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Abstract

Although the importance of technological change for increasing prosperity is undisputed and economists typically deem it unlikely that labor-saving technology causes long-term employment losses, people's anxiety about automation and its distributive consequences can be an important shaper of economic and social policies. This paper considers the political economy of automation, proposing that individuals in occupations that are more at risk of losing their job to automation have stronger preferences for government redistribution. Analysis of cross-national individual-level survey data from three different sources confirms the effect of occupational automation risk on redistribution preferences. The same effect is found when considering indirect exposure to automation risk through the occupation of one's spouse or partner and using the automatability of individuals' own occupation as a generic control variable. In addition, the effect is not limited to the preference for redistribution in general but extends to a preference for a specific policy with redistributive consequences, namely the preference for government support of declining industries.

JEL codes: J23, J24, J31, O14

Keywords: Preferences for redistribution; automation; social insurance; robotization; task content; welfare state; routineness

I. INTRODUCTION

Whereas few people deny the power of technological change to radically transform economies, economists typically emphasize the long-run benefits of creative destruction and technological change for increasing prosperity (Autor 2015; Mokyr et al. 2015). Advances in robotics, task automation, machine learning and artificial intelligence algorithms, however, have been fueling widespread concerns about the possibility of long-lasting technological unemployment and the disruptive effect of labor-saving technology on society (Brynjolfsson and McAfee 2014; Etzioni 2017; Ford 2015; Krugman 2012; Sachs and Kotlikoff 2012; Srnicek and Williams 2015; Summers 2013). The core of such automation anxiety is that technological change has distributional effects between groups in society, meaning that the benefits of technological change are not spread evenly.[1] Recent debate and anxiety thereby highlight a specific automation concern, which is that some workers or occupations end up losing from labor-saving technology not just compared to other groups but also in absolute terms. If large groups in society are indeed in danger of long-run losses from automation this would be a powerful shaper of economic and social policies. Jobs that are more automatable come with higher unemployment risk and economic uncertainty, stoking up demand for government action that mitigates or insures against income losses. Different estimates of the labor market effects of automation exist. Frey and Osborne (2017), for example, find that approximately 47% of the U.S. labor force is at risk of displacement by machines. A report by McKinsey (2017) similarly finds that roughly six out of ten occupations in the U.S. involves tasks that can be automated for at least 30%. Finally, Acemoglu and Restrepo (2017) consider the effect of robotization on the U.S. labor market, estimating that one additional robot per 1,000 workers reduces the

[1] Concern with automation has a long history involving the likes of Keynes (1930) and Marx (1887) before him as well as the famous Luddite movement, which protested automation by destroying weaving equipment in early 19th century England (Akst 2013; Hobsbawm 1952; Sale 1995). I use the terms automation and labor-saving technology interchangeably. Formally, however, the latter includes both automation and mechanization.

employment ratio by 0.18-0.34 percentage points and wages by 0.25-0.5%.

This paper considers the political economy of automation, linking the automatability of work, specifically individuals' risk of losing their job to automation, to preferences for redistribution. Redistributing material wealth has traditionally been one of the most important roles played by governments and individuals' preferences for redistribution have been widely studied (Ashok et al. 2015; Corneo and Grüner 2000; Dahlberg et al. 2012; Fong 2001; Kuziemko et al. 2015; Luttmer 2001; Luttmer and Singhal 2011). The workhorse model for understanding differences in preferences for redistribution comes from Meltzer and Richards' (1981) seminal work, which emphasizes the role of individuals' income (relative to the median) (see, also, Romer 1975 and Roberts 1977). However, expectations concerning future income or wealth and socioeconomic mobility are also commonly proposed as determinants of redistribution preferences (Bénabou and Ok 2001; Piketty 1995) and confirmed by empirical evidence. Ravallion and Lokshin (2000), for instance, find that negative expectations about future welfare increase demand for redistribution (see, also, for example, Corneo and Grüner 2002). My hypothesis is that greater occupational automation risk leads to a stronger preference for redistribution. The underlying logic is that individuals are aware of the nature of their job tasks and recognize the implications of their occupational task content for the automatability of their work and hence for their income and wealth prospects and the net pecuniary gains that they can expect from government redistribution.

In order to analyze the effect of exposure to automation risk on preferences for redistribution, this paper follows earlier work on occupational task content (e.g., Acemoglu and Autor 2011) and draws on individual-level survey data to construct an aggregate indicator of the degree of automatability of different occupations. Empirical analysis shows that combining insights on the risk of job loss due to automation from employees actually working in a particular type of job renders a valid measure of occupational automatability or exposure to automation risk. Individual-level cross-national data on self-reported preferences for redistribution and various other factors recognized to affect these preferences come from the International Social Survey Programme modules on Social Inequality (ISSP-SI), four

waves of data in total (ISSP Research Group 2014). The indicator of occupational automatability is matched to these data using codes from the 1988 version of the International Standard Classification of Occupations (ISCO). Seven waves of data from the European Social Survey or ESS (European Social Survey 2016) provide a means for triangulating results and taking into account an alternative set of potential confounders. Similarly, data from the 1996 and 2006 Role of Government module of the ISSP or ISSP-ROG (ISSP Research Group 2008) enables extending results from preferences for redistribution, which are relatively broad and abstract, to preferences concerning a specific policy issue, namely government support of declining industries.

Key challenge for valid identification of the causal effect of occupational automation risk on preferences for distribution is properly controlling for omitted variables. Hence, I consider a large variety of control variables, mostly concerning individual-level differences but also concerning differences between occupations. Rather uniquely, these controls do not only involve standard variables such as education but also, among others, the comprehensive measures of human motivations provided by the basic human values framework, the leading framework of personal values in psychology (e.g., Schwartz 1992; see Figure B.1 in Appendix B). The paper's main identification strategy, however, is that, instead of considering the effect of individuals' own automation risk, I consider the effect of individuals' exposure to automation risk through the occupation of their spouse or partner, while using the automatability of individuals' own occupation as a generic control variable.

The key findings of this paper are as follows. First, individuals in occupations that are more at risk of job loss due to automation do indeed exhibit stronger preferences for redistribution, indicating an important channel through which automation anxiety can end up affecting societies, independent of automation's direct labor market effects. Recent technological change seems to increase economic uncertainty for a growing part of the population, prompting citizens to pressure their governments into compensatory social and economic policies. Second, occupational task routineness and complexity do not affect preferences for redistribution when occupational automatability is taken into account. Finally, the effect of occupational automatability on preferences extends to preferences for a concrete economic

policy with redistributive consequences in the form of government support of declining industries.

This paper builds on and contributes to different literatures. The possible economic effects of automation have been widely considered, both theoretically and empirically. However, this work focuses mostly on direct labor market effects and pays little explicit attention to significant indirect effects involving individuals' attitudes and demand for government policies. Even when the direct labor market effects of labor-saving technology and thus the objective threat of future unemployment and income losses are limited, automation can still have radical effects on society and its policies. The reason is that the subjective perception of automation as an economic threat is already a powerful force influencing people. Automation anxiety affects citizens' political attitudes, changing the political landscape and pushing governments into action. This paper, then, provides an important complement to studies of the societal implications of key economic trends that focus on direct and objective effects only and pay little attention to indirect but more fundamental changes to society brought on by automation, globalization or other such developments.

Measurement of distinct job characteristics and characterizing the task content of employment is an important topic in different fields, particularly the labor economics literature on job polarization and the new trade literature (Autor and Dorn 2013; Autor et al. 2003; Autor et al. 2015; Blinder and Krueger 2013; Costinot et al. 2011; Goos et al. 2014). The indicator of occupational automatability constructed for the present analysis adds to this literature by providing a valid dimension of occupational task content that complements extant indicators of occupational task routineness and complexity.

This paper resonates most strongly with the literature on preferences for redistribution. The role of net pecuniary gains in shaping individuals' preferences for redistribution has long been recognized (see Alesina and Giuliano 2011 for a review). Similarly, much attention has been paid to an individual's income and wealth prospects as determinants of his/her preference for redistribution through their effect on expected costs and benefits of government redistribution. Furthermore, there is a growing body of research that seeks to flesh out the role of income expectations and mobility perceptions in shaping preferences individuals' expectations about future income or wealth and socioeconomic mobility.

Giuliano and Spilimbergo (2013), for example, find that individuals that have experienced a recession during their formative years end up preferring more government redistribution. Similarly, Alesina et al. (2018) find that perceptions of intergenerational mobility shape redistribution preferences, even when these perceptions do not accurately match reality. The nature of individuals' occupation, in contrast, does not yet figure prominently in this literature. The evidence presented in this paper, however, suggests that job characteristics are an important factor shaping individuals' expectations about future income and socioeconomic mobility.

II. OCCUPATIONAL AUTOMATABILITY

II.A. Measuring Occupational Automatability

Measurement of the automatability of occupations in this paper follows the seminal work by Autor et al. (2003) and other important studies of the task content of employment that have appeared since (e.g., Autor and Dorn 2013; Goos et al. 2014). Two main approaches to assessing the automatability of jobs can be discerned. The first approach revolves around well-established job or task characteristics such as routineness or complexity (Acemoglu and Autor 2011). Following this approach, a job can be seen as comprising a set of tasks, each of which can be more or less susceptible to automation, not least because each task involves more or less routineness and complexity. The automatability of a given job is therefore a function of the automatability of individual job tasks, weighted by the importance of each task as part of the overall content of the job. The second approach is to rely on technology experts judging the overall automatability of different jobs (cf. Frey and Osborne 2017).

