Jnl. Soc. Pol. (2024), 53, 3, 751–771 doi:10.1017/S0047279422000629

Wishing for More: Technological Change, the Rise of Involuntary Part-Time Employment and the Role of Active Labour Market Policies

LARS VAN DOORN* **AND OLAF VAN VLIET****

*Leiden University, Department of Economics
email: l.m.j.van.doorn@law.leidenuniv.nl
**Leiden University, Department of Economics and Institute of Public Administration
email: o.p.van.vliet@law.leidenuniv.nl
Corresponding author, email: l.m.j.van.doorn@law.leidenuniv.nl

Abstract

Technological change has squeezed the demand for middle-skill jobs, which typically involve routine-intense tasks. This squeeze has coincided with an increase in the number of part-time working individuals who wish to work more hours. We argue that these two trends are linked. Due to the decline of middle-skill employment, medium-educated workers shift into low-skill employment, increasing the supply of labour for jobs in this segment of the labour market. This pushes those dependent on these jobs to accept part-time jobs, even if these involve fewer hours than they prefer. To empirically assess this claim, we analyse involuntary part-time employment across 16 European countries between 1999 and 2010. Our analysis confirms that a decline in middle-skill employment is associated with an increase in involuntary part-time employment at the bottom end of the labour market. This finding implies that the automation of routine-intense labour worsens employment possibilities in this segment of the labour market. However, we show that training and job creation schemes mitigate this effect. These programmes cushion competition either by providing medium-educated workers with the necessary skills to shift into high-skill jobs or by increasing employment possibilities. Thus, governments have the tools to support workers facing challenges in the knowledge economy.

Keywords: automation; social investment; knowledge economy; involuntary part-time; low-skill employment

1. Introduction

Technological change is one of the main drivers of the transition to the knowledge economy. The consequences of this transition for the labour market feature prominently on the political agendas in many Western countries. Amongst the numerous policy reports which have been published about this topic, one of the publications that triggered the policy debate the most is arguably the OECD's (2019) 'Under Pressure: The Squeezed Middle Class'. The report depicts the

unequal distributive effects of new technologies: the number of jobs involving routine-intense tasks, typically occupied by medium-educated workers, declined due to the increased applicability of computers and robotics. At the same time, non-standard employment is on the rise, in particular at the bottom of the labour market. For instance, recent studies report a growing number of part-time working individuals who wish to work more hours (Greve, 2017). This has raised concerns as these jobs exhibit higher risks of in-work poverty (Gardiner and Millar, 2006; Marx et al., 2012; Brülle et al, 2019).

We contribute to the comparative political economy literature by providing a novel theoretical explanation that ties the declined demand for routine-intense labour and involuntary part-time employment together. Building on previous studies showing that replacement risks are a key determinant in explaining labour market outcomes (Eichhorst and Marx, 2015; Reichelt, 2015; Bellani and Bosio, 2019; Weisstanner, 2021; Mattijssen et al., 2020), we argue that those in low-skill employment also feel the squeeze in demand for routine-intense labour. Workers in this segment of the labour market have a relatively high replacement risk, even though their jobs involve tasks that cannot easily be performed by computers or robotics (Autor et al., 2003; Acemoglu and Autor, 2011). However, the skills needed to perform these tasks typically require little investments in education or training (Goldthorpe, 2000; Emmenegger, 2009). Hence, these workers can easily be replaced by someone else. This makes them relatively vulnerable to shifts in supply of labour (Eichhorst and Marx, 2015). The increased supply for low-skill jobs, resulting from a substantial number of medium-educated workers that shifted into low-skill employment (Murphy, 2014; Cortes, 2016; Dauth et al., 2017; Kurer and Gallego, 2019; Acemoglu and Restrepo, 2020), has been corrosive to the bargaining power of these workers. That in turn pushes them to accept part-time jobs that involve fewer than the desired number of hours.

This study empirically assesses the link between the size of middle-skill employment and the incidence of involuntary part-time employment across 16 European countries for the period 1999-2010. Our empirical analysis also examines the role of active labour market policies (ALMPs). In particular, social investment-oriented ALMPs – policies aimed at stimulating labour market participation – might cushion competition for low-skill employment as they aim to prevent new social risks that are associated with the transition to the knowledge economy from materialising (Taylor-Gooby, 2004; Bonoli, 2013). So far, the effectiveness of ALMPs is mainly examined in relation to labour market participation, either measured using the employment rate or the unemployment rate (Abrassart, 2015; Benda et al., 2019; Bakker and Van Vliet, 2021). However, an empirical assessment of whether these programmes have actually protected workers against new social risks, like possessing obsolete skills due to the automation of routine-intense labour, is lacking. Our analysis provides insights into

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

the effectiveness of ALMPs in protecting workers from these risks. These insights are also relevant for governments' employment policies.

2. Theory

The dwindling shares of middle-skill employment

Recently, studies in the field of labour economics have shaken up the consensus that technological change mainly erodes low-skill employment (Autor et al., 2003; Spitz-Oener, 2006; Acemoglu and Autor, 2011; Goos et al., 2014).[1] Focussing on a job's task content rather than its skill level, these studies show that technological change is routine-biased. New technologies are especially suited to perform routine tasks, that can be characterised as repetitive, procedural and rule-based. As jobs involving these routine tasks typically lie in the middle of the skills distribution, medium-educated workers have been gradually substituted for computers and robotics. This has resulted in a squeezed demand for routine-intense labour, attested by dwindling shares of middle-skill employment in Western economies (Michaels et al., 2014; Gregory et al., 2022).

In contrast, both the shares of low- and high-skill employment have grown during the same period. Again, the explanation for this trend is rooted in the task content of these jobs (Autor et al., 2003; Acemoglu and Autor, 2011). On the higher end of the skills distribution, digital capital has complemented workers performing non-routine cognitive tasks. Accordingly, the demand for high-educated workers increased, fuelling the transition to the knowledge economy. On the other end of the skills distribution, jobs involve non-routine manual tasks that cannot easily be substituted by computers or robotics, like cleaning, renovating, or serving. This implies that these workers are relatively sheltered from automation risks. Besides, the demand for low-skill labour increased, predominately due to the growing demand for low-skill services (Goos and Manning, 2007; Autor and Dorn, 2013).[2]

These findings resonate with the comparative political economy literature analysing the service sector expansion that underpinned the transition to the knowledge economy (Iversen and Wren, 1998; Wren, 2013; Hope and Martelli, 2019). On this reading, the adoption of new technologies in high-end service sectors increased the demand for high-educated workers, given their complementary skills. As a corollary, high-educated workers concentrated in sectors, like finance, business services and communication.[3] Meanwhile, low-educated workers shifted from shrinking traditional sectors, like agriculture and manufacturing, into low-end service sectors in which the diffusion of new technologies is relatively limited.

