current income. Individuals were asked whether living on their current income is *very difficult*, *difficult*, they are *coping*, or *comfortable*. Finally, we attempt to measure ideology by drawing on political self-description where respondents place themselves on an 11-point scale ranging from (1) *left* to (11) *right*. We assume that individuals who place themselves more to the political right have a more conservative political orientation. In addition, we control for age, gender, and the country in which a person resides.

4.1.3. Vignette experiment

To measure policy preferences in a more constrained setting, we conducted a vignette experiment. Respondents were confronted with the following scenario: *Imagine the government in [country] is setting up a new fund for workers who are at risk of losing their job or have already lost their job due to [digitalization and automation/the green transition]*. Next, the characteristics of the fund were described by three dimensions with $4 \times 4 \times 3$ levels:

1 Income support:
- Workers will receive higher unemployment benefits based on their prior earnings.
- Workers will receive more financial support for early retirement.
- Workers will receive a UBI ("equal amount for all").
- Workers will receive no compensation.

2 Education:
- Workers will receive more financial support for lifelong learning and on-the-job training.
- The younger generation will receive more financial support for vocational education and training.
- The younger generation will receive more financial support for higher education at a university.
- There will be no additional investment in education and training.

3 Fund financing:
- By imposing a new tax on robots and similar machines ("robot tax"). OR: By imposing a new tax on carbon emissions ("carbon emission tax") on individuals and businesses.
- By increasing income taxes for the rich.
- By increasing public debt.

Each respondent received one randomized vignette on digitalization and one on the green transition, with the order of the two vignettes being randomized as well. The randomization algorithm ensured that the different vignette variants were largely equally distributed within and across countries. After each vignette, the surveyed individuals stated to what extent they support the proposed fund on a scale ranging from 0 (*do not support at all*) to 10 (*fully support*).

4.2. Methods

4.2.1. Statistical modeling of unconstrained data

To examine the split-sample data of the first study, we estimate Bayesian two-parameter ordered logistic (2POL) IRT models. This modeling approach allows us to describe the observed responses to our questions about preferred policy responses to digitalization and the green transition as reflecting the expected two underlying latent continuous traits, that is, political attitudes toward compensation and social investment. As these attitudes are not directly observable, we have to elicit them using a battery of items related to both social policy areas. The advantage of the IRT approach lies in its contrast with classical test theory, which treats the corresponding item parameters as fixed. In contrast, IRT models offer the efficiency of estimating item parameters directly from the data, enabling a more nuanced representation of the relationship between items and latent traits (Bürkner, 2021).

The model equation is given by:

$$\begin{aligned}
\text{Prefrences}_{ri} &\sim \text{Categorical}\left(\mathbf{p}_{ri,\kappa}\right),\\
\text{logit}\left(\mathbf{p}_{ri,\kappa}\right) &= \beta \mathbf{x}_{ri} + \log\alpha_i\left(\theta_r + \xi_i\right),\\
\kappa_k &\sim \text{Student}\, t\left(3,0,2.5\right),\\
\alpha_i, \xi_i &\sim \text{Student}\, t\left(3,0,1\right),\\
\theta_r &\sim \text{Constant}\left(1\right),\\
\beta &\sim \text{Uniform}\left(0,1\right),
\end{aligned}$$

where Prefrences_{ri} are the categorical responses of respondent r to item i, with i referring to either the four compensation policies or the four social investment policies. The cumulative logit-link function is used to constrain the model predictions to the probability space between 0 and 1. The vector $\mathbf{p}_{ri,\kappa} = \left\{p_{ri,1}, p_{ri,2}, p_{ri,3}, p_{ri,4}\right\}$ contains the relative probabilities of each response value k (ranging from 1 = *strongly disagree* to 4 = *agree*) below the maximum response value of *strongly agree*, which by definition has a cumulative probability of 1. By θ_r we denote the person parameter and by ξ_i the item parameter. We multiply both parameters by the discrimination parameter α_i, which varies across items but not across persons and is modeled on a log-scale to be strictly positive. The discrimination parameter relaxes the assumption that the answers to each of our policy questions have to be equally weighted and thus two persons agreeing to the same amount of items receive the same estimate irrespective of which specific items they agree to. Finally, $\mathbf{x}_{ri}$ is the vector of our individual-level explanatory variables.

We adopt a weakly regularizing prior approach by placing Student's t priors both on the intercept parameters κ_k as well as the item (ξ_i) and discrimination (α_i) parameters (Gelman et al., 2008). Moreover, we fix the person parameter θ_r at 1 and apply flat priors to the parameters of the explanatory variables (β). We estimate the Bayesian 2POL IRT models separately for digitalization and the green transition as well as compensation and social investment policies using the *brms* package (Bürkner, 2017) in R. The results which we report in the next section are based on 8,000 Markov chain Monte Carlo (MCMC) iterations, of which 4000 are used as burn-in.