The approach in this paper is closer to the latter approach, as it involves aggregated knowledge of employees actually working in a particular type of occupation. The underlying idea is that this approach harnesses the wisdom of crowds and helps overcome biases likely to occur using any of the other two approaches. Calculating occupational automatability on the basis of task content is an intricate process that requires not only that task attributes such as routineness are measured accurately but also that each task is assigned proper weight as part of the overall task content of a given occupation. Expert judgments

face other limitations. A particular concern is the possibility that there are blind spots that are shared by the group of experts asked for their opinion, which is quite likely when the assessment involves a large number of jobs. Two further challenges are lack of cultural diversity among the experts consulted and the use of a system of job classification that does not follow international standards. In these cases, the concern is that the resulting measure of occupational automatability is not universally applicable or valid, likely causing a bias in subsequent empirical analyses.[2]

To implement my proposed approach, I rely on data collected by the International Social Survey Programme in the 1997 module on Work Orientations or ISSP-WO (ISSP Research Group 1999). This module surveyed respondents from a diverse group of 21 country regions about various aspects of their jobs.[3] One specific item asked respondents about the likely effect of automation on employment: "New kinds of technology are being introduced more and more in [country]: computers, robots, and so on. Do you think these new technologies will over the next few years..." The Likert type answer scale provided to respondents comprised five possible answers: "1, Greatly increase the number of jobs?," "2, Slightly increase the number of jobs?," "3, Make no difference to the number of jobs?," "4, Slightly reduce the number of jobs?," or "5, Greatly reduce the number jobs?" For more than 19,000 respondents, the survey further recorded their occupation using four-digit codes from the 1988 version of the international standard classification of occupations (ISCO). For an additional 5,000 respondents, the 1997 ISSP module

[2] As an illustration, in cross-country cross-industry analyses such systematic differences in the accuracy of the industry benchmark considered are known to cause an "amplification bias" (see, for example, Ciccone and Papaioannou 2016).

[3] There have been three other ISSP Work Orientations modules in 1989, 2005 and 2015. Each of these modules, however, has collected slightly different data than the 1997 module. The country regions covered by the 1997 module are Germany (East and West separately), Great Britain, U.S., Hungary, Norway, Sweden, Czech Republic, Slovenia, Poland, Bulgaria, Russia, New Zealand, Canada, Japan, Israel (Jews and Arabs separately), France, Cyprus, Portugal, Denmark and Switzerland.,

on Work Orientations recorded their occupation using three-digit ISCO88 codes.

My proposed indicator of occupational automatability involves aggregating individual assessments of automation-driven job loss at the level of two-digit ISCO codes, which is the most common level of analysis in studies of the economic implications of occupational task content (e.g., Goos et al. 2014). Hence, I combine the available three-digit and four-digit occupational data and convert them into two-digit ISCO codes. To make sure that calculated averages of the individual responses are reliable, the empirical analysis limits the sample to consider only two-digit occupations for which the aggregate automatability score is based on data from minimum 20 individual respondents. However, as a robustness check, I also repeat my baseline analyses using different thresholds for the minimum number of underlying individual responses. Similarly, I also estimate models in which occupational automatability is measured at the three- or four-digit ISCO level instead of at the two-digit level. Advantage of measuring automatability at the three- or four-digit ISCO level is that the resulting indicator is more fine-grained. Disadvantage is not only that the two-digit level is the more common level of analysis but also that using a three- or four-digit classification leaves fewer individuals per occupational code, on average, resulting in an indicator that is more noisy. Table A.1 in Appendix A presents automatability scores for selected two-digit occupations.

II.B. Validity of Measured Occupational Automatability

The indicator of occupational automatability constructed above has much intuitive appeal. Instead of imposing a personal view on what makes a job more or less automatable, the approach harnesses the wisdom of crowds to create an indicator that is void of individual biases or other such subjectivity. Moving beyond intuitive appeal, however, there are also different pieces of evidence testifying to the validity of the automatability indicator thus constructed.

First, gauging Table A.1, measured automatability differences have strong face validity in that occupations intuitively expected to have low/high automation risk indeed have low/high automation risk (e.g., *Legislators and senior officials* or *Physical, mathematical, engineering science professionals* vs.

Machine operators and assemblers or *Drivers and mobile plant operators*). For a formal test of the (construct) validity of the occupational automatability indicator, I further consider how this indicator correlates with other indicators measuring related constructs, particularly occupational routineness and complexity. Though distinct constructs, measured automation risk should correlate reasonably strongly both with differences in occupational task routineness and with differences in occupational task complexity (cf. Goos et al. 2014). Table I presents the results.

<<Insert Table I about here>>

As expected, automatability correlates strongly positively with job routineness and strongly negatively with job complexity. At the same time, correlations found are not so strong to suggest that routineness or complexity are essentially the same as automatability. Hence, the automatability indicator appears to add to common routineness and complexity indicators, capturing features of occupational task content not fully captured by either of these two job characteristics.

III. EMPIRICAL APPROACH

III.A. Empirical Model and Identification Strategy

The basic empirical model used to assess the effect of automatability of individuals' jobs on their preferences for redistribution reads:

$$P_{io} = \beta_0 + \beta_1 A_o + \beta_2 \mathbf{X}_i + \beta_3 \mathbf{Z}_o + \varepsilon_{io}. \quad (1)$$

In this model, P_{io} is the preference for redistribution of individual i working in occupation o, A_o is the automatability of occupation o, $\mathbf{X}_i$ is a vector of individual characteristics, and $\mathbf{Z}_o$ is a vector of occupational characteristics other than automatability, and ε_{io} is a random error term. Per my hypothesis, I expect that β_1 is statistically significantly positive, as this would indicate that individuals that are more at

risk of losing their job to automation have a stronger preference for redistribution. Because the analysis involves data that are structured hierarchically with individuals nested in occupations, I use robust standard errors that are clustered at the level of occupations.

As indicated, key challenge for valid identification of the causal effect of occupational automation risk on preferences for distribution is properly controlling for omitted variables. Two factors stand out as possible sources of an omitted variable bias. The first is a personal trait or generic preference factor that might affect both individuals' preference for redistribution and their preference for jobs with a particular task content, which, in turn, might correlate with the degree to which these jobs are automatable. The second factor concerns an individual's skill level, which likely affects both his/her net pecuniary gain from redistribution and his/her ability to find employment in jobs with particular task content. Notably, it seems likely that individuals with comparatively low skill levels have more difficulty finding employment in occupations with low automation risk and vice versa.

Following these two main sources of potential omitted variable bias, the main analyses include an extensive set of control variables, not least of which are various measures of individuals' preferences. Concerning skill level, basic control variables are years of education and educational degree, but also measures of individuals' employment status, which, in turn, is partly a realized outcome of occupational automatability. In addition, I check results with key features of individuals' occupation, specifically occupational task routineness and occupational task complexity, controlled for. Details on the specific variables and measures used, which vary between data sets, are presented below and in Tables A.2-A.4 in Appendix A.

The paper's main identification strategy is to consider the effect of an individual's indirect exposure to automation risk through the occupation of his/her spouse or partner, while controlling for the individual's own, direct exposure to automation risk. The underlying logic is as follows. First, spousal automation risk is likely to affect an individual's wealth prospects and hence his/her expected net pecuniary gains from government redistribution. Compared to the direct effect of the automatability of one's own occupation, the effect of spousal automation risk is likely much weaker, but the effect may still be significant. Second,

the measure of individuals' own occupational automation risk provides a powerful means of controlling for omitted variables, not least any unobserved differences in preferences or skill levels not yet captured by the various other control variables.

III.B. Data Sources

The main data for this paper is individual-level survey data from the ISSP modules on Social Inequality or ISSP-SI (ISSP Research Group 2014). The modules have been conducted in 1987, 1992, 1999 and 2009 and include data on respondents from 28 country regions.[4] In addition to data on self-reported preferences for redistribution and various other important variables, these modules have recorded respondents' occupation using the 1988 version of the ISCO. The measure of occupational automation risk applies the same occupational classification so that the individual-level ISSP-SI data can be matched to the automatability indicator constructed and validated in the previous section. The ISSP Social Inequality module(s) are commonly used to study preferences for redistribution (Corneo and Grüner 2000; Eugster et al. 2011; Kerr 2014). Dropping respondents with missing answers leaves about 45,000 individuals, depending on the model specification used. Table A.2 in Appendix A presents a description of the variables in the four ISSP Social Inequality modules used for the empirical analysis and some descriptive statistics.