Our argument builds on these insights, but departs from the automation of routine-intense labour and its effect on employment possibilities for medium-educated workers. Note that jobs involving routine tasks were both prevalent in

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

the manufacturing sector and high-end service sectors. Not only the number of blue-collar jobs, like machine operators and assemblers, but also white-collar jobs, like customer service employees and office clerks, have sharply declined during the last decades (Goos et al., 2009; 2014). This study therefore focusses on jobs instead of sectors in analysing the widespread effects of technological change.

The squeezed demand for routine-intense labour has affected medium-educated workers' employment possibilities: they have become more likely to work in low-skill employment over the past decades (OECD, 2020; Van Vliet et al., 2021). This shift stems from the nature of these workers' skills which are typically less suited to the tasks involved in high-skill jobs compared to those in low-skill jobs. This explains why a substantial number of displaced medium-educated workers shifted into low-skill employment, albeit some middle-educated workers managed to retain their job (Murphy, 2014; Cortes, 2016; Kurer and Gallego, 2019; Acemoglu and Restrepo, 2020). Furthermore, young labour market entrants who completed medium-education are more likely to start working in low-skill jobs (Dauth et al., 2017). At this point, it is important to note that there might be variation in this regard between countries as ALMPs, in particular training, and vocational education and training (VET) systems might provide workers with the necessary skills to shift into high-skill jobs (Busemeyer and Trampusch, 2012; Wang, 2020). Nevertheless, the overall picture shows a growing share of middle-educated workers in low-skill employment, increasing the competitive pool for jobs in this segment of the labour market.

The above-described trends are confirmed by Figure 1, which shows employment data of 16 European countries in the period between 1999 and 2010. First, low-skill employment as a share of total employment indeed increased. The United Kingdom is leading the pack, just ahead of Finland, Norway, and Spain, with an increase in the share of low-skill employment of eight percentage points. The only exceptions are Italy and Luxembourg – in these countries the share of low-skill employment declined, respectively with four and one percentage points. More importantly, the figure confirms the expected shift of medium-educated workers into low-skill employment. In fact, the shares of these workers in low-skill jobs increased by at least 10 percentage points in the majority of the countries. The largest increases can be found in Belgium, Greece and Finland, where their share increased by approximately 18 percentage points. Interestingly, Denmark, Norway, and Sweden – the other three Scandinavian countries – are the only countries bucking this trend.

Replacement risks and shifting supply

Although sheltered from automation risks, the squeezed demand for routine-intense labour also worsens the employment possibilities for workers

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

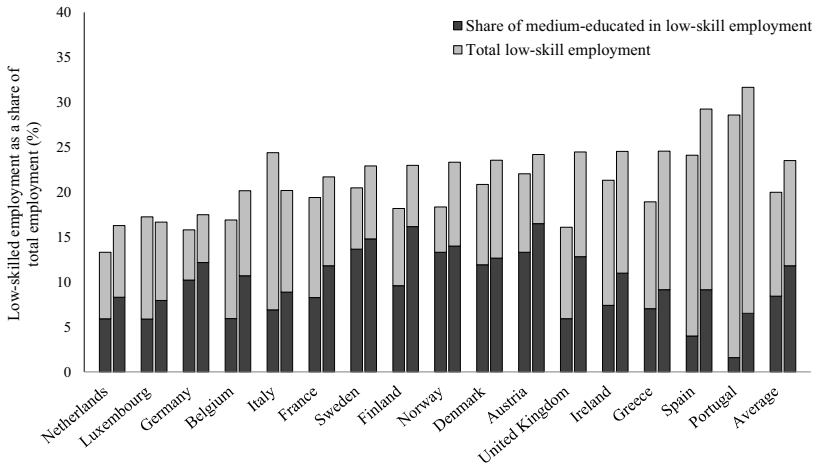

FIGURE 1. Medium-educated workers' dependence on low-skill employment, 1999 and 2010
Source: European Union Labour Force Survey (Eurostat, 2019).
Notes: Job categorisation based on ISCO-88. Educational attainment coded according to ISCED.

in low-skill employment. The skills needed to perform tasks associated with low-skill jobs typically require little investment in training or education. Due to this skill profile workers at the bottom end of the labour market have a relatively high replacement risk: employers can replace these workers relatively easily (Goldthorpe, 2000; Emmenegger, 2009; Eichhorst and Marx, 2015). As replacement is lurking, the bargaining power of these workers is relatively limited. In the same vein, as the burden of finding a replacement is relatively low, employers face few incentives to bind workers to the firm through favourable working conditions, like permanent full-time contracts. This mechanism explains differences in workers' job trajectories (Eichhorst and Marx, 2015; Reichelt, 2015; Mattijssen et al., 2020), and relative wage risks resulting from labour market flexibilisation (Bellani and Bosio, 2019; Weisstanner, 2021).

The skill profile of workers in low-skill employment makes them relatively vulnerable to the shifts in labour supply stemming from the automation of routine-intense labour. The described inflow of medium-educated workers in the competitive pool for low-skill jobs implies a growing number of potential substitutes for workers depending on this type of employment (Acemoglu and Restrepo, 2020). This in turn has a corrosive effect on these workers' already limited bargaining power, pushing them to accept part-time jobs that involve few hours to prevent unemployment. Moreover, recall that the growing shares of low-skill employment are mainly driven by the increased demand for low-skill services, which includes a lot of jobs that require flexible working times to meet customers' needs (Hipp et al., 2015). The increased supply of labour

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

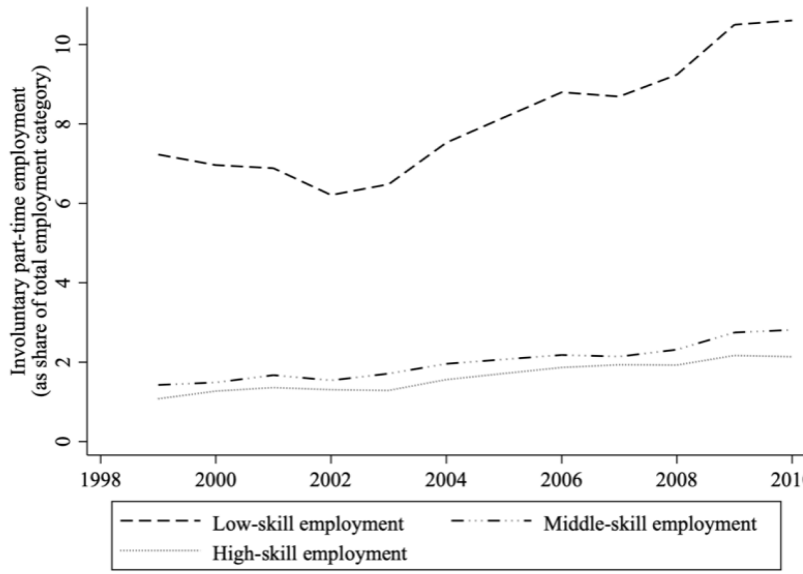

FIGURE 2. Rise of involuntary part-time employment at the bottom end of labour market
Source: European Union Labour Force Survey (Eurostat, 2019).
Notes: Job categorisation based on ISCO-88. Presented trends illustrate an average of 16 countries.

for low-skill jobs gives employers greater leverage to achieve this flexibility through the use of part-time contracts.