4.2.2. Statistical modeling of vignette data

We model the data from the vignette experiment (second study) in the following way:

$$\begin{gathered}
\text{Support}_{rv} \sim \text{Normal}(\mu_{rv}, \sigma), \\
\mu_{rv} = \gamma + \sum_{l=1}^{4-1} \delta_l \text{IncomeSupport}_{l,rv} + \sum_{l=1}^{4-1} \psi_l \text{Education}_{l,rv} + \sum_{l=1}^{3-1} \upsilon_l \text{Financing}_{l,rv}, \\
\gamma \sim \text{Student}\, t\,(3,6,3) \\
\delta, \psi, \upsilon \sim \text{Normal}\,(0,1) \\
\sigma \sim \text{Student}\, t\,(3,0,3),
\end{gathered}$$

where we treat the individual answers—Support_{rv}—on the 11-point scale on which a respondent r expresses support for a specific policy vignette v as a continuous variable coming from a normal distribution with mean μ_{rv} and standard deviation σ. These responses are modeled as a function of the $4-1$ levels l of the income-support dimension ($\text{IncomeSupport}_{l,rv}$, with "no compensation" as reference category), the $4-1$ levels of the education dimension ($\text{Education}_{l,rv}$, with "no additional investments" as reference category), and the $3-1$ levels of the financing dimension ($\text{Financing}_{l,rv}$, with "increasing public debt" as reference category). Since we exclude the three implausible vignettes in which no additional income compensation and education investments are combined with our three financing options, we are left with 45 ($4 \times 4 \times 3 - 3$) unique vignettes. Finally, we put Student's t priors on the intercept γ and the standard deviation σ, and apply normal priors to the parameters of the vignette dimensions ($\delta_{1,2,3}$). The subsequent results are again based on 8000 MCMC iterations, with 4000 being used as burn-in.

5. Empirical results

5.1. Descriptive analysis of policy preferences

We start with a brief descriptive examination of our dependent variable in the split-sample design: support for different policies aimed at digitalization and the green transition. Table 2 presents the percentage of individuals supporting each individual policy (ratio of those respondents who reply with *agree* or *strongly agree*). The results indicate that support for compensation policies (first four policies) is generally lower than support for social investment policies (last four policies). Support for policies directly related to individuals' labor market prospects, such as vocational training or lifelong learning, are higher on average compared to support for research. There are little differences in average support across the subitems of compensatory policies. At the same time, the differences between digitalization and the green transition are relatively small. Based on Wilcoxon rank-sum tests, we only find two statistically significant sample differences: there appears to be statistically significantly more support for education and lifelong learning in the digitalization split sample than in the split sample on the green transition, and vice versa for support for more spending on research.

Moreover, Figure 2 shows the average percentage of support across all policies in each country, separate for digitalization and the green transition. The cross-country average is around 60%, ranging from slightly more than 50% in Japan to over 70% in Spain. As could be expected from Table 2, the figure indicates that there are no meaningful differences between the average support for digitalization and the average support for the green transition. In fact, the percentage of individuals demanding policy action is close to identical in both areas. This finding therefore supports H1b while rejecting H1a.

Table 2 Percentage of individuals supporting each policy and *p*-values of Wilcoxon rank-sum test comparing digitalization versus the green transition

Policies	Digitalization (%)	Green transition (%)	Wilcoxon test
Public employment	50.6	49.2	0.06
Working hours	53.6	54.0	0.23
Subsidies	49.3	49.5	0.98
Unemployment benefits	51.0	50.4	0.30
Education/lifelong learning	66.3	63.9	**0.00**
Research	58.9	60.6	**0.01**
Job transition	63.3	63.9	0.84
Vocational training	70.9	70.1	0.38

Finally, Figure 3 produces similar findings distinguishing between compensation and social investment policies. In line with the results in Table 2, we find that the average percentage of support is substantially higher for social investment (about 70% of support across all countries) than for compensation (about 55% of support across all countries). This pattern holds in every sampled country, although to a slightly lesser degree in Japan. Again, we do not detect any meaningful differences between digitalization and the green transition within countries.

5.2. Results from split-sample study

Before we take a look at the resulting regression coefficients from the 2POL IRT models, Figure 4 depicts the estimated discrimination parameters for compensation (Fig. 4a) and social investment (Fig. 4b) policies. Since the discrimination parameters are originally modeled on the log-scale, we retransform the estimates by exponentiation. Across both types of social policy, there are only minor differences between the respective model on digitalization and the respective model on the green transition. However, in the case of compensation policies, we find that the discrimination estimates vary across items (posterior mean estimates roughly between 0.87 and 1.17 with considerable uncertainty in the form of 95% credible intervals roughly between 0.61 and 1.68), with support for public employment and firm subsidies contributing relatively more to the underlying construct—that is, support for compensation—than support for unemployment benefits and reduced working hours. In the case of social investment policies, the discrimination estimates are quite similar across items (posterior mean estimates roughly between 0.93 and 1.09 with 95% credible intervals roughly between 0.81 and 1.34), where research is on the lower end, and measures facilitating job transitions are on the higher end of the discrimination spectrum.