Whereas the analyses using ISSP-SI data are my main analyses, as part of my robustness checks I also consider samples of individuals from two alternative data sources. The first of these alternative sources is the European Social Survey or ESS, Waves 1-7 (European Social Survey 2016). These data have been collected bi-annually during the period 2002-2014 and cover 32 mostly European and some Eurasian

[4] These country regions are Australia, Austria, Bulgaria, Canada, Chile, Cyprus, Czech Republic and Slovak Republic (both also as part of former Czechoslovakia), France, (East and West) Germany, Great Britain, Hungary, Israel, Italy, Japan, Latvia, New Zealand, Norway, Philippines, Poland, Portugal, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland and U.S.

countries. Chief motivation for using data from the ESS is that the ESS includes interesting individual-level (control) variables not available in the ISSP Social Inequality modules. In addition, the ESS covers a different group of countries than the ISSP-SI does, which increases the international generalizability of my results.[5] Dropping respondents with missing answers leaves almost 150,000 individuals, depending on the model specification used. Table A.3 in Appendix A presents a description of the variables in the ESS used for the empirical analysis and some descriptive statistics. The second alternative data source is the third and fourth Role of Government module of the ISSP or ISSP-ROG (ISSP Research Group 2008). These data have been collected in 1996 and 2006 and cover 20 country regions.[6] Main motivation for using ISSP-ROG data is that these data provide an alternative dependent variable concerning individuals' preference for government support of declining industries. The advantage is that this preference is more specific about the preferred policy action. In addition, considering this particular preference as the dependent variable enables including measures of more generic preferences for redistribution as control variables, providing powerful means to address potential omitted variable bias. Dropping respondents with missing answers leaves about 29,000 individuals, depending on the model specification used. Table A.4 in Appendix A presents a description of the variables in the third and fourth ISSP Role of Government modules used for the empirical analysis and some descriptive statistics.

[5] These country regions are Austria, Belgium, Bulgaria, Switzerland, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, United Kingdom, Greece, Croatia, Hungary, Ireland, Israel, Iceland, Italy, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Russia, Sweden, Slovenia, Slovakia, Turkey, and Ukraine.

[6] Data from the other ISSP Role of Government modules cannot be used because these modules have not collected data on occupation. The countries covered by the third and fourth Role of Government module are Australia, Canada, Czech Republic, France, Germany, Hungary, Ireland, Israel, Japan, Latvia, New Zealand, Norway, Poland, Russia, Slovenia, Spain, Sweden, Switzerland, Great Britain and U.S.

III.C. Variables and Measures

III.C.1. Dependent Variable

The main dependent variable in this paper is an individual's preference for redistribution. The specific item from the ISSP-SI that I use to measure this preference asks respondents whether the government should reduce income differences. The first part of this item reads: "It is the responsibility of the government to reduce the differences in income between people with high incomes and those with low incomes." Possible answers are given by the following Likert -type scale: "1, Strongly agree," "2, Agree," "3, Neither agree nor disagree," "4, Disagree," or "5, Strongly disagree." To facilitate interpretation, I reverse code scores on this item so that higher scores indicate a stronger preference for redistribution. Similarly, the main analyses reported in this paper treat this item as a continuous measure of redistribution preferences. However, I obtain similar results when I estimate the empirical models using ordered probit or ordered logit techniques (detailed results available on request). As mentioned, the measure of preferences for redistribution available from the ISSP-SI data is widely used (e.g., Corneo and Grüner 2000). However, to be complete, Table A.5 in Appendix A presents some stylized evidence on the validity of this measure. If the ISSP-SI measure of preferences for redistribution is valid, we would, expect, for instance, a positive relation between this measure and measures of individuals' attitudes towards basic income and unemployment benefits, which is confirmed by the evidence.

The ESS item measuring preferences for redistribution is highly similar to the ISSP-SI item. It asks respondents about the extent to which they agree or disagree with the statement that "the government should take measures to reduce differences in income levels." The answer scale is again a five-point Likert-type scale: "1, Agree strongly," "2, Agree," "3, Neither agree nor disagree," "4, Disagree," or "5, Disagree strongly." As before, I reverse code scores on this item.

Finally, as indicated, data available from the ISSP-ROG offers the opportunity to assess the effect of occupational automatability on a concrete economic policy with redistributive consequences in the form of government support of declining industries. The relevant item starts with a generic text asking about economic policies: "Here are some things the government might do for the economy. Please show which

actions you are in favor of and which you are against." The specific policy is thereby described as "support for declining industries to protect jobs" and answers are recorded on a five-point Likert-type scale that is reverse coded for the empirical analysis: "1, Strongly in favor of," "2, In favor of," "3, Neither in favor of nor against," "4, Against," or "5, Strongly against."

III.C.2. Independent Variables

For most of the empirical analyses in this paper, the key independent variable is the indicator of occupational automatability constructed in the previous section. As indicated, I match this indicator to the individual-level ISSP-SI and ISSP-ROG data using two-digit codes from the 1988 version of the ISCO. I apply the same matching procedure for the analyses involving individual-level data from the ESS. However, Waves 6 and 7 of the ESS (2012 and 2014) have not recorded occupation using ISCO88 codes but using ISCO08 codes. Hence, for these two waves I first convert ISCO08 codes into ISCO88 codes using the crosswalk provided by Ganzeboom and Treiman (2015). All the analyses include year/wave fixed effects that capture measurement error that is specific to particular waves.

As discussed, as part of my identification strategy instead of considering the effect of individuals' own automation risk, I consider the effect of individuals' exposure to automation risk through the occupation of their spouse or partner. All three data sources—ISSP-SI, ESS and ISSP-ROG—have collected data on the occupation of individuals' spouses using ISCO codes. Although considering spousal occupation risk has the advantage that the automatability of individuals' own occupation can be used as a generic control variable, the disadvantage is that the sample is reduced to individuals with a partner only. As before, matching of the occupational automatability indicator is done on the basis of two-digit codes from the 1988 version of the ISCO. Similarly, spousal occupation data from Waves 6 and 7 of the ESS are again converted from ISCO08 codes into ISCO88 codes before matching.

III.C.3. Basic Control Variables

The main empirical models that I estimate include various control variables. Some basic control variables

that I consider are sex (1=male), age and age squared. Because my data are cross-national and collected at different points in time, the basic set of controls not only includes year (or wave) dummies but also country dummies. Preferences for redistribution and occupational automatability likely correlate with education. Hence, I also control for measures of educational differences. To be exhaustive, I thereby use two different measures, one concerning years of education and one concerning level of education (e.g., no formal qualification, lowest formal qualification, et cetera). Similarly, although employment status is partly a realized outcome of occupational automation risk, all models include controls for employment status as a proxy for individual skill differences. Because prior studies find a role for religion in shaping preferences for redistribution (e.g., Basten and Betz 2013), I further include sets of dummies both for individuals' religious denomination and for their attendance of religious services. Tables A.2-A.4 in Appendix A provide details on the measures used.

As much as possible, the control variables that I include to address potential omitted variable bias are measured at the individual level. The skill intensity of one's occupation may, for instance, affect preferences for redistribution but this effect is controlled for by including measures of individuals' years of education and education level. Notwithstanding, to make sure that any found effect of occupational automatability on preferences for redistribution is genuinely due to automatability I also consider two other features of individuals' occupation, namely its routineness and its complexity. The specific measures that I use are the same measures of job routineness and job complexity considered earlier (see Table I for details). An important downside of including these two control variables is that they are available for fewer occupations than the measure of occupational automatability is. Hence, the models that control for occupational task routineness and complexity are not my preferred models.

III.B.4. Sample-Specific Control Variables

Whereas the basic control variables are independent from the sample considered, ISSP-SI, ESS or ISSP-ROG, further control variables that I use are typically only available for a specific sample.

ISSP-SI Control Variables

Relevant control variables that are specific to the ISSP-SI sample concern individuals' economic and social status and their experience of socioeconomic mobility. Both these factors are partly a realized outcome of occupational automation risk but also important determinants of preferences of redistribution (see, for example, Alesina et al. 2018 or Corneo and Grüner 2002). I measure economic status using an item asking respondents about their social class (e.g., working class or middle class) and social status using an item asking respondents to rank their social position in society, whether they tend towards the top or towards the bottom. Concerning socioeconomic mobility, I consider individuals' actual experience of mobility, which is measured by a set of dummies that measures how the prestige of an individual's job compares to the prestige of the job of his/her father. In addition, I consider a measure of individuals' self-reported beliefs about what it is needed for getting ahead in society, specifically the importance of family income. Table A.2 provides details on these items and the measures used in the analyses of the ISSP-SI sample.

ESS Control Variables

Relevant control variables that are specific to the ESS sample again concern economic status and experienced socioeconomic mobility but also two other measures that speak to the net pecuniary gains that an individual can expect from redistribution and his/her skill level. In addition, the analyses of the ESS sample consider some unique measures of individuals' preferences and motivations. To proxy economic status I use the ESS item asking respondents about their income (measured on a 10- or 12-point scale) to create an indicator of rank income, meaning the percentile score of an individual's income relative to other individuals in the same country. Similarly, I consider experienced socioeconomic mobility by including two sets of dummies capturing features of the socioeconomic status of individuals' parents. The first set concerns the level of education of an individual's father and mother respectively, while the second set concerns the employment status of the individual's father and his/her mother when the individual was 14 years old. A further ESS-specific control variable that I consider because it likely

affect individuals' expected benefits from government redistribution is their health status where individuals with poorer health are expected to benefit more from redistribution and therefore to have stronger preferences for redistribution. Similarly, I consider an individual's prior unemployment experience (1=yes; 0=no), as this variable speaks to the individual's skill level but also to the likelihood of future unemployment and hence his/her income and wealth prospects.