This dynamic implies a macro-level increase in the number of part-time employed workers who wish to work more hours, in particular at the bottom end of the labour market. Studies presenting descriptive evidence show that their numbers are indeed rising in Europe (Greve, 2017). Besides, the share of involuntary part-time employment is highest amongst low-skilled service workers (Peugny, 2019). The labour market data presented in Figure 2 tell the same tale. Whereas the share of involuntary part-time employment is relatively stable in middle- and high-skill employment, the share has increased in low-skill employment. Hence, we expect that a decline in the size of middle-skill employment is associated with an increase in the incidence of involuntary part-time employment at the bottom end of the labour market.

ALMPs: cushioning competition

Active labour market policies (ALMPs) might cushion the competition that stems from the increased supply of labour for low-skill jobs. These policies took off in the 1990s when many governments transformed their welfare states

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

against a backdrop of growing concerns regarding their carrying capacity, and the emergence of new social risks stemming from the transition to the knowledge economy (Hemerijck, 2013; Nelson, 2013; Clasen et al., 2016).[4] Accordingly, the rationale underlying labour market policies became the promotion of labour market participation through activation and investment in human capital policy (Bonoli and Natali, 2012:9).

Following Bonoli (2013), we distinguish two types of ALMPs. On the one hand, there are so-called social investment-oriented ALMPs, which invest in human capital and have a pro-market employment orientation. These policies are designed to increase the quantity and quality of the labour force. In particular, two policies are relevant in this regard: training and employment incentives. First, training increases an individual's employability by human capital enhancement, which has been associated with an increase in labour market participation (Kluve, 2010; Card et al., 2018). Training can also help workers, who found themselves possessing obsolete skills due to the automation of routine-intense labour, acquiring the necessary skills to shift into high-skill jobs (Rodrik and Stantcheva, 2021). This might limit the inflow of redundant workers in the competitive pool for low-skill employment. As a result, we expect that high levels of effort on training attenuate the rise in involuntary part-time employment by cushioning competition.

Second, employment incentives also aim to stimulate labour market participation (Graversen and Van Ours, 2011). However, we expect that the effect differs regarding the prevalence of involuntary part-time employment. The bulk of spending in this category includes making-work-pay-policies, like income maintenance and support payments, and back-to-work bonuses. This entails payments to formerly unemployed individuals who have taken up part-time or full-time employment and as a result experience an income loss relative to unemployment benefits. Therefore, they are encouraged to accept (part-time) jobs even though earnings might be lower than the level of benefits due to a lower wage or fewer hours (Haapanala, 2021). Thus, we expect that effort on employment incentives increases the incidence of involuntary part-time employment.

On the other hand, there are demand-side ALMPs that stimulate labour market participation by increasing employment possibilities, like public job creation schemes. The creation of these jobs offers workers dependent on low-skill employment an alternative to exit unemployment. This reduces the need to accept a part-time job in the private sector to prevent unemployment. However, the effectiveness of these schemes in relation to labour market participation is inconclusive (Kluve, 2010; Card et al., 2018). This might call the attractiveness of these public jobs as a realistic alternative into question. Nevertheless, we expect that effort on direct job creation mitigates competition and is thus

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

associated with a decrease in the incidence of involuntary part-time employment.

3. Method, measures and data

Using a partial adjustment model, we regress the share of involuntary part-time employed workers in a country on indicators measuring the automation of routine-intense labour, active labour market policies, and institutional and economic factors (see Appendix 1 for a technical explanation of our model). As this model captures both transitory and permanent effects (De Boef and Keele, 2008; Williams and Whitten, 2012), we are able to analyse not only the immediate impact of the decline of middle-skill jobs but also the way this contributes to the structural change in the dynamics at the bottom end of the labour market. Note that our model controls for serial correlation, panel-heteroscedasticity and contemporaneous spatial correlation (Beck and Katz, 2011).

We define our dependent variable as the number of part-time employed workers who wish to work more than the current number of hours as a share of the total number of workers in low-skill employment (see Appendix 2 for the operationalisation of all variables and sources). To define low-skill employment, we follow Goos et al. (2014) and categorise jobs based on their mean wage rank using two-digit International Standard Classification for Occupations (ISCO) codes.[5] The jobs that are included in this category are typically low-paying and involve few routine tasks, meaning that they are not easy to automate.

Focussing on low-skill employment is relevant for two reasons. First, the automation of routine-intense labour intensifies competition at the bottom end of the labour market (Acemoglu and Restrepo, 2020). Workers in these jobs are especially vulnerable to competitive pressures as they have a relatively high replacement risk. Second, our measure is relevant in the context of the growing number of working poor in Europe, as insufficient working hours, especially in low-skill employment, are one of the main determinants of in-work poverty (Gardiner and Millar, 2006; Marx et al., 2012; Brülle et al., 2019).

For our measure of the size of middle-skill employment, the main independent variable, we again use two-digit ISCO codes to categorise jobs based on the ranking provided by Goos et al. (2014).[6] Subsequently, we use the relative number of hours worked in this category to measure the size of middle-skill employment: this measure is frequently used to analyse the labour market structure (Verdugo and Allègre, 2020; Maarek and Moiteaux, 2021). In this way, we are able to capture the decrease in demand for routine-intense labour, which is associated with an increase in the competitive pool for low-skill jobs.

The data underlying our dependent variable and the main independent variable come from the European Labour Force Survey (Eurostat, 2019). We aggregated micro-level data to create time-series cross-sectional data for 16 countries

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

between 1999 and 2010.[7] Due to a break in the occupational classification in 2011 (from ISCO88 to ISCO08), our analysis focuses on the longest consistent time series available (1999-2010). This could be a potential limitation of our analysis. However, a sensitivity analysis shows that our results also hold if we extend the period to 2018 by applying a crosswalk to link both classifications (see the robustness tests). Furthermore, we restricted our sample to individuals of working-age (15-64), excluding full-time students, unpaid family workers and the agricultural sector. Note that the results of our analysis are not sensitive to the exclusion of these categories.