Figure 5 displays the main results from our analysis. It shows posterior mean estimates and 95% credible intervals from our four Bayesian 2POL IRT models. The results for individual risk perceptions suggest that higher levels of perceived employment risk are associated with more demand for compensation (note, however, that the estimates for the moderately concerned are not statistically significant). In contrast, support for social investment policies initially declines with increasing individual risk perceptions and turns significantly positive only for those who are extremely concerned about digitalization. In the case of the green transition, the effect of being extremely concerned is not distinguishable from zero. Generally, however, the differences between digitalization and the green transition are small and only relevant for the highest risk categories. This lends more support for H2b compared to H2a. The findings also align with our descriptive analysis above, indicating that disparities are more conspicuous among different categories of social policies (compensation vs. social investment) than among different types of structural sources of labor market risk (digitalization vs. the green transition).

To facilitate an easier comparison between support for digitalization-related and green-transition-related policies, Figure 6 pools both split samples and includes a dummy for the green-transition sample. We interact this binary indicator with our main variable of interest measuring individual risk perceptions. The results corroborate the impression from Figure 5 that the effect of subjective risk on policy preferences for compensation and social investment is not statistically significantly different between both samples. Hence, the findings suggest that individuals—in spite of some variation in individual risk perceptions—generally demand and support the same kind of policy responses from the government based on their risk profile, independent of whether these policies are meant to deal with digitalization or

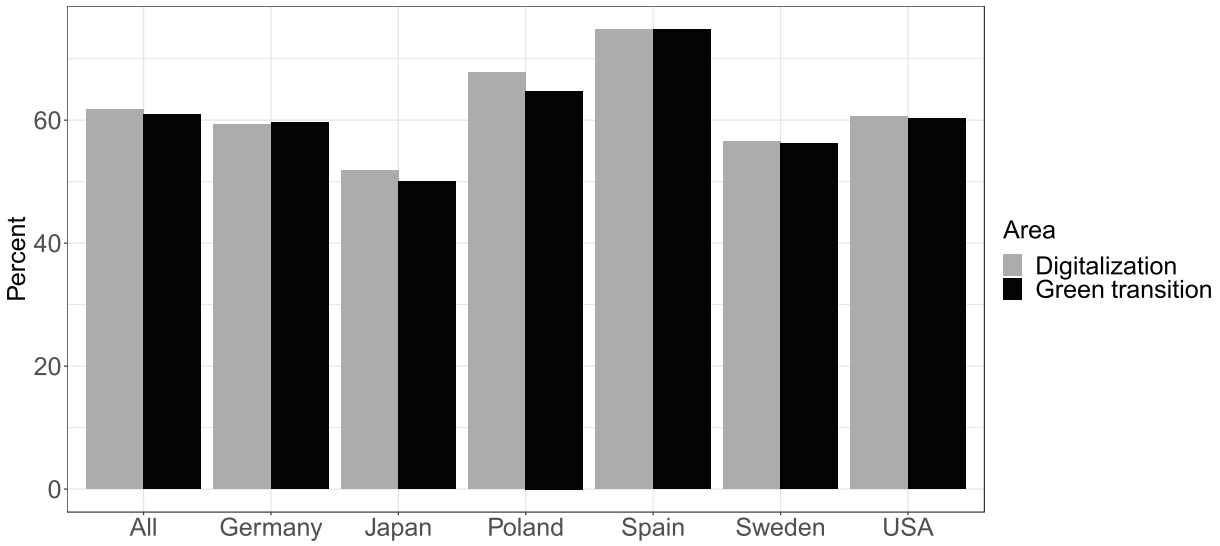

Figure 2 Percentage of individuals supporting policy action across digitalization and the green transition

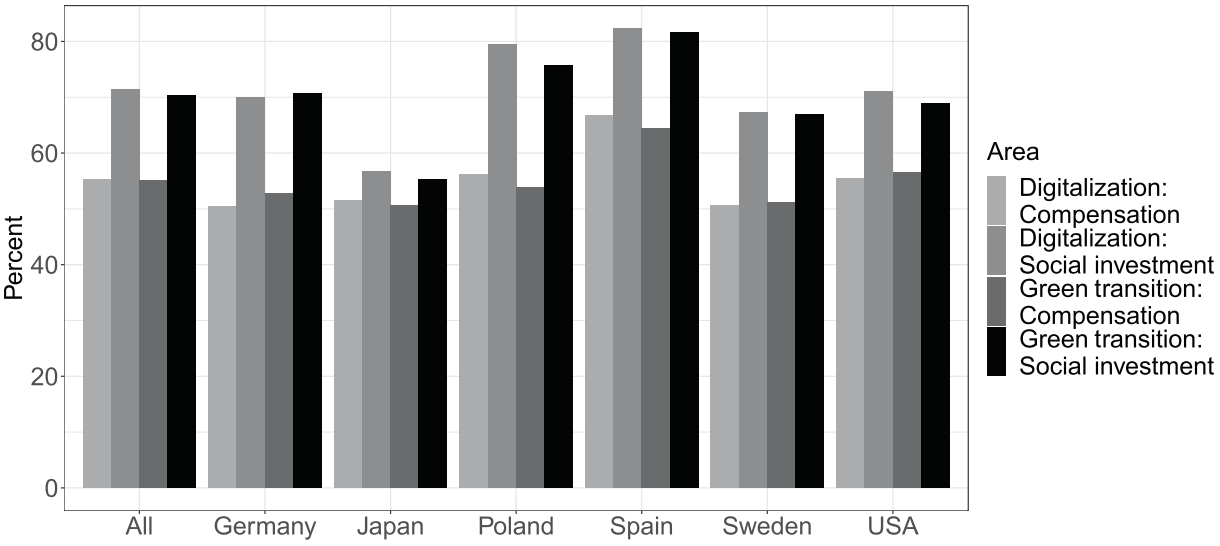

Figure 3 Percentage of individuals supporting compensation and social investment policies aimed at digitalization and the green transition across countries