Concerning individuals' preferences I include a variety of measures. The first measure is the classic left-right political self-placement scale in which respondents identify their political preferences on a spectrum that ranges from left to right (e.g., Di Tella and MacCulloch 2005). Left-right political orientation has been identified as part of a cluster of preferences involving the role of government in the economy, including preferences for redistribution (Jæger 2008; Knutsen 1995; Scheepers and Te Grotenhuis 2005). Hence, including this measure provides powerful means to rule out that there is a generic preference factor that causes individuals with a strong preference for redistribution to self-select into occupations that are highly automatable and vice versa.

The second measure is a composite index of individuals' trust in politics, specifically trust in their country's parliament and trust in politicians. The idea is that occupational automation risk affects individuals' political attitudes, which then may go on to affect their preferences for redistribution. By controlling for trust in politics, however, the analysis can focus on the direct effect of automation risk on preferences for redistribution. Table A.3 provides details on the construction of the trust in politics index and the various other items and measures used in the analyses of the ESS sample.

Finally, I include a set of indicators measuring individuals' basic values, as identified by Schwartz's framework of universal human values, the leading framework of personal values in psychology (e.g., Schwartz 1992). The 10 basic values in this framework are universal in that they are recognized in all cultures and distinct in that they refer to different motivations. The values further form a circumplex that reflects the compatibility of each motivation with the other motivations. Specifically, values that are close in the circumplex have compatible motivations, referring to goals that can be achieved simultaneously without one necessarily coming at the expense of the other (see Figure B.1 in Appendix B). Values that

are opposite each other in the circumplex, in contrast, are not compatible and cannot be achieved simultaneously. Finally, the framework conceptualizes values as having a relative priority only and not an absolute priority. Hence, it is not possible for individuals to attach great value to everything. A short description of the 10 basic values is as follows (Schwartz et al. 2001, p. 270): *Power* refers to a desire for social status and prestige and for control or dominance over people and resources; *Achievement* refers to a desire for personal success; *Hedonism* refers to a desire for pleasure and enjoying life; *Stimulation* refers to a desire for novelty and an exciting and challenging life; *Self-direction* refers to a desire for being creative and independent and having freedom; *Universalism* refers to a desire for understanding, appreciating and tolerating others, and protection of the welfare of all people and nature; *Benevolence* refers to a desire for preserving and enhancing the welfare of people with whom one is in frequent personal contact; *Tradition* refers to a desire for respect for, commitment to, and acceptance of the customs and ideas that traditional culture or religion provide individuals; *Conformity* refers to a desire to restrain oneself to avoid actions likely to upset or harm others and violate social expectations or norms; finally, *Security* refers to a desire for safety, harmony, and social order. Appendix B provides detailed information on the empirical operationalization of the framework of universal human values using questionnaire items included in the ESS.

ISSP-ROG Control Variables

Relevant control variables that are specific to the ISSP-ROG sample again concern different measures of individuals' preferences. The Role of Government modules of the ISSP contain data on individuals' preferences towards a variety of social and economic policies. Taking individuals' preference for government support of declining industries as the dependent variable thus creates the opportunity to use measures of other policy preferences as control variables. I consider four such preferences. First and foremost, when analyzing individuals' preference for government support of declining industries, I control for individuals' generic preference for redistribution. The second policy preference concerns individuals' preference for government financing of projects for new jobs. The third policy preference

concerns individuals' preference for government spending on unemployment benefits. Finally, the analysis of the ISSP-ROG sample considers the preference for government responsibility in providing a decent living standard for the unemployed. Together, these four measures likely capture important individual differences concerning both preferences and skills that could otherwise bias the analyses using individuals' preference for government support of declining industries as the dependent variable. Table A.4 present details on the various ISSP-ROG measures used. Meanwhile, due to missing data, analyses of the ISSP-ROG sample are unable to control for some of the factors considered in the analyses of the ISSP-SI and ESS samples, for instance socioeconomic mobility.

IV. RESULTS

IV.A. Evidence from the ISSP-SI Sample

Table II presents the baseline results. Consistent with my hypothesis, results indicate a strong positive relationship between the strength of individuals' preferences for redistribution and their occupational automatability or automation risk (Model 1). This relationship becomes only slightly less strong when controlling for measures concerning socioeconomic mobility (Model 2) where socioeconomic mobility has the expected effect on preferences for redistribution. For example, compared to individuals with a job that has much more prestige than their father's job, the preference for redistribution of individuals with a job that has much less prestige than their father's job is about 0.08 standard deviations higher. Adding variables concerning economic and social status does lower the estimated coefficient for occupational automatability. However, the relationship remains highly statistically significant (Models 3 and 4). Results are also largely the same when considering job routineness and job complexity as additional control variables (Model 5). In fact, the estimated coefficient for automation risk increases somewhat in Model 5 compared to Model 4. Possible explanation for this finding involves the criterion requiring at least 20 individual observations per occupation when constructing occupational routineness and complexity indicators, which filters out occupations that are relatively rare (see Section II). Hence,

compared to Model 4, Model 5 includes fewer occupations that are relatively rare and for which occupational automatability is measured with more measurement error. This reduction in measurement error, in turn, could shift the size of the estimated coefficient for occupational automation risk upwards. In general, the model with occupational controls is not my preferred model, however, given that this model concerns fewer observations, particularly 27 instead of 33 occupations.

<<Insert Table II about here>>

Comparing effect sizes, say, social class seems more important for understanding differences in preferences for redistribution than occupational automation risk, as evidenced by the size of the standardized coefficient (-0.097 vs. 0.054; Model 3). However, part of the effect of occupational automation risk on preferences for redistribution involves occupational automatability negatively impacting individuals' socioeconomic status. Moreover, automatability is measured at the occupation level and not at the individual level where there is more variation.

Finally, results are robust to the use of indicators of occupational automatability constructed using fewer or more than 20 underlying individual observations (see Section II) or considering automatability measured at the three- or four-digit ISCO level instead of at the two-digit level (Table A.6 in Appendix A). The most noticeable difference is that in the models with occupational automatability measured at the three- or four-digit level (Models A3 and A4), the estimated coefficient for automation risk is lower than before. As before, possible explanation for this finding is that a more fine-grained occupational classification implies that the automatability indicator is calculated using fewer underlying individual observations per occupation on average, likely resulting in more measurement error and a corresponding downward shift in the estimated coefficient.

<<Insert Table III about here>>

Digging deeper, results indicate that the apparent effect of exposure to automation risk also occurs when considering the occupational automation risk of individuals' spouses instead of—or, more correctly, in addition to—individuals' own occupational automation risk (Table III). Controlling for employment status, social class or job routineness, among others, as in Table II goes a long way in ruling out that the relationship between occupational automatability and preferences for redistribution is spurious, driven by, say, unobserved differences in individuals' skills. However, given that the relationship between exposure to automation risk and preferences for redistribution also exists in case of indirect exposure, it seems even more implausible that some unobserved differences between individuals are driving this apparent relationship. Overall, the evidence thus strongly supports a significant effect of occupational automation risk on individuals' preferences for redistribution.

IV.B. Evidence from Other Samples and Further Robustness Checks

To extend the main analyses involving the ISSP-SI sample and provide further evidence of the robustness of the effect of occupational automatability on preferences for redistribution, Tables A.7-A.8 in Appendix A present results for analyses using the ESS sample. In all cases, results confirm the conclusion that (direct or indirect) exposure to automation risk significantly strengthens individuals' preferences for redistribution. In addition, control variables that are unique to this sample, for example political left-right self-placement or health status, have the expected relationship with individuals' preference for redistribution.

Turning to the ISSP-ROG sample and using a dependent variable that concerns a concrete policy action with redistributive consequences, results again support the earlier conclusion that occupational automation risk affects individuals' preferences for redistributive government policy (Table A.9 in Appendix A). Also with, among others, individual differences in the generic preference for redistribution and for government financing of projects for new jobs controlled for, there is a significant relationship between (direct or indirect) exposure to automation risk and the strength of individuals' preference for government support of declining industries.

V. CONCLUSION

This paper shows that individuals in occupations that are more at risk of losing their job to automation have stronger preferences for redistribution. This result is supported by evidence from three different large-scale cross-country survey data sets and extends to preferences for a concrete policy action with redistributive consequences in the form of government support for declining industries. Furthermore, findings are robust to the inclusion of a large variety of control variables, including some unique measures of individuals' preferences and variables such as socioeconomic status that are partly a realized outcome of occupational automation risk. Finally, the effect of automation risk on preferences for redistribution is also found when considering indirect exposure to automation risk through the occupation of one's spouse or partner. Hence, results do not appear driven by unobserved individual differences in preferences or skill level.

Recent years have seen an increasingly intense debate about the possible disruptive effects of technological advances in robotics and artificial intelligence algorithms, among others. A most prominent issue thereby involves the distributional effects of technological change and the concern that some groups in society will not only lose from automation in relative terms but possibly also in absolute terms. However, as this paper shows, automation can have important societal implications even when the objective threat of automation causing unemployment and income losses is limited. The reason is that fear and anxiety about automation alone are sufficient to radically alter people's political attitudes and increase the pressure on governments to take action.