To analyse the effect of ALMPs, we focus on the three previously described policies: two social investment-oriented ALMPs, training and employment incentives, and public job creation schemes. Effort on each policy is operationalised as expenditures corrected by the number of unemployed relative to GDP per capita. In this regard, the unemployed serve as a proxy for the number of recipients (Van Vliet and Koster, 2011; Kuitto, 2016). The data underlying our measure are from the OECD's Labour Market Programmes, and the National Accounts databases.

In our analysis, we also control for a number of institutions and economic explanations of involuntary part-time employment. First, passive labour market policies (PLMPs) are associated with a shrinkage of the labour supply (Bassanini and Duval, 2009). Hence, we include a measure of PLMPs, which comprises unemployment benefits and early retirement programmes, to control for this. Second, the strictness of employment protection legislation (EPL) might impact hiring decisions of employers (Kalleberg, 2003). We control for this by including the OECD's EPL indicator for regular contracts. Third, the degree of firm involvement in the provision of VET determines the development and quality of medium-educated worker's skills (Busemeyer and Trampusch, 2012). The theoretical skills that are important for (high-end) service sector jobs are less provided if firms are heavily involved in the provision of VET, compared to a school-based setting or on-the-job-learning (Anderson and Hassel, 2013). To account for these differences in the skill formation process, we follow Busemeyer and Iversen (2012) and control for the share of students in vocational training schemes that combine school- and workplace-based VET. Fourth, the effect of automation on labour market outcomes is conditional on the strength of organised labour, reflected by trade union membership and wage-setting institutions (Parolin, 2021). Automation has, however, also chipped away at organised labour's power (Meyer, 2019), and trade unions typically have difficulties gaining ground in the service sector (Brady, 2007; Palier and Thelen, 2010). We control for the strength of organised labour by adding trade union density and the centralisation of wage bargaining. Fifth, we use government partisanship to control for the impact of left-wing governments. Left-wing parties express more criticism regarding various forms of non-standard

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

employment (Picot and Menéndez, 2019). Finally, we account for economic conditions by including GDP growth and the unemployment rate. Economic downturns are typically associated with an increase in involuntary part-time employment (Valletta et al., 2020).

4. Results

Regression results

Table 1a shows the estimation results from our partial adjustment model. The coefficients of the size of middle-skill employment show a negative and statistically significant relationship with the incidence of involuntary part-time employment at the bottom end of the labour market. In other words, a decline in the size of middle-skill employment is associated with an increase in the incidence of involuntary part-time employment. This implies that the automation of routine-intense labour indeed intensifies competition. Moreover, the long-run multiplier shows that a percentage point decrease in middle-skill employment is associated with a permanent increase in involuntary part-time employment of approximately 0.8 percentage points (see Table 1b).[8] These results confirm our hypothesis that technological change pushes workers to accept part-time jobs that have fewer than the desired number of hours.

Turning to the social investment-oriented ALMPs (see Table 1a), effort on training is associated with a decrease in the incidence of involuntary part-time employment. The coefficient is significant, indicating that a one-unit increase in effort on training per unemployed as a share of GDP tends to decrease the incidence of involuntary part-time employment by 0.06 percentage points. This finding is in line with previous studies reporting positive effects regarding effort on training (Kluve, 2010; Card et al., 2018). In contrast, effort on employment incentives is associated with an increase in involuntary part-time employment. This is in line with our expectation that employment incentives encourage unemployed individuals to accept jobs that involve few hours. Finally, effort on direct job creation is associated with a decrease in the incidence of involuntary part-time employment, confirming our expectation. This might provide support for the importance of the cushioning role of demand-side policies, like the "Melkertbanen" in the Netherlands, and "Nouveaux Services Emplois Jeunes" in France (Daguerre, 2007; Huo, 2009; Vlandas, 2013).

With regard to the results of the institutional and economic factors, the coefficients of effort on PLMP and EPL are insignificant. Firm involvement in training seems to increase involuntary part-time employment, providing support for the argument that dual training systems limit a countries' ability to adjust to the knowledge economy (Anderson and Hassel, 2013). Furthermore, trade union density is associated with a decrease in the

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

TABLE 1A. Partial adjustment models of involuntary part-time employment

	Δ Involuntary part-time employment			
	(1)	(2)	(3)	(4)
Competitive pressure				
Size middle-skill employment	−0.094***	−0.208***	−0.096***	−0.154***
	(0.028)	(0.062)	(0.034)	(0.038)
Active labour market policies				
Training	−0.056***	−0.369***	−0.056***	−0.087***
	(0.020)	(0.142)	(0.020)	(0.021)
Middle-skill empl. * Training		0.009**		
		(0.004)		
Employment incentives	0.068***	0.051**	0.056	0.067***
	(0.026)	(0.023)	(0.144)	(0.026)
Middle-skill empl. * Employment incentives			0.000	
			(0.004)	
Direct job creation	−0.074*	−0.059	−0.075*	−0.688**
	(0.038)	(0.037)	(0.039)	(0.323)
Middle-skill empl. * Direct job creation				0.015*
				(0.008)
Institutional and economic factors				
PLMPs	0.001	−0.006	0.001	0.011
	(0.006)	(0.007)	(0.006)	(0.008)
EPL	−0.124	−0.156	−0.126	0.070
	(0.191)	(0.205)	(0.190)	(0.215)
Firm involvement in training	0.014**	0.009	0.014**	0.016**
	(0.007)	(0.008)	(0.007)	(0.007)
Trade union density	−0.026***	−0.026***	−0.027***	−0.031***
	(0.008)	(0.008)	(0.008)	(0.008)
Bargaining centralisation	−0.009	0.097	−0.008	0.022
	(0.160)	(0.143)	(0.161)	(0.166)
Partisanship government (left)	−0.003	−0.002	−0.003	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)
GDP growth	−0.084***	−0.074***	−0.084***	−0.078***
	(0.029)	(0.027)	(0.028)	(0.029)
Unemployment	−0.009	0.028	−0.009	−0.018
	(0.042)	(0.045)	(0.041)	(0.045)
Involuntary part-time employment (t-1)	−0.123***	−0.152***	−0.123***	−0.158***
	(0.026)	(0.029)	(0.026)	(0.033)
Constant	5.899***	10.238***	5.971***	7.968***
	(1.517)	(2.772)	(1.595)	(1.799)
Observations	148	148	148	148
Adjusted R^2	0.260	0.272	0.258	0.268

Note: Panel corrected standard errors (in parentheses) and panel specific AR1 structure (estimated through Prais-Winsten transformation). Trend not shown. * p<0.1, ** p<0.05, *** p<0.01

incidence of involuntary part-time employment, which is in line with previous studies (Parolin, 2021). The coefficients of bargaining centralisation and left-wing governments have the expected sign but are insignificant. Finally, GDP growth is associated with a decrease in the incidence of involuntary