the green transition. This is also confirmed in our calculations of predicted probabilities based on Figure 5, which we present in Figure A10 in the Supporting Information Appendix. This finding is, again, supportive of H2b but opposite to H2a. At the same time, we find partial support for H3, which claims the presence of interaction effects between respondent characteristics (here: subjective perceptions of labor market risk) and the treatment (see Fig. 6).

As for the remaining explanatory variables in Figure 5, the estimates of education indicate that, in line with previous research, higher levels of education are positively related to the demand for social investment policies. However, educational attainment does not seem to have an effect on support for compensation. Moreover, our results suggest that higher subjective income tends to be associated with lower demand for compensation in the area of digitalization but not in the area of the green transition. Particularly those individuals who state that they live comfortably on their present income exhibit—in addition to their general preference for social investment policies—higher levels of support for compensatory policies associated with the green transition. The latter effect is interesting because it could indicate that high-income individuals do in fact distinguish between different kinds of labor market challenges and are more supportive of providing compensation in the case of the green transition.

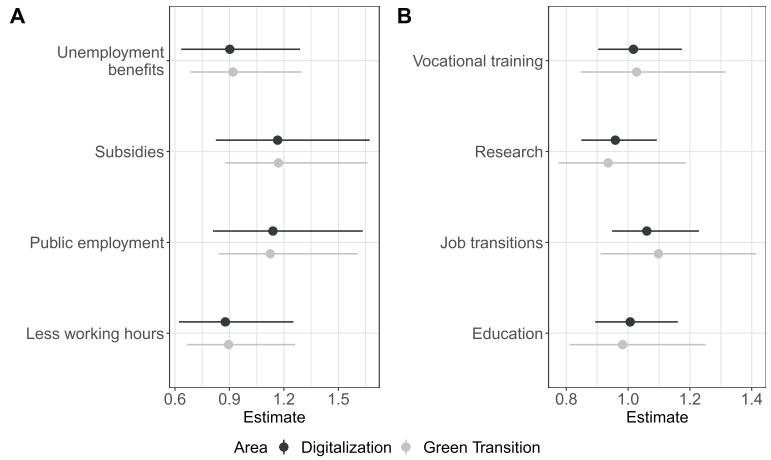

Figure 4 Estimated discrimination parameters for compensation (a) and social investment (b) policies

Looking at the results for the left–right scale, we find that a more conservative ideology correlates with lower support for policy action across policy areas and policy types, as expected. Finally, the remaining control variables indicate that age is associated with more support for social investment and less demand for compensation policies and that women (when compared to men) appear, on average, more supportive of both compensation and social investment policies, with support for the former being slightly more pronounced than for the latter. However, in contrast to the results for individual risk, all of these estimated coefficients are relatively small and often close to zero.

When it comes to country differences, the analysis reveals significant differences across country contexts. In line with H4a and, partially, H4b, overall support for compensatory policies is higher in the more residual welfare states (in particular Spain and the United States, to some extent also in Japan and Poland) but lower in universalist Sweden (the reference country here is Germany, which is also a relatively generous welfare state). In support of self-undermining feedback effects (H4b), demand for social investment policies is lower in Japan, whereas support for compensatory policies is higher. In the case of Spain, where some catching up has occurred with regard to compensatory policies, the demand for social investment policies is particularly strong. Despite this indicative evidence for feedback effects, the overall picture is somewhat mixed, providing only partial support for the feedback thesis, even though documenting significant cross-country differences in attitudinal patterns.

5.3. Results based on vignette data

Figure 7 shows the results from the vignette experiment in which we presented respondents with two hypothetical funds addressing the negative labor market effects of digitalization and the green transition. The results across both areas are similar. We find that overall support for the hypothetical fund increases significantly when compensatory policies (unemployment benefits, early retirement, UBI) are included. Compared to the reference category of no additional income support, approval of the fund increases by roughly 0.5–0.6 points or 0.2 standard deviations with each of these three compensation proposals in the case of digitalization and about 0.2–0.3 points or 0.1 standard deviations in the case of the green transition. The inclusion of early retirement policies in the package has a slightly stronger effect on average levels of support of the whole package. However, given the overlapping credible intervals, these differences are not statistically significant. More important than variation of policies within the broad domains of social investment and compensatory policies is the overall significant difference between the two domains. In contrast to compensatory policies, including social investment policies such as investing in lifelong learning, vocational training or higher education does not significantly affect overall levels of support for the hypothetical fund, confirming H5. This is somewhat surprising given the overall high levels of support for social investment policies, which we document above. We interpret this finding as confirmation of the general insight in the literature on policy trade-offs, showing that support for policies whose benefits