Appendix A

<<Insert Tables A.1-A.9 here>>

Appendix B

This appendix describes the operationalization of the framework of universal human values using the Portrait Values Questionnaire or PVQ developed by Schwartz and collaborators (Schwartz et al. 2001). The PVQ consists of 21 "portraits" that ask individuals to describe themselves. The generic item text reads: "Now I will briefly describe some people. Please listen to each description and tell me how much each person is or is not like you." Answers can range from "1, Very much like me" to "6, Not like me at all." Table B.1 describes the 21 portraits and how they relate to the 10 basic values and motivations recognized in the universal human values framework.

<<Insert Table B.1 about here>>

As mentioned in the main text, in the universal human values framework, values only have a relative priority and not an absolute priority. Practically, getting from absolute scores on the PVQ items to relative priorities, requires that we ipsatize all individual ratings (Schwartz et al. 2001). To do so, we first need to calculate individuals' average score on the 21 items and then subtract this average score from individuals' scores on each item. This renders item scores that are standardized to indicate how weakly or strongly an individual scores on a particular value item compared to his/her score on other value items. Moreover, given that answers originally come on a 1 to 6 scale, ipsatized item scores can, in principle, vary from -5 to +5. Finally, ipsatized scores on the 21 items can be used to construct individual ratings on the 10 basic human values, following the mapping presented in Table B.1. In this case, ipsatized item scores are simply added and divided by the number of items. Theoretically, the range of possible scores on the resulting values measures can again range from -5 to +5. Figure B.1 present a graphical description of the interrelationship between the 10 distinct basic values in the framework of universal human values.

<<Insert Figure B.1 about here>>

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Table I. Construct Validity of Occupational Automatability.

Correlations for 27 occupations	Automatability	Routineness
Automatability	1	
Routineness	0.542	1
Complexity	-0.623	-0.773

Notes: Indicators of occupational task routineness and complexity are constructed to concern occupations at the two-digit level of the 1988 version of the ISCO. Data on job routineness and 1988 ISCO codes are available from Waves 2 and 5 of the European Social Survey or ESS (European Social Survey 2016). I measure routineness using the ESS item asking respondents to indicate how much the statement "there is a lot variety in my work" applies to their job. Respondents can respond using the following answer scale: "1, Not at all true," "2, A little true," "3, Quite true," or "4, Very true." The occupational routineness indicator is constructed by reverse coding individual answers on this item and aggregating them at the two-digit ISCO level. Data on job routineness and complexity and 1988 ISCO codes are available from Waves 3-6 of the European Working Conditions Survey or EWCS (European Foundation for the Improvement of Living and Working Conditions 2018). I measure job complexity using the EWCS item asking respondents whether their generally job involves complex tasks (1) or not (0). The occupational complexity indicator is constructed by aggregating individual answers on this item at the two-digit ISCO level. Dropping occupations with fewer than 20 underlying individual responses for both the routineness and the complexity indicator leaves 27 two-digit occupations.

Table II. Occupational Automatability and Preferences for Redistribution.

Dependent = preference for redistribution	1	2	3	4	5
Automation risk	0.077 (0.018) [0.000]	0.074 (0.018) [0.000]	0.054 (0.014) [0.001]	0.054 (0.014) [0.001]	0.057 (0.016) [0.002]
Sex (1=Male)	-0.129 (0.022) [0.000]	-0.131 (0.022) [0.000]	-0.126 (0.018) [0.000]	-0.130 (0.018) [0.000]	-0.128 (0.021) [0.000]
Years of education	-0.011 (0.014) [0.408]	-0.011 (0.014) [0.424]	0.012 (0.013) [0.353]	0.012 (0.013) [0.370	0.015 (0.013) [0.248]
Belief about importance of family wealth for getting ahead	-	0.066 (0.006) [0.000]	-	0.057 (0.006) [0.000]	0.057 (0.006) [0.000]
Rank of social class	-	-	-0.097 (0.007) [0.000]	-0.095 (0.007) [0.000]	-0.092 (0.007) [0.000]
Rank of top-bottom self-placement	-	-	-0.094 (0.006) [0.000]	-0.091 (0.006) [0.000]	-0.091 (0.006) [0.000]
Job routineness	-	-	-	-	0.002 (0.028) [0.938]
Job complexity	-	-	-	-	-0.009 (0.027) [0.745]
Dummies for occupational prestige relative to father	No	Yes	No	Yes	Yes
Dummies for employment status	Yes	Yes	Yes	Yes	Yes
Dummies for education level	Yes	Yes	Yes	Yes	Yes
Dummies for religious denomination	Yes	Yes	Yes	Yes	Yes
Dummies for religious attendance	Yes	Yes	Yes	Yes	Yes
Age and age^2	Yes	Yes	Yes	Yes	Yes
Dummies for country	Yes	Yes	Yes	Yes	Yes
Dummies for year	Yes	Yes	Yes	Yes	Yes
No. of occupations	33	33	33	33	27
No. of individuals	44,935	44,935	44,935	44,935	44,493
R^2	0.1987	0.2033	0.2192	0.2225	0.2229

Notes: Results obtained using the ISSP-SI sample. Standard errors (in parentheses) are robust standard errors that are clustered at the level of occupations. P-values are in square brackets. The dependent variable and continuous independent variables are standardized to have a mean of 0 and a standard deviation of 1. To save space, the table presents a selection of coefficients, standard errors and p-values but complete results are available on request.

Table III. Spousal Automation Risk and Preferences for Redistribution.

Dependent = preference for redistribution	6	7	8
Spousal automation risk	0.034 (0.012) [0.006]	0.028 (0.012) [0.024]	0.026 (0.010) [0.017]
Automation risk	-	0.055 (0.008) [0.000]	0.055 (0.009) [0.000]
Spousal job routineness	-	-	0.022 (0.014) [0.130]
Spousal job complexity	-	-	0.003 (0.014) [0.801]
Other control variables	Yes	Yes	Yes
No. of spousal occupations	33	33	27
No. of individuals	29,303	25,685	25,376
R^2	0.2374	0.2490	0.2515

Notes: Results obtained using the ISSP-SI sample. Standard errors (in parentheses) are robust standard errors that are clustered at the level of spousal occupations. P-values are in square brackets. The dependent variable and continuous independent variables are standardized to have a mean of 0 and a standard deviation of 1. Other control variables are years of education, sex, belief about importance of family wealth for getting ahead, rank of social class, rank of top-bottom self-placement, dummies for employment status, dummies for religious denomination, dummies for religious attendance, dummies for occupational prestige relative to father, dummies for education level, age, age squared, dummies for country and dummies for year (see Model 4 in Table II). To save space, the table presents a selection of coefficients, standard errors and p-values but complete results are available on request.

Table A.1. Automatability of Selected Occupations.

Occupation (two-digit ISCO88 code in square brackets)	Automatability score
Legislators and senior officials [11]	3.24
Physical, mathematical and engineering science professionals [21]	3.35
Corporate managers [12]	3.53
General managers [13]	3.66
Customer services clerks [42]	3.83
Metal, machinery and related trades workers [72]	3.84
Office clerks [41]	3.84
Machine operators and assemblers [82]	3.91
Drivers and mobile-plant operators [83]	3.96

Notes: Source is own calculations based on data from the 1997 ISSP Work Orientations module (ISSP Research Group 1999).

Table A.2. Variable Description and Descriptive Statistics for Selected ISSP-SI Variables.

Variable and variable description	Mean and SD	
Preference for redistribution (1-5). See the main text for a description.	3.71	(1.16)
Occupational automation risk (two-digit ISCO88) (1-5) [n=45,061]. See the main text for a description.	3.76	(0.144)
Spousal automation risk (1-5) (two-digit ISCO88) [n=29,303]. See the main text for a description.	3.77	(0.144)
Occupational automation risk (three-digit ISCO88) (1-5) [n=43,710]. See the main text for a description.	3.77	(0.194)
Occupational automation risk (four-digit ISCO88) (1-5) [n=33,778]. See the main text for a description.	3.78	(0.249)
Sex (1=male; 0=female)	47.1%	(49.9%)
Age(in years)	46.5	(16.3)
Years of education. Measured by the item asking respondents how many (full-time equivalent) years they have been in formal education.	11.6	(3.78)
Education level. Measured as a set of dummies derived from the item asking respondents about the highest level of education that they have attained. Answers are coded using the International Standard Classification for Education (ISCED): "No formal qualification," "Lowest formal qualification," "Above lowest qualification," "Higher secondary completed," "Above higher secondary level," or "University degree completed, graduate studies."		
Employment status. Measured as a set of dummies derived from the item asking respondents about their current employment status / economic position / main source of living. Answer categories are "Employed, full-time," "Employed, part-time," "Employed, less than part-time," "Helping family member," "Unemployed," "Student, at school, in education, vocational training," "Retired," "Housewife, houseman, home duties," "Permanently disabled, sick," "Other, not in labor force," or "Employed" (with the latter category only used in the 1987 module).		
Social class percentile rank. Measured by the item asking respondents to which social class they belong. Possible answers are Lower class, Working class, Lower middle class, Middle class, Upper middle class, or Upper class. To fit the idea of median income or wealth (Meltzer and Richards 1981) answers are recoded into a percentile score that ranks respondents' social class relative to the social class of respondents from the same country surveyed in the same year.	50.3	(26.4)
Top-bottom self-placement percentile rank. Measured by the item asking respondents for a subjective assessment of the group in society to which they belong, a group that tends towards the top or a group that tends towards the bottom. Answers range from "1, Lowest/Poorest/Bottom" to "10, Highest/Richest/Top." To fit the idea of median income or wealth (Meltzer and Richards 1981) answers are recoded into a percentile score that ranks respondents' top-bottom self-placement relative to the top-bottom self-placement of respondents from the same country surveyed in the same year.	50.4	(27.9)
Belief about importance of family wealth for getting ahead (1-5). Measured by the item asking respondents how important coming from a wealthy family is for getting ahead. Possible answers range from "1, Essential" to "5, Not	2.87	(1.13)