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

TABLE 1B. Partial adjustment models of involuntary part-time employment

	Δ Involuntary part-time employment			
	(1)	(2)	(3)	(4)
Long-run multiplier				
Middle-skill employment	−0.767***	−1.369***	−0.780***	−0.975***
	(0.167)	(0.282)	(0.212)	(0.145)
Observations	148	148	148	148
Adjusted R^2	0.260	0.272	0.258	0.268

Note: Panel corrected standard errors (in parentheses) and panel specific AR1 structure (estimated through Prais-Winsten transformation). * p<0.1, ** p<0.05, *** p<0.01

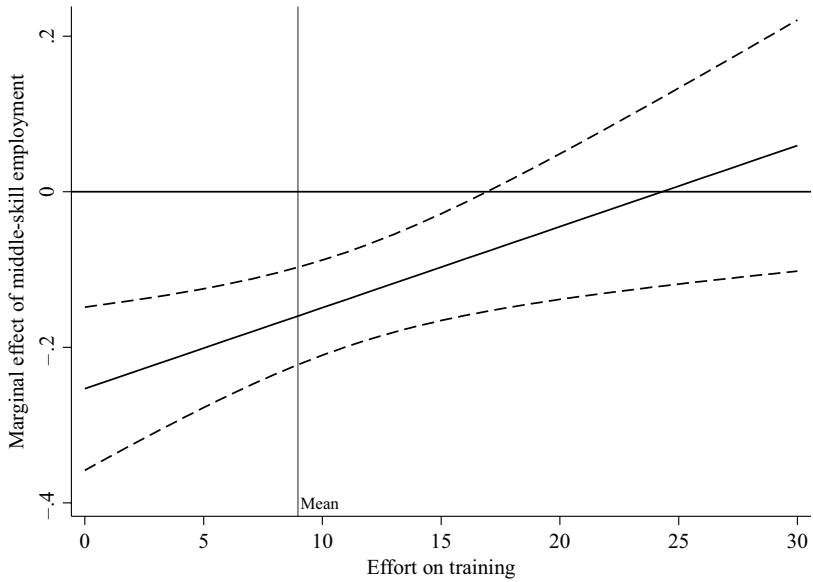

FIGURE 3. Interaction effect of middle-skill employment and effort on training

part-time employment, whereas the coefficient for unemployment is not significant.

Our second hypothesis pertains the potential cushioning role of ALMPs regarding the competition stemming from the squeezed demand for routine-intense labour. Figure 3 graphically plots the result of the interaction with effort on training (see Table 1a for the coefficients). The figure shows that the decline of middle-skill employment does not have a significant effect in countries with relatively high levels of effort on training. However, the average effort on training exceeds 16 percent per unemployed as a share of GDP per capita only in Denmark for the entire period. Besides, for some periods in Austria (between

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

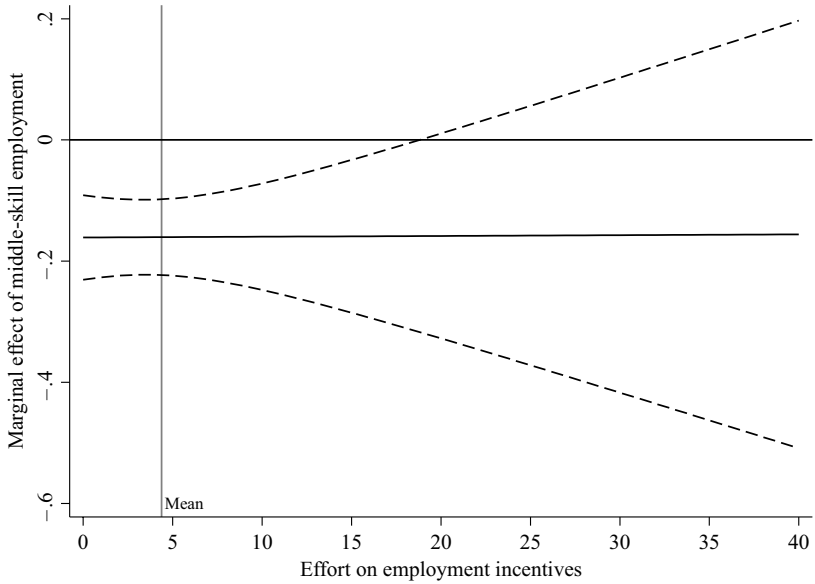

FIGURE 4. Interaction effect of middle-skill employment and effort on employment incentives

2008 and 2010), Norway (between 1999 and 2004, and in 2007) and Sweden (between 1999 and 2002) the yearly level of effort on training exceeds the threshold. Overall, these findings support our hypothesis that effort on training cushions competition, and is thus associated with a decrease in involuntary part-time employment at the bottom end of the labour market. In this regard, this policy seems to live up to expectations.

Figure 4, which plots the interaction with effort on employment incentives, does not show a significant effect. Hence, employment incentives do not exacerbate competition for low- skill employment. Finally, Figure 5 plots the results of the interaction with effort on direct job creation. The plot reveals a similar pattern as described for effort on training. In countries with higher levels of effort on direct job creation, a decline in the size of middle-skill employment does not have a significant effect. The Netherlands is the only country in which effort on job creation exceeds the threshold of 10 percent per unemployed as a share of GDP per capita between 1999 and 2010. Furthermore, effort in Belgium (in 2000 and 2001), France (between 2000 and 2004, and in 2007), Ireland (between 1999-2008), and Luxembourg (in 2010) also exceeds the threshold during some periods. Although the coefficient of the interaction with job creation is only significant at the 10 percent level (also reflected in the confidence intervals), this finding underlines the previously suggested success of demand-

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

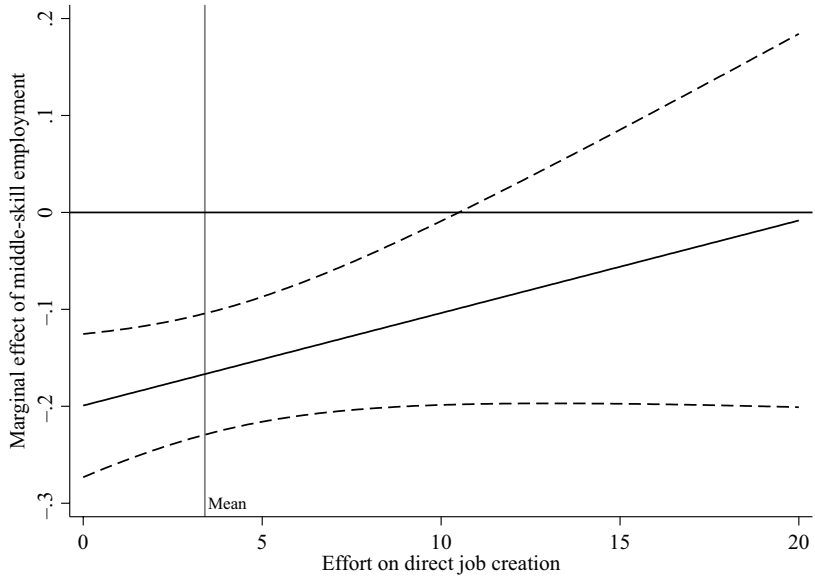

FIGURE 5. Interaction effect of middle-skill employment and effort on direct job creation

side policies in cushioning competition stemming from the automation of routine-intense labour.