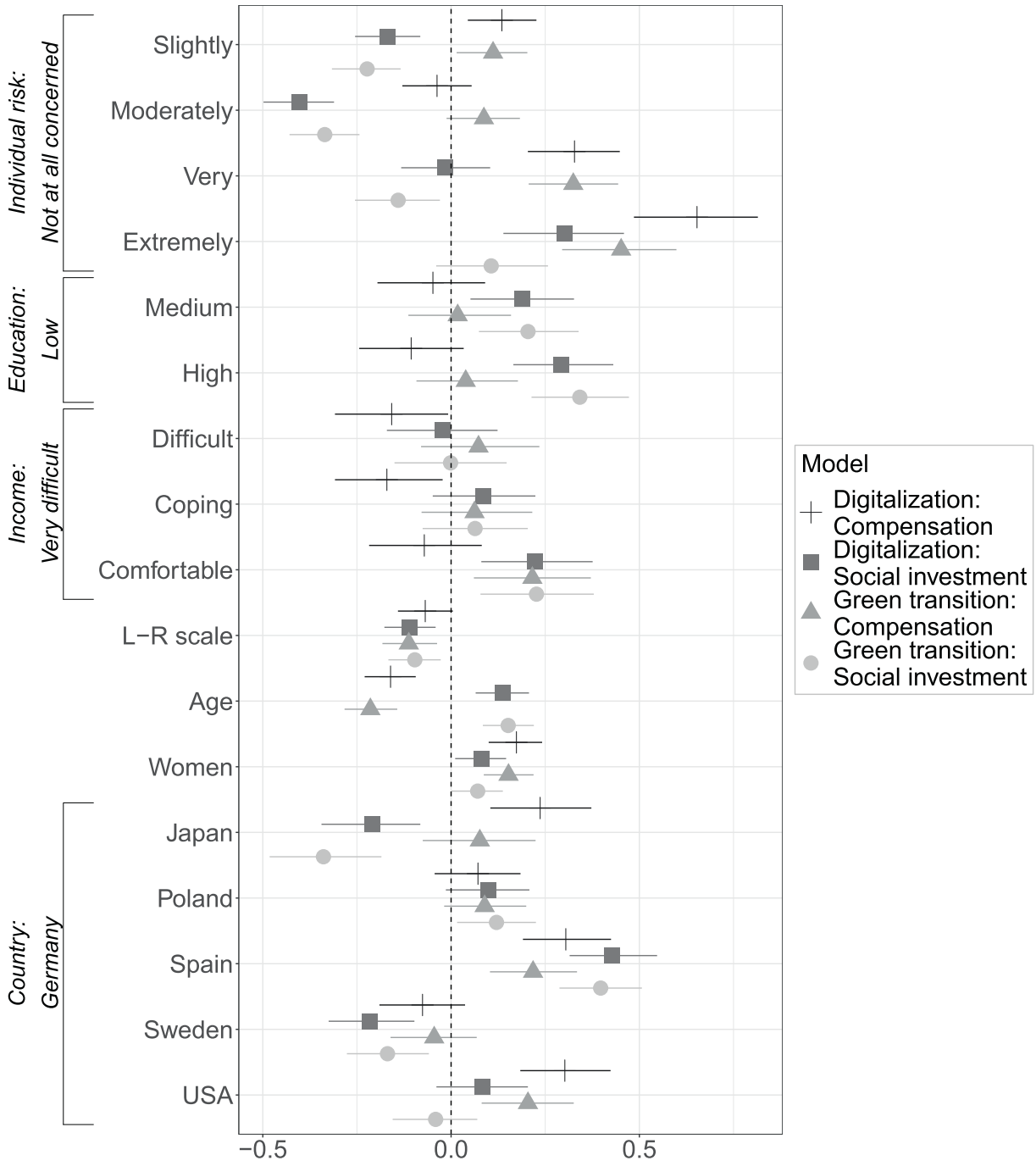

Figure 5 Posterior mean estimates and 95% credible intervals from four Bayesian two-parameter ordered logistic (2POL) item response theory (IRT) models: preferences for (1) compensation in response to digitalization, (2) social investment in response to digitalization, (3) compensation in response to the green transition, (4) social investment in response to the green transition

materialize over the long term tends to be overestimated in unconstrained settings. Thus, to some extent, the findings from the vignette experiment indicate some limitations regarding the generalizability of the findings from the split-sample setting. Interestingly, how the fund would be financed does not seem to matter for overall levels of support.