important at all" and are reverse coded for the empirical analysis.		
Occupational status compared to father. Measured as a set of dummies derived from the item asking respondents about the level of status of their job compared to their father's job. Possible answers are "Much higher," "Higher," "About equal," "Lower," "Much lower," "I never had a job," or "I don't know what my father did, father never had a job, never knew father."		
Religious denomination. Measured as a set of dummies derived from the item asking "Do you belong to a religion and, if yes, which religion do you belong to?" Answer categories are "No religion," "Roman Catholic," "Protestant," "Christian Orthodox," "Jewish," "Islam," "Buddhism," "Hinduism," "Other Christian Religions," "Other Eastern Religions," "Other Religions," or "No (Christian) denomination given."		
Religious attendance. Measured as a set of dummies derived from the item asking respondents about their attendance of religious services. Possible answers are "Once or several times a week," "Once to three times a month," "Several times a year," "Less frequently, once or twice a year," "Never," or "Not applicable, no (Christian) religion."		
Job routineness (two-digit ISCO88) (1-4) [n=44,493]. See Table I / the main text for a description.	2.13	(0.321)
Job complexity (two-digit ISCO88) (0-1) [n= 44,493]. See Table I / the main text for a description.	0.598	(0.165)
Spousal job routineness (1-4) (two-digit ISCO88) (1-4) [n=25,376]. See Table I / the main text for a description.	2.13	(0.316)
Spousal job complexity (0-1) (two-digit ISCO88) (0-1) [n=25,376]. See Table I / the main text for a description.	0.599	(0.163)

Notes: Standard deviations in parentheses. Number of observations is 61,386 unless otherwise indicated. Sources are own calculations and the four ISSP Social Inequality modules (ISSP Research Group 2014).

Table A.3. Descriptive Statistics for Selected ESS Variables.

Variable and variable description	Mean and SD	
Preference for redistribution (1-5). See the main text for a description.	3.83	(1.05)
Occupational automation risk (1-5) (two-digit ISCO88) [n=149,645]. See the main text for a description.	3.75	(0.145)
Spousal automation risk (1-5) (two-digit ISCO88) [n=63,201]. See the main text for a description.	3.74	(0.154)
Power values (-5,5). See Appendix B for a description.	-0.891	(0.867)
Achievement values (-5,5). See Appendix B for a description.	-0.429	(0.924)
Hedonism values (-5,5). See Appendix B for a description.	-0.231	(0.967)
Stimulation values (-5,5). See Appendix B for a description.	-0.703	(0.992)
Self-direction values (-5,5). See Appendix B for a description.	0.404	(0.765)
Universalism values (-5,5). See Appendix B for a description.	0.598	(0.632)
Benevolence values (-5,5). See Appendix B for a description.	0.711	(0.641)
Tradition values (-5,5). See Appendix B for a description.	0.008	(0.911)
Conformity values (-5,5). See Appendix B for a description.	-0.128	(0.943)
Security values (-5,5). See Appendix B for a description.	0.362	(0.857)
Left-right self-placement (0, Left - 10, Right). Measured by the item "In politics people sometimes talk of "left" and "right." Using this card, where would you place yourself on this scale, where 0 means the left and 10 means the right?"	5.10	(2.18)
Political trust. Measured as the factor of two items (Cronbach α = 0.842, well-above the standard threshold value of 0.7; e.g., Clark and Watson 1995). The first item asks about "trust in the country's parliament" and the second item about "trust in politicians." Both items use a Likert-type answer scale that ranges from "0, No trust at all" to "10, Complete trust."	0.134	(0.971)
Sex (1=male; 0=female)	48.8%	(50.0%)
Age (in years)	47.6	(17.6)
Years of education. Measured by the item asking respondents how many years of fulltime education they have completed.	12.8	(4.06)
Education level. Measured as a set of dummies derived from the item asking respondents about the highest level of education that they have achieved. Answer are coded using the ESS version of the ISCED: "Less than lower secondary education," "Lower secondary education completed," "Upper secondary education completed," "Post-secondary non-tertiary education completed," "Tertiary education completed," "Other," or "Not possible to harmonize."		

Employment status. Measured as a set of dummies derived from the item asking respondents about what they have been doing for the last 7 days. Answers are coded into the following categories: "Paid work," "Education," "Unemployed, looking for job," "Unemployed, not looking for job," "Permanently sick or disabled," "Retired," "Community or military service," "Housework, looking after children, others," or "Other."		
Income rank percentile. Measured using the item asking respondents about the total net income of their household. Waves 1-3 of the ESS used a 12-point scale, while the later waves used a 10-point answer scale for this item. Hence, to ensure intertemporal as well as cross-country comparability answers are recoded into a percentile score that ranks respondents' score on the income scale relative to the income scores of respondents from the same country surveyed in the same year.	52.3	(28.3)
Poor health (1-5). Measured by the item asking "How is your health in general?" with five possible answers, ranging from "1, Very good" to "5, Very bad."	2.16	(0.890)
Unemployed and seeking work for more than three months (1=yes; 0=no). Measured by the item asking respondents whether they have ever been unemployed and seeking work for a period of more than three months?	26.8%	(44.3%)
Education level father. Measured as a set of dummies derived from the item asking respondents about the highest level of education achieved by their father. Answer are coded using the ESS version of the ISCED) "Less than lower secondary education," "Lower secondary education completed," "Upper secondary education completed," "Post-secondary non-tertiary education completed," "Tertiary education completed," "Other," or "Not possible to harmonize."		
Education level mother. Measured as a set of dummies derived from the item asking respondents about the highest level of education achieved by their mother. Answer are coded using the ESS version of the ISCED: "Less than lower secondary education," "Lower secondary education completed," "Upper secondary education completed," "Post-secondary non-tertiary education completed," "Tertiary education completed," "Other," or "Not possible to harmonize."		
Employment status father when respondent was 14. Measured as a set of dummies derived from the item asking "When you were 14, did your father work as an employee, was he self-employed, or was he not working then?" Possible answers are "Employee," "Self-employed," "Not working," or "Father dead/absent."		
Employment status mother when respondent was 14. Measured as a set of dummies derived from the item asking "When you were 14, did your mother work as an employee, was she self-employed, or was she not working then?" Possible answers are "Employee," "Self-employed," "Not working," or "Mother dead/absent."		
Religious denomination. Measured as a set of dummies derived from the item asking respondents which religion or denomination they belong to at present. Individuals that indicated having no religion or domination are coded as the base category. Other answer categories are "Roman Catholic," "Protestant," "Eastern Orthodox," "Other Christian denomination," "Jewish," "Islamic," "Eastern religions," or "Other non-Christian		

religions." Base category is individuals that indicated having no religious denomination.		
Religious attendance. Measured as a set of dummies derived from the item asking "Apart from special occasions such as weddings and funerals, about how often do you attend religious services nowadays?" Possible answers are "Every day," "More than once a week," "Once a week," At least once a month," "Only on special holy days," "Less often," or "Never."		
Job routineness (two-digit ISCO88) (1-4) [n=148,968]. See Table I / the main text for a description.	2.10	(0.321)
Job complexity (two-digit ISCO88) (0-1) [n=148,968]. See Table I / the main text for a description.	0.609	(0.167)
Spousal job routineness (1-4) (two-digit ISCO88) (1-4) [n=60,535]. See Table I / the main text for a description.	2.06	(0.299)
Spousal job complexity (0-1) (two-digit ISCO88) (0-1) [n=60,535]. See Table I / the main text for a description.	0.631	(0.164)

Notes: Standard deviations in parentheses. Number of observations is 162,399 unless otherwise indicated. Sources are own calculations and ESS, Waves 1-7 (European Social Survey 2016).

Table A.4. Descriptive Statistics for Selected ISSP-ROG Variables.