Sensitivity analysis

Appendix 2 presents a number of additional estimations to examine the robustness of our results. The first row in this table presents the standardised beta coefficient and LRM of our baseline estimation of the association between the size of middle-skill employment and the incidence of involuntary part-time employment (see Table 1, first column). First, the findings hold if we extend the period to 2018 by applying a crosswalk to link the ISCO-88 and ISCO-08 classifications. Second, our findings are robust if we extend our analysis to the total employment by including all jobs (low-, middle- and high-skill). Note that the magnitude of the coefficients is relatively small compared to the original results. This seems to confirm that the competitive pressures mainly affect those at the bottom end of the labour market. Next, we limit our sample to individuals of prime working age (between 25-54). In this way, we rule out the possibility that our findings are mainly driven by workers just entering the labour market or approaching retirement. Indeed, the presented coefficients are fairly similar. Third, we restrict our sample to either men or women. There are various studies showing that (involuntary) part-time employment is especially relevant regarding women's labour market position (Insarauto, 2021). Although our results

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

confirm that women are more affected by the changing labour market structure, the coefficient for the estimation only including men is also highly significant.

Subsequently, we test the robustness of our results for different methodological specifications. First, we include the initial share of low-skill employment to control for differences between countries to the extent they already relied on low-skill jobs. Second, our preferred specification does not include country and/or year fixed-effects as this might introduce bias into the model (Nickell, 1981) or amplify bias (Plümper and Troeger, 2019). Nevertheless, our results are largely unaltered by the introduction of country fixed effects or a combination of country and year fixed effects. Finally, we test whether our results hold up using a general error correction model.[9] Again, the coefficients remain highly significant and comparable in magnitude.

5. Conclusion

Technological change has transformed Western economies' labour markets substantially since the early 1990s. As artificial intelligence, computers, and robotics proved to be a low-cost substitute for routine-intense labour, medium-educated workers suffered a fall in demand. As a result, a sizeable proportion of medium-educated workers is forced to shift into low-skill employment. We argue that the inflow of these workers in the competitive pool for low-skill employment worsens the employment possibilities of those dependent on this type of employment. Workers in low-skill employment have a high replacement risk: they typically perform tasks that require little investment in training. Their bargaining position corroded as the automation of routine-intense labour increased their potential number of substitutes. This pushed these individuals to accept part-time jobs that involve fewer than the desired number of hours.

Our empirical analysis provides support for the argument that the automation of routine-intense labour is associated with an increase in involuntary part-time employment at the bottom end of the labour market. Analysing 16 European countries between 1999 and 2010, we show that involuntary part-time employment in this segment of the labour market increased at the macro-level. Accounting for the cross-country variation in (labour market) institutions, we show that the decrease in the size of middle-skill employment is associated with an increase in the incidence of involuntary part-time employment, both in the short and the long run. This finding fits within previous studies that showed how high replacement risks impact job trajectories (Reichelt, 2015; Mattijssen et al., 2020), translates into wage pressure in the context of flexibilization (Bellani and Bosio, 2019; Weisstanner, 2021), and affects job quality (Eichhorst and Marx, 2015). Moreover, the results add to the descriptive evidence that the transition to the knowledge economy and the squeezed demand for routine-

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

intense labour are linked to a rise in non-standard employment (Green and Livanos, 2017; Greve, 2017; Peugny, 2019).

Furthermore, the results confirm that effort on training cushions competition for low-skill employment. Previous studies have already shown that training is associated with an increase in the employment rate (Kluve, 2010; Card et al., 2018). We add to this that training helps individuals, whose skills have become obsolete due to automation, acquiring the skills necessary to shift into high-skill jobs. As a result, these programmes relieve pressure on the bottom end of the labour market. We also presented evidence that effort on direct job creation has a similar effect. Encompassing job creation schemes mitigate the adverse effect of the automation of routine-intense labour at the bottom end of the labour market. However, note that our analysis of the effectiveness of ALMPs comes with two limitations. First, our measure does not include benefit conditions and eligibility rules (Knotz, 2020). Besides, ALMPs can complement each other: the success of an individual policy might hinge on such complementarities (Benda et al., 2019; Bakker and Van Vliet, 2021).

To conclude, the transition to the knowledge economy goes hand in hand with increased competition at the bottom end of the labour market, increasing involuntary part-time employment. However, training and direct job creation can cushion this competition. These findings are relevant considering predictions that more jobs will disappear in the next 15 to 20 years (Frey and Osborne, 2013). In this regard, they provide support for the prominence of skills in the European Pillar of Social Rights; an initiative of the European Commission to reform European labour markets. Even so, governments face obstacles in expanding such policies, as recent studies show that these policies have not found their way to workers' hearts yet (Bremer and Bürgisser, 2022; Busemeyer and Sham, 2021).

Supplementary material

To view supplementary material for this article, please visit https://doi.org/10.1017/S0047279422000629

Acknowledgments

This study is part of the research project Flexibilisation, globalisation and technological change: consequences for labour markets and social security. Financial support from Institute Gak is gratefully acknowledged. Earlier versions of this paper were presented at the SASE Conference (July 2020), the 78th Annual Midwest Political Science Association Conference (April 2021), and the 27th International Conference of Europeanists (June 2021). We thank Despina Alexiadou, David Weisstanner and all participants as well as two anonymous reviewers for their helpful comments and suggestions.

Competing interests

The authors declare none.

Notes

1 In the broader literature, this squeeze in demand for routine-intense labour is mainly linked to rising income inequality (Kristal and Cohen, 2017; Parolin, 2021) and political and policy preferences (Thewissen and Rueda, 2019; Kurer, 2020).

2 Note that Oesch and Rodríguez Menes (2011) show that there are large cross-country differences in the growth of low-skill employment.