A further important insight from Figure 7 is that support for compensatory policies is significantly higher in the case of digitalization compared to the green transition. This is somewhat at odds with our initial theoretical

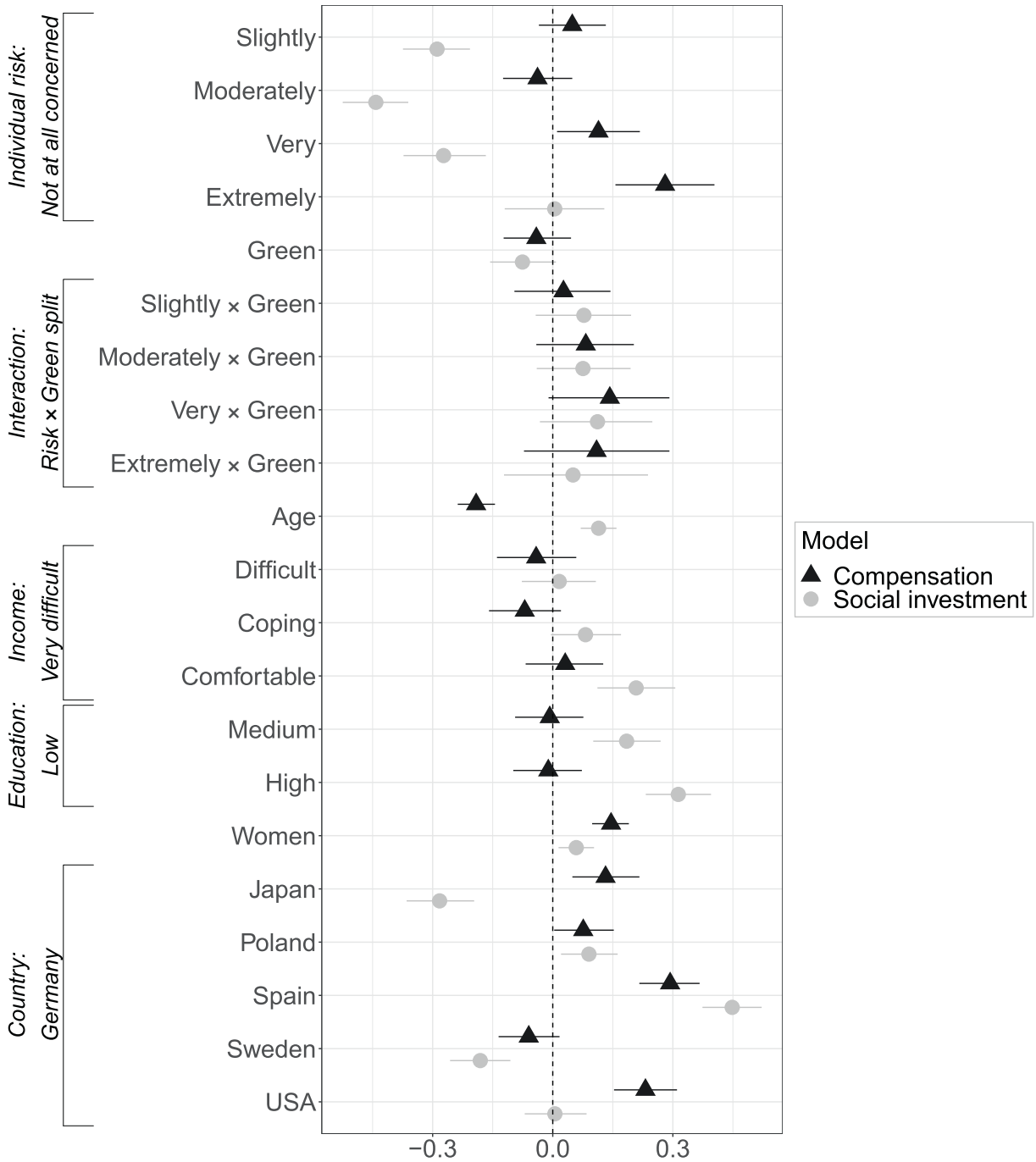

Figure 6 Posterior mean estimates and 95% credible intervals from two Bayesian two-parameter ordered logistic (2POL) item response theory (IRT) models: preferences for (1) compensation pooled across both split samples and (2) social investment pooled across both split samples. The variable *green* is a dummy indicating the green-transition sample.

expectations (see the discussion of H2a and H2b), where we expected higher support for compensation in the case of the green transition due to the more limited opportunities for upskilling in this case. One potential explanation for the counter-intuitive findings could be that workers have already started to feel the pressure of the digital transformation in their work contexts, whereas the main effects of the green transition have not yet materialized. This difference in time horizons between domains is partly independent of the overall salience of the different issues. Hence, even though citizens might be particularly worried about climate change in general,