Variable and variable description	Mean and SD	
Preference for government support of declining industries (1-5). See the main text for a description.	2.57	(1.17)
Occupational automation risk (1-5) (two-digit ISCO88). See the main text for a description.	3.75	(0.154)
Spousal automation risk (1-5) (two-digit ISCO88) [n=16,544]. See the main text for a description.	3.76	(0.153)
Preference for redistribution (1-5). Measured using the same item on preferences for redistribution as used by ISSP-SI (see the main text).	2.98	(0.988)
Preference for government financing of projects for new jobs (1-5). Measured by the item asking respondents about their view on government financing of projects to create new jobs. The item starts with the same generic text as the measure concerning government support of declining industries. Answers can range from "1, Strongly in favor of" to "5, Strongly against" and are reverse coded for the empirical analysis.	3.13	(0.911)
Preference for government spending on unemployment benefits (1-5). Measured by the item asking respondents whether they would like to see more or less government spending on employment benefits. Answers can range from "1, Spend much more" to "5, Spend much less" and are reverse coded for the empirical analysis.	3.10	(1.02)
Preference for government responsibility for living standard of the unemployed (1-4). Measured by the item asking respondents whether it should or should not be the government's responsibility to provide a decent standard of living for the unemployed. Possible answers can range from "1, Definitely should be" to "4, Definitely should not be" and are reverse coded for the empirical analysis.	2.84	(0.873)
Sex (1=male; 0=female)	51.0%	(50.0%)
Age (in years)	46.1	(15.5)
Years of education. Measured by the item asking respondents how many (full-time equivalent) years they have been in formal education.	12.6	(3.50)
Education level. Measured as a set of dummies derived from the item asking respondents about the highest level of education that they have attained. Answers are coded using the International Standard Classification for Education (ISCED): "No formal qualification," "Lowest formal qualification," "Above lowest qualification," "Higher secondary completed," "Above higher secondary level," or "University degree completed, graduate studies."		
Employment status. Measured as a set of dummies derived from the item asking respondents about their current employment status / economic position / main source of living. Answer categories are "Employed, full-time," "Employed, part-time," "Employed, less than part-time," "Helping family member," "Unemployed," "Student, at school, in education, vocational training," "Retired," "Housewife, houseman, home duties," "Permanently disabled, sick," "Other, not in labor force," or "Employed."		
Religious denomination. Measured as a set of dummies derived from the item asking "Do you belong to a religion and, if yes, which religion do you belong to?" Answer categories are "No religion," "Roman Catholic," "Protestant," "Christian Orthodox," "Jewish," "Islam,"		

"Buddhism," "Hinduism," "Other Christian Religions," "Other Eastern Religions," "Other Religions," or "No denomination given."		
Religious attendance. Measured as a set of dummies derived from the item asking respondents about their attendance of religious services. Possible answers are "No religion," "Several times a week," "Once a week," "Two or three times a month," "Once a month," "Several times a year," "Once a year," "Less frequently," or "Never."		
Job routineness (two-digit ISCO88) (1-4) [n=29,062]. See Table I / the main text for a description.	2.10	(0.313)
Job complexity (two-digit ISCO88) (0-1) [n=29,062]. See Table I / the main text for a description.	0.614	(0.165)
Spousal job routineness (1-4) (two-digit ISCO88) (1-4) [n=16,201]. See Table I / the main text for a description.	2.09	(0.306)
Spousal job complexity (0-1) (two-digit ISCO88) (0-1) [n=16,201]. See Table I / the main text for a description.	0.615	(0.162)

Notes: Standard deviations in parentheses. Number of observations is 29,718 unless otherwise indicated. Sources are own calculations and the third and fourth Role of Government module of the ISSP (ISSP Research Group 2008).

Table A.5. Construct Validity of Measured Preference for Redistribution.

Description of construct related to preference for redistribution	Average redistribution preference (1-5)		
Government should provide jobs for everyone who wants one [n=34,826]			
Strongly agree	4.20	(SD=1.05)	[n=12,486]
Agree	3.62	(SD=0.942)	[n=12,284]
Neither agree nor disagree	3.26	(SD=1.03)	[n=4,298]
Disagree	2.70	(SD=1.10)	[n=4,494]
Strongly disagree	2.00	(SD=1.30)	[n=1,264]
Government should provide decent living standard for unemployed [n=42,180]			
Strongly agree	4.45	(SD=0.936)	[n=9,660]
Agree	3.73	(SD=0.978)	[n=17,837]
Neither agree nor disagree	3.47	(SD=1.10)	[n=8,432]
Disagree	3.03	(SD=1.26)	[n=4,786]
Strongly disagree	2.79	(SD=1.56)	[n=1,465]
Government should provide basic income for all [n=32,792]			
Strongly agree	4.25	(SD=1.03)	[n=9,399]
Agree	3.66	(SD=0.945)	[n=11,657]
Neither agree nor disagree	3.39	(SD=1.01)	[n=4,202]
Disagree	2.89	(SD=1.15)	[n=5,495]
Strongly disagree	2.46	(SD=1.41)	[n=2,039]

Notes: Standard deviations in parentheses. Number of observations in square brackets. Data are from the first, second and fourth ISSP Social Inequality modules (ISSP Research Group 2014).

Table A.6. Robustness of ISSP-SI Results to Construction of Occupational Automatability Indicator.

Dependent = preference for redistribution	Minimum 50 individual observations for measuring occupational automatability	Minimum 10 individual observations for measuring occupational automatability	Occupational automatability measured at three-digit ISCO level	Occupational automatability measured at four-digit ISCO level
	A1	A2	A3	A4
Automation risk	0.055 (0.014) [0.001]	0.053 (0.014) [0.001]	0.040 (0.011) [0.000]	0.030 (0.010) [0.003]
Control variables	Yes	Yes	Yes	Yes
No. of two-digit occupations	31	36	-	-
No. of three-digit occupations	-	-	111	-
No. of four-digit occupations	-	-	-	179
No. of individuals	44,889	45,061	43,710	33,778
R^2	0.2227	0.2225	0.2228	0.2205

Notes: Results obtained using the ISSP-SI sample. Standard errors (in parentheses) are robust standard errors that are clustered at the level of two-digit occupations, three-digit occupations or four-digit occupations. P-values are in square brackets. The dependent variable and continuous independent variables are standardized to have a mean of 0 and a standard deviation of 1. Control variables are years of education, sex, belief about importance of family wealth for getting ahead, rank of social class, rank of top-bottom self-placement, dummies for employment status, dummies for religious denomination, dummies for religious attendance, dummies for occupational prestige relative to father, dummies for education level, age, age squared, dummies for country and dummies for year (see Model 4 in Table II). To be sure, for the models with occupational automatability measured at the three- or four-digit ISCO level, I only include occupations with minimum 20 individual observations for measuring occupational automatability. To save space, the table presents a selection of coefficients, standard errors and p-values but complete results are available on request.

Table A.7. Occupational Automatability and Preferences for Redistribution, ESS Sample.

Dependent = preference for redistribution	A5	A6	A7	A8	A9	A10
Automation risk	0.078 (0.014) [0.000]	0.061 (0.011) [0.000]	0.068 (0.010) [0.000]	0.051 (0.008) [0.000]	0.050 (0.008) [0.000]	0.046 (0.009) [0.000]
Income rank	-	-0.105 (0.012) [0.000]	-	-0.083 (0.010) [0.000]	-0.081 (0.009) [0.000]	-0.082 (0.010) [0.000]
Poor health	-	0.031 (0.004) [0.000]	-	0.015 (0.003) [0.000]	0.014 (0.003) [0.000]	0.014 (0.003) [0.000]
Unemployment experience (1=yes)	-	0.099 (0.007) [0.000]	-	0.074 (0.007) [0.000]	0.072 (0.007) [0.000]	0.073 (0.007) [0.000]
Political left/right self-placement	-	-	-0.185 (0.018) [0.000]	-0.176 (0.017) [0.000]	-0.170 (0.017) [0.000]	-0.176 (0.018) [0.000]
Political trust	-	-	-0.057 (0.005) [0.000]	-0.046 (0.006) [0.000]	-0.047 (0.006) [0.000]	-0.046 (0.006) [0.000]
Job routineness	-	-	-	-	-	-0.001 (0.016) [0.952]
Job complexity	-	-	-	-	-	-0.016 (0.017) [0.342]
Sex (1=Male)	-0.146 (0.016) [0.000]	-0.129 (0.013) [0.000]	-0.079 (0.010) [0.000]	-0.072 (0.009) [0.000]	-0.072 (0.008) [0.000]	-0.068 (0.011) [0.000]
Years of education	-0.021 (0.008) [0.014]	-0.014 (0.008) [0.074]	-0.034 (0.006) [0.000]	-0.016 (0.005) [0.005]	-0.015 (0.005) [0.007]	-0.014 (0.005) [0.010]
21-item PVQ values battery	No	No	No	No	Yes	No
10 basic human values	No	No	Yes	Yes	No	Yes
Dummies education level father	Yes	No	No	Yes	Yes	Yes
Dummies education level mother	Yes	No	No	Yes	Yes	Yes
Dummies employment status father individual age 14	Yes	No	No	Yes	Yes	Yes
Dummies employment status mother individual age 14	Yes	No	No	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
No. of occupations	31	31	31	31	31	27
No. of individuals	149,645	149,645	149,645	149,645	149,645	148,968
R^2	0.1330	0.1437	0.1832	0.1936	0.2012	0.1942

Notes: Results obtained using the ESS sample. Standard errors (in parentheses) are robust standard errors that are clustered at the level of

occupations. P-values are in square brackets. The dependent variable and continuous independent variables are standardized to have a mean of 0 and a standard deviation of 1. Other control variables are dummies for employment status, dummies for religious denomination, dummies for religious attendance, dummies for education level, age, age squared, dummies for country and dummies for year. Model A9 repeats model A8 but instead of including measures of the 10 basic human values it includes the complete set of items used to measure these 10 values (see Appendix B). The advantage of including the 21 items separately is that they provide a more fine-grained measure of individual differences in preferences. The disadvantage is that the theoretical meaning of these 21 items is not clear. Hence, the model that includes measures of the 10 basic human values is the preferred model. To save space, the table presents a selection of coefficients, standard errors and p-values but complete results are available on request.