3 Interestingly, Germany is an important exception in this regard (Diessner et al., 2021). Here, high-educated workers, particularly in science, technology, engineering, and mathematics (STEM), concentrated in the manufacturing sector, whereas reforms across industrial relations and social protection have benefited high-end exporting firms in this sector.

4 Moreover, European integration (Van Vliet and Koster, 2011) and the financial crisis in 2008 (Bengtsson et al., 2017) have fueled this transformation.

5 Based on this categorisation, low-skill employment includes labourers in mining construction, manufacturing and transport; personal and protective service workers; models, salespersons, and demonstrators; and sales and service elementary occupations.

6 The complete list of occupations in middle-skill employment includes: stationary plant and related operators; metal machinery and related trade workers; drivers and mobile plant operators; office clerks; precision, handicraft, craft printing and related trade workers; extraction and building trades workers; customer service clerks; machine operators and assemblers; other craft and related workers.

7 We focus on the countries that made up the European Union previous to the 2004 enlargement (Austria, Belgium, Denmark, Germany, Greece, Finland, France, Luxembourg, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom) plus Norway.

8 Recall that this coefficient captures the total cumulative effect of competition in the long run.

9 The inclusion of lagged independent variables makes this model more flexible. However, this asks a lot more from the data. To illustrate, such a model would include ten differenced independent variables and four interactions instead of one.

References

Abrassart, A. (2015), Low-skill jobs or jobs for low-skilled workers? An analysis of the institutional determinants of the employment rates of low-educated workers in 19 OECD countries, 1997–2010. *Journal of European Social Policy*, 25(2), 225–241.

Acemoglu, D. and Autor, D.H. (2011), Skills, Tasks and Technologies: Implications for Employment and Earnings. In: D. Card and O. Ashenfelter (eds.), *Handbook of Labor Economics*, *Volume* 4, *Part B*. Amsterdam: Elsevier, pp. 1034–1171.

Acemoglu, D. and Restrepo, P. (2020), Robots and jobs: Evidence from US labor markets. *Journal of Political Economy*, 128(6), 2188–2244.

Anderson, K. M. and Hassel, A. (2013), Pathways of change in CMEs: Training regimes in Germany and the Netherlands. A. Wren (ed.), *The political economy of the service transition*. Oxford: Oxford University Press, pp. 171–194.

Autor, D. H., Levy, F. and Murnane, R. J. (2003), The skill content of recent technological change: An empirical exploration. *The Quarterly Journal of Economics*, 118(4), 1279–1333.

Autor, D.H. and Dorn, D. (2013), The growth of low-skill service jobs and the polarization of the US labor market. *American Economic Review*, 103(5), 1553–97.

https://doi.org/10.1017/S0047279422000629 Published online by Cambridge University Press

Bakker, V. and Van Vliet, O. (2021), Social Investment, Employment and Policy and Institutional Complementarities: A Comparative Analysis across 26 OECD countries. *Journal of Social Policy*, 24(1): 1–23.

Bassanini, A. and Duval, R. (2009), Unemployment, institutions, and reform complementarities: re-assessing the aggregate evidence for OECD countries. *Oxford Review of Economic Policy*, 25(1), 40–59.

Beck, N. and Katz, J. N. (2011), Modeling dynamics in time-series-cross-section political economy data. *Annual Review of Political Science*, 14: 331–352.

Bellani, D. and Bosio, G. (2019), Knockin'on heaven's door? Reframing the debate on temporary employment and wages: Evidence from Europe. *Socio-Economic Review*, 19(3): 869–907.

Benda, L., Koster, F. and Van der Veen, R. (2019), Activation is not a panacea: Active labour market policy, long-term unemployment and institutional complementarity. *Journal of Social Policy*, 49(3): 483–506.

Bengtsson, M., De la Porte, C. and Jacobsson, K. (2017), Labour market policy under conditions of permanent austerity: Any sign of social investment? *Social Policy & Administration*, 51(2): 367–388.

Bonoli, G. (2013), *The origins of active social policy: Labour market and childcare policies in a comparative perspective*. Oxford: Oxford University Press.

Bonoli, G. and Natali, D. (2012), 'The Politics of the 'New' Welfare States: Analysing Reforms in Western Europe'. In: G. Bonoli and D. Natali (eds.), *The politics of the new welfare state*. Oxford University Press, pp. 3–20.

Brady, D. (2007), Institutional, economic, or solidaristic? Assessing explanations for unionization across affluent democracies. *Work and Occupations*, 34(1), 67–101.

Bremer, B. and Bürgisser, R. (2022), Public opinion on welfare state recalibration in times of austerity: Evidence from survey experiments. *Political Science Research and Methods*, 1–19.

Brülle, J., Gangl, M., Levanon, A. and Saburov, E. (2019), Changing labour market risks in the service economy: Low wages, part-time employment and the trend in working poverty risks in Germany. *Journal of European Social Policy*, 29(1), 115–129.

Busemeyer, M. R. and Iversen, T. (2012), Collective skill systems, wage bargaining, and labor market stratification. Busemeyer, M. R. and Trampusch, C. (eds.), (2012), *The political economy of collective skill formation*. Oxford: Oxford University Press, pp. 205–233.

Busemeyer, M. R. and Trampusch, C. (eds.), (2012), *The political economy of collective skill formation*. Oxford: Oxford University Press.

Busemeyer, M. and Sham, A. (2021), Social investment, redistribution or basic income? Exploring the association between automation risk and welfare state attitudes in Europe. *Journal of Social Policy*, 1–20.

Card, D., Kluve, J. and Weber, A. (2018), What works? A meta analysis of recent active labor market program evaluations. *Journal of the European Economic Association* 16(3): 894–931.

Clasen, J., Clegg, D. and Goerne, A. (2016), Comparative social policy analysis and active labor market policy: Putting quality before quantity. *Journal of Social Policy* 45(1): 21–38.

Cortes, G. (2016), Where have the middle-wage workers gone? A study of polarization using panel data. *Journal of Labor Economics*, 34(1), 63–105.

Daguerre, A. (2007), *Active labour market policies and welfare reform: Europe and the US in comparative perspective*. New York: Palgrave Macmillan.

Dauth, W., Findeisen, S. and Suedekum, J. (2017), Trade and manufacturing jobs in Germany. *American Economic Review*, 107(5), 337–42.

De Boef, S. and Keele, L. (2008), Taking Time Seriously. *American Journal of Political Science*, 52(1), 184–200.

Diessner, S., Durazzi, N. and Hope, D. (2021), Skill-biased liberalization: Germany's transition to the knowledge economy. *Politics & Society*, 50(1), 117–155.