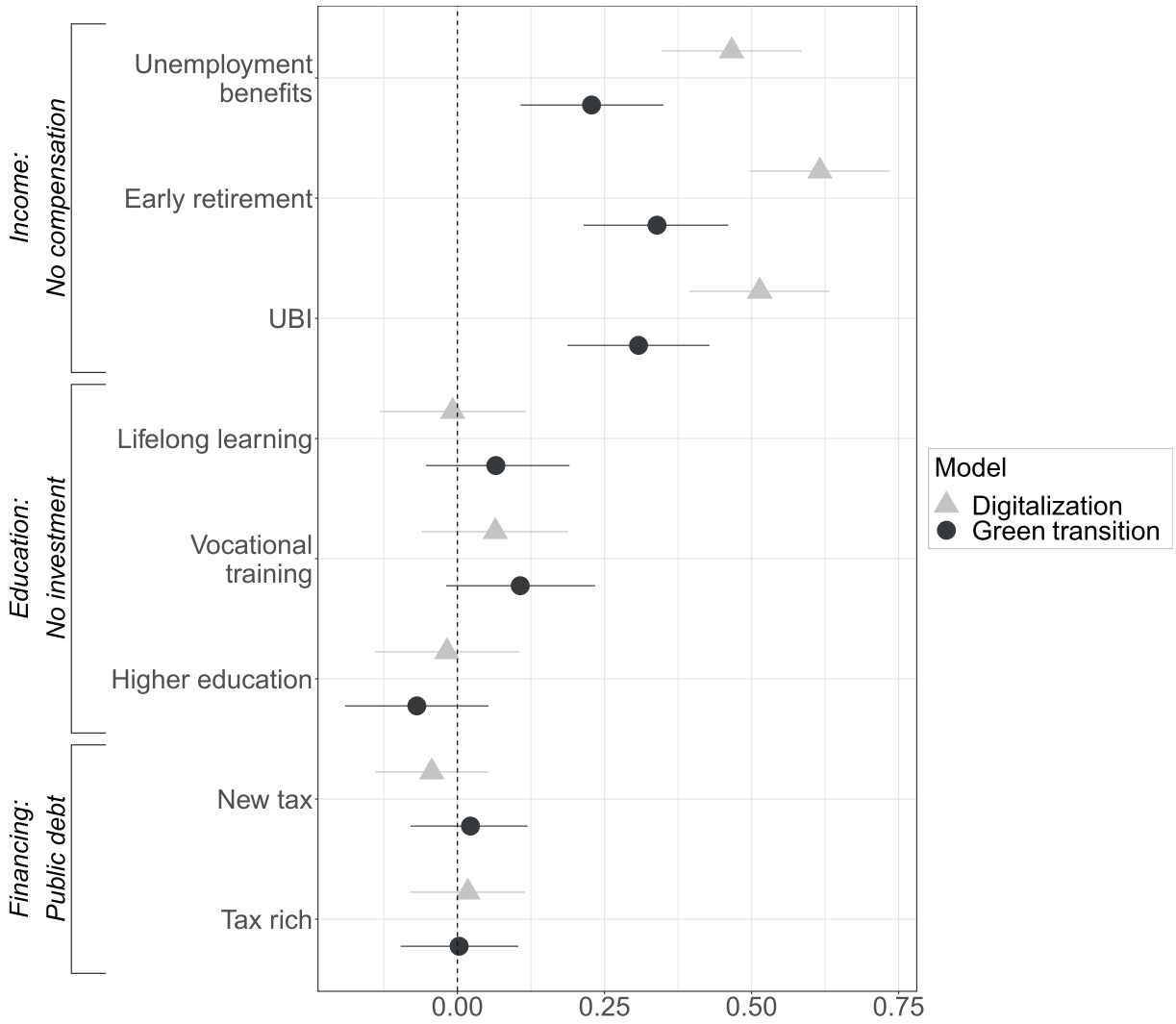

Figure 7 Posterior mean estimates and 95% credible intervals from two vignette experiments on policy solutions to digitalization and the green transition

they have more concrete experiences with how the digital transformation affects their work environment, leading to more urgent demands for compensatory social policies in the case of digitalization compared to the green transition.

6. Discussion and conclusion

This paper has examined the relationship between digitalization and the green transition as two sources of structural labor market risks and social policy preferences in response to the two challenges. Our main finding is that while there is some variation across preferences for different types of social policies (compensation vs. social investment), there is little heterogeneity when it comes to the social policy response patterns for the two different types of labor market challenges (digitalization vs. the green transition). Thus, the clear answer to our first research question raised above is that there are no systematic differences in policy preferences between the different labor market challenges, even though there are some differences in how individuals perceive exposure to these risks (see Fig. 1). Relatedly, the answer to our second research question—whether individuals demand different policies depending on the labor market challenge—is also clear: they do not. Instead, as suggested by the third research question, individual-level and, to some extent, country-level contextual factors matter most in shaping

individuals' preferences for social policy responses. Confirming previous work, we find that overall support for social investment policies is very high (and higher than for compensatory policies), but those perceiving their jobs to be at risk (either due to digitalization or the green transition) demand compensatory policies. The results from the vignette study further confirm strong support for the latter policies across the board, indicating that measuring support for social investment policies in unconstrained settings might be somewhat overestimated.

All in all, this paper provides some first evidence on the green transition as a source of structural labor market risk in comparison with digitalization, which is crucial in order to adequately design policies to accompany both labor market developments over the next decades. At the same time, further research on this topic is necessary in order to better understand the formation of preferences for social policy responses to the two labor market risks. For instance, we did not include the option to express support or opposition to the pace of labor market change in our survey. In the case of digitalization, Gallego et al. (2021) find little support for slowing down the pace of technological change, but this might be different in the case of the green transition, where more resistance could be expected due to the politicized and increasingly polarized nature of the climate change debate. A further limitation of our study is that we had to rely on subjective perceptions of labor market risk. Even though multiple measures of objective risk are available in the case of digitalization, there are significant questions regarding the validity of these measures (Walo, 2023). In the case of the green transition, hardly any measures of objective risk exist. Hence, we opted for focusing on subjective risk perceptions for this paper, but further research should try to develop more reliable measures of objective risk exposure in both cases, including the important aspect of how exposure varies across sectors and subnational regions.