Table A.8. Spousal Automation Risk and Preferences for Redistribution, ESS sample.

Dependent = preference for redistribution	A11	A12	A13
Automation risk	-	0.058 (0.005) [0.000]	0.057 (0.005) [0.000]
Spousal automation risk	0.035 (0.008) [0.000]	0.031 (0.008) [0.000]	0.020 (0.008) [0.019]
Spousal job routineness	-	-	0.011 (0.015) [0.473]
Spousal job complexity	-	-	-0.009 (0.015) [0.5556]
Other control variables	Yes	Yes	Yes
No. of spousal occupations	31	31	27
No. of individuals	63,201	61,006	60,535
R^2	0.2067	0.2082	0.2086

Notes: Results obtained using the ESS sample. Standard errors (in parentheses) are robust standard errors that are clustered at the level of spousal occupations. P-values are in square brackets. The dependent variable and continuous independent variables are standardized to have a mean of 0 and a standard deviation of 1. Other control variables are years of education, sex, income rank, poor health, unemployment experience, political trust, political left/right self-placement, 10 basic human values, dummies for employment status, dummies education level father, dummies education level mother, dummies employment status father individual age 14, dummies employment status mother individual age 14, dummies for religious denomination, dummies for religious attendance, dummies for education level, age, age squared, dummies for country and dummies for year (see Model A8 in Table A.7). To save space, the table presents a selection of coefficients, standard errors and p-values but complete results are available on request.

Table A.9. Exposure to Automation Risk and Preferences for Government Support of Declining Industries.

Dependent = preference for government support of declining industries	A14	A15	Occupational controls A16	Spousal automation risk A17	Spousal automation risk A18
Automation risk	0.090 (0.013) [0.000]	0.060 (0.009) [0.000]	0.051 (0.013) [0.001]	0.047 (0.008) [0.000]	0.050 (0.008) [0.000]
Spousal automation risk	-	-	-	0.039 (0.009) [0.000]	0.022 (0.012) [0.073]
Preference for redistribution	-	0.139 (0.007) [0.000]	0.138 (0.007) [0.000]	0.142 (0.009) [0.000]	0.141 (0.009) [0.000]
Preference for government financing of job creation	-	0.231 (0.006) [0.000]	0.232 (0.006) [0.000]	0.222 (0.008) [0.000]	0.220 (0.008) [0.000]
Preference for government spending on unemployment benefits	-	0.091 (0.008) [0.000]	0.092 (0.008) [0.000]	0.088 (0.008) [0.000]	0.089 (0.008) [0.000]
Preference for government responsibility for living standard of the unemployed	-	0.083 (0.006) [0.000]	0.083 (0.006) [0.000]	0.082 (0.009) [0.000]	0.082 (0.009) [0.000]
Job routineness	-	-	0.027 (0.011) [0.025]	-	-
Job complexity	-	-	0.005 (0.014) [0.728]	-	-
Spousal job routineness	-	-	-	-	0.010 (0.013) [0.420]
Spousal job complexity	-	-	-	-	-0.020 (0.013) [0.135]
Sex (1=male)	-0.239 (0.020) [0.000]	-0.186 (0.014) [0.000]	-0.187 (0.014) [0.000]	-0.223 (0.016) [0.000]	-0.232 (0.016) [0.000]
Years of education	-0.075 (0.010) [0.000]	-0.062 (0.009) [0.000]	-0.059 (0.010) [0.000]	-0.059 (0.007) [0.000]	-0.055 (0.007) [0.000]
Other control variables	Yes	Yes	Yes	Yes	Yes
No. of occupations	33	33	27	-	-
No. of spousal occupations	-	-	-	33	27
No. of individuals	29,718	29,718	29,062	16,544	16,201
R^2	0.1422	0.2597	0.2618	0.2609	0.2623

Notes: Results obtained using the ISSP-ROG sample. Standard errors (in parentheses) are robust standard errors that are clustered at the level of occupations or spousal occupations respectively. The dependent variable and continuous independent variables are standardized to have a mean of

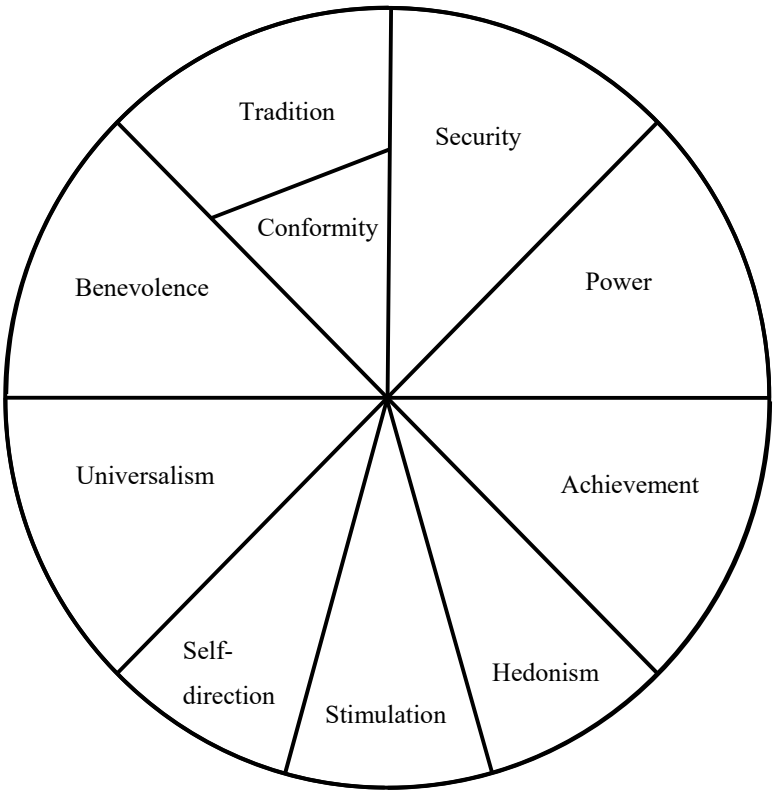
0 and a standard deviation of 1. Other control variables are dummies for employment status, dummies for religious denomination, dummies for religious attendance, dummies for education level, age, age squared, dummies for country and dummies for year. To save space, the table presents a selection of coefficients, standard errors and p-values but complete results are available on request.

Table B.1. Items for Measuring Basic Human Values.

Basic value	Portrait Values Questionnaire (PVQ) items
Self-direction	1. Thinking up new ideas and being creative is important to him/her. He/she likes to do things in his/her own original way. 2. It is important to him/her to make his/her own decisions about what he/she does. He/she likes to be free and not depend on others.
Stimulation	3. He/she likes surprises and is always looking for new things to do. He/she thinks it is important to do lots of different things in life. 4. He/she looks for adventures and likes to take risks. He/she wants to have an exciting life.
Hedonism	5. Having a good time is important to him/her. He/she likes to "spoil" him/herself. 6. He/she seeks every chance he/she can to have fun. It is important to him/her to do things that give him/her pleasure.
Achievement	7. It is very important to him/her to show his/her abilities. He/she wants people to admire what he/she does. 8. Being very successful is important to him/her. He/she hopes people will recognize his/her achievements.
Power	9. It is important to him/her to be rich. He/she wants to have a lot of money and expensive things. 10. It is important to him/her to be in charge and tell others what to do. He/she wants people to do what he/she says.
Security	11. It is important to him/her to live in secure surroundings. He/she avoids anything that might endanger his/her safety. 12. It is important to him/her that the government insure his/her safety against all threats. He/she wants the state to be strong so it can defend its citizens.
Conformity	13. He/she believes that people should do what they are told. He/she thinks people should follow rules at all times, even when no one is watching. 14. It is important to him/her always to behave properly. He/she wants to avoid doing anything people would say is wrong.
Tradition	15. It is important to him/her to be humble and modest. He/she tries not to draw attention to him-/herself. 16. Tradition is important to him/her. He/she tries to follow the customs handed down by his/her religion or his/her family.
Benevolence	17. It is very important to him/her to help the people around him/her. He/she wants to care for their well-being. 18. It is important to him/her to be loyal to his/her friends. He/she wants to devote herself to people close to him/her.
Universalism	19. He/she thinks it is important that every person in the world be treated equally. He/she believes everyone should have equal opportunities in life. 20. It is important to him/her to listen to people who are different from him/her. Even when he/she disagrees with them, he/she still wants to understand them. 21. He/she strongly believes that people should care for nature. Looking after the environment is important to him/her.

Notes: See Schwartz et al. (2001) for details.

Figure B.1. Framework of Universal Human Values.



Notes: The 10 basic values refer to distinct motivations guiding human action. The place of a value in the circumplex reflects the value's compatibility with the other values where values that are adjacent are compatible whereas values that are opposite each other are not compatible. The main text provides a description of the 10 basic values. See Schwartz (1992) and Schwartz et al. (2001) for details.