Eichhorst, W. and Marx, P. (2015), 'Introduction: an occupational perspective on non-standard employment.' In: W. Eichhorst and P. Marx (eds.), *Non-Standard Employment in Post-Industrial Labour Markets*. Cheltenham: Edward Elgar Publishing, pp. 1–25.
Emmenegger, P. (2009), Specificity versus replaceability: the relationship between skills and preferences for job security regulations. *Socio-Economic Review*, 7(3), 407–430.
Eurostat (2019), *European Labour Force Survey*. Brussels.
Frey, C.B. and Osborne, M. (2013), The future of employment: How susceptible are jobs to computerisation? *Oxford Martin School Working Paper*.
Gardiner, K. and Millar, J. (2006), How low-paid employees avoid poverty: An analysis by family type and household structure. *Journal of Social Policy*, 35(3), 351–369.
Goldthorpe, J. H. (2000), On Sociology. *Numbers, Narratives, and the Integration of Research and Theory, 2000*. Oxford: Oxford University Press.
Goos, M. and Manning, A. (2007), Lousy and lovely jobs: The rising polarization of work in Britain. *The review of economics and statistics*, 89(1), 118–133.
Goos, M., Manning, A. and Salomons, A. (2009), Job polarization in Europe. *American economic review*, 99(2), 58–63.
Goos, M., Manning, A. and Salomons, A. (2014), Explaining job polarization: Routine-biased technological change and offshoring. *American Economic Review*, 104(8), 2509–26.
Graversen, B. K. and Van Ours, J. C. (2011), An activation program as a stick to job finding. *Labour*, 25(2), 167–181.
Green, A. and Livanos, I. (2017), Involuntary non-standard employment in Europe. *European Urban and Regional Studies*, 24(2), 175–192.
Gregory, T., Salomons, A. and Zierahn, U. (2022), Racing with or against the machine? Evidence on the role of trade in Europe. *Journal of the European Economic Association* 20(2), 1–38.
Greve, B. (2017), Welfare States and Labour Market Change: What is the Possible Relation? *Social Policy & Administration*, 51(2), 389–403.
Haapanala, H. (2022), Carrots or sticks? A multilevel analysis of active labour market policies and non-standard employment in Europe. *Social Policy & Administration* , 56(3), 1–18.
Hemerijck, A. (2013), *Changing welfare states*. Oxford: Oxford University Press.
Hipp, L., Bernhardt, J. and Allmendinger, J. (2015), Institutions and the prevalence of non-standard employment. *Socio-Economic Review*, 13(2), 351–377.
Hope, D. and Martelli, A. (2019), The transition to the knowledge economy, labor market institutions, and income inequality in advanced democracies. *World Politics*, 71(2), 236–288.
Huo, J. (2009), *Third way reforms: Social democracy after the golden age*. Cambridge: Cambridge University Press.
Insarauto, V. (2021), Women's Vulnerability to the Economic Crisis through the Lens of Part-time Work in Spain. *Work, Employment and Society*, 35(4), 621–639.
Iversen, T. and Wren, A. (1998), Equality, employment, and budgetary restraint: the trilemma of the service economy. *World Politics*, 50(4), 507–546.
Kalleberg, A. L. (2003), Flexible firms and labor market segmentation: Effects of workplace restructuring on jobs and workers. *Work and Occupations*, 30(2), 154–175.
Kluve, J. (2010), The effectiveness of European active labor market programs. *Labour Economics*. 17(6): 904–918.
Knotz, C. M. (2020), Does demanding activation work? A comparative analysis of the effects of unemployment benefit conditionality on employment in 21 advanced economies, 1980–2012. *European Sociological Review*, 36(1), 121–135.
Kristal, T. and Cohen, Y. (2017), The causes of rising wage inequality: The race between institutions and technology. *Socio-Economic Review*, 15(1), 187–212.
Kuitto, K. (2016), From social security to social investment? Compensating and social investment welfare policies in a life-course perspective. *Journal of European Social Policy*, 26(5): 442–459.

Kurer, T. (2020), The declining middle: Occupational change, social status, and the populist right. *Comparative Political Studies*, 53(10-11), 1798–1835.
Kurer, T. and Gallego, A. (2019), Distributional consequences of technological change: Worker-level evidence. *Research & Politics*, 6(1), 1–9.
Maarek, P. and Moiteaux, E. (2021), Polarization, employment and the minimum wage: Evidence from European local labor markets. *Labour Economics*, 73, 102076.
Marx, I., Vanhille, J. and Verbist, G. (2012), Combating in-work poverty in Continental Europe: an investigation using the Belgian case. *Journal of Social Policy*, 41(1), 19–41.
Mattijssen, L., Pavlopoulos, D. and Smits, W. (2020), Occupations and the non-standard employment career: How the occupational skill level and task types influence the career outcomes of non-standard employment. *Work, Employment and Society*, 34(3), 495–513.
Meyer, B. (2019), Financialization, technological change, and trade union decline. *Socio-Economic Review*, 17(3), 477–502.
Michaels, G., Natraj, A. and Van Reenen, J. (2014), Has ICT polarized skill demand? Evidence from eleven countries over twenty-five years. *Review of Economics and Statistics*, 96(1), 60–77.
Murphy, E.C. (2014), Workers' movement out of declining occupations in Great Britain, Germany and Switzerland. *European Sociological Review*, 30(6), 685–701.
Nelson, M. (2013), Making markets with active labor market policies: The influence of political parties, welfare state regimes, and economic change on spending on different types of policies. *European Political Science Review*, 5(2), 255–277.
Nickell, S. (1981), Biases in dynamic models with fixed effects. *Econometrica: Journal of the Econometric Society*, 49(6), 1417–1426.
OECD. (2019), *Under Pressure: The Squeezed Middle Class*. Paris: OECD Publishing.
OECD. (2020), *OECD Employment Outlook 2020*. Paris: OECD Publishing.
Oesch, D. and Rodríguez Menés, J. (2011), Upgrading or polarization? occupational change in Britain, Germany, Spain and Switzerland, 1990–2008. *Socio-Economic Review*, 9(3), 503–531.
Palier, B. and Thelen, K. (2010), Institutionalizing dualism: Complementarities and change in France and Germany. *Politics & Society*, 38(1), 119–148.
Parolin, Z. (2021), Automation, occupational earnings trends, and the moderating role of organized labor. *Social Forces*, 99(3), 921–946.
Peugny, C. (2019), The decline in middle-skilled employment in 12 European countries: New evidence for job polarisation. *Research and Politics*, 6(1), 1–7.
Picot, G. and Menéndez, I. (2019), Political parties and non-standard employment: An analysis of France, Germany, Italy and Spain. *Socio-Economic Review* 17(4), 899–919.
Plümper, T. and Troeger, V. E. (2019), Not so harmless after all: The fixed-effects model. *Political Analysis*, 27(1), 21–45.
Reichelt, M. (2015), Career progression from temporary