Our study also has limitations related to the nature of the data we collected. Even though particular attention has been paid to achieving a high standard of data quality, survey data gathered with online access panels still does not amount to the same standard as full random population samples. Given that we focus mostly on experimental effects, potential biases in responses and the associated lack of representativeness may matter less than in other cases. Furthermore, differences in economic, social, and cultural contexts and practices may affect the comparability of survey data across countries, which is a challenge for all types of cross-country comparative research. Nevertheless, we feel confident that our survey data can produce meaningful insights into the dynamics of social policy preferences.

Finally, an interesting avenue for future research is exploring the interlinkages and connections between the individual-level dynamics of attitudes and the particular policy trajectories which countries pursue in response to the twin challenges of digitalization and the green transition. Our findings suggest that countries could be confronted with a political dilemma: On the one hand, expanding social investment policies seems advisable to facilitate labor market transformations and to provide workers with the necessary skills for these transformations. On the other hand, demands for compensatory policies are likely to be strong, in particular in the short term.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Endnotes

[1] One exception from this is the automotive sector, in which parts of the transformation occur within the same sector with the transition from internal combustion engine vehicles to electric vehicles.

[2] This stands in contrast to scholars regularly pointing to the crucial importance of retraining and reskilling in this context (see literature cited above).

[3] We thank an anonymous reviewer for pointing this out to us.

[4] The survey data collection has been approved by the Ethics Committee of the University of Konstanz.

[5] To provide some information on the survey metrics: 70% of all respondents who started the survey by clicking the survey link also completed the questionnaire; 5% were screened out because they did not have the minimum age of 18 years; 13% were rejected because they had a profile where we already reached enough interviews (quota full); 12% dropped out of the questionnaire or did not find time to complete it. Those dropouts occurred mainly during the first questions, that is, 37% at the welcome page, 7% at the tricky question on calculating the years spent in full-time education (eduyears), 4%–5% each at the vignette questions as well as at the question on the birth year of the respondent. The overall dropout rates are typical for convenience panels. Hence, no single question seems to have caused any major technical or cognitive problem.

[6] Admittedly, the term "labor market measures" is slightly more ambivalent compared to the other items. In our understanding, this refers to active labor market policies which provide support (financial, administrative, etc.) to workers when changing jobs. The item did not raise any particular concerns in the pretests, so we are confident that most respondents understood it correctly. We thank an anonymous reviewer for making us aware of this issue.

[7] In Figure A1 in the Supporting Information Appendix, we plot the percentage of high-risk perceptions across age, educational, and (subjective) income groups. Although we find that risk perceptions within these groups are strongly correlated across digitalization and the green transition, we also find some differences. For instance, the overall descriptive result that risk perceptions from the green transition are higher than those from digitalization appears particularly pronounced for older and economically better-off individuals.

[8] This prevents that "a switch in the sign of α_i can be corrected for by a switch in the sign of $\theta_r + \xi_i$ without a change in the overall likelihood" (Bürkner, 2021, p. 26).

[9] We also estimated models without discrimination parameter. Comparing model fit results from approximate leave-on-out cross-validation via Pareto-Smoothed importance sampling (Vehtari et al., 2017) indicates a clear preference for the 2POL IRT model.

[10] Since the multiplicative relationship between the distributional scales of person and discrimination parameters results in nonidentifiability, we follow the commonly adopted approach in 2POL IRT models of fixing the distribution of the person parameter at 1 to ensure convergence (see Bürkner, 2021).

[11] In other words, we estimate in sum four models: (1) support for compensation in the area of digitalization, (2) support for social investment in the area of digitalization, (3) support for compensation in the area of the green transition, and (4) support for social investment in the area of the green transition.

[12] Both visual and numerical diagnostics for Markov chain behavior for the parameters of interest indicate robust convergence of the MCMC chains. Trace plots (see Figures A2, A4, A6, and A8 in the Supporting Information Appendix) displayed stable, random-like behavior, without discernible trends or patterns, suggesting effective exploration of the parameter space. Autocorrelation plots (see Figures A3, A5, A7, and A9 in the Supporting Information Appendix) demonstrated rapid decay in autocorrelation as lag increased, further confirming the independence of samples. Additionally, the effective sample size calculations (see Table A1 in the Supporting Information Appendix) yielded substantial values, signifying efficient sampling. Finally, potential-scale reduction factor (PSRF or $\widehat{R}$) values (see Table A1 in the Supporting Information Appendix) were very close to unity, indicating consistency across the parallel chains.

[13] In Figure A11 in the Supporting Information Appendix, we probe whether the relationship between perceived job risk from the green transition and social policy preferences is moderated by beliefs about the urgency of policy action in this area. *A priori*, one might expect that individuals with lower risk perceptions become more supportive of policy interventions if they think government action is urgent. However, our results suggest that urgency perceptions have little to no effect on the social policy preferences of lower-risk-perceiving individuals. Moreover, Table A2 in the Supporting Information Appendix shows that the impact of perceived risks on policy preferences is largely invariant across countries. The United States is the only exception, with the results suggesting that higher levels of perceived risks are associated with more demand for both types of social policy across both policy areas.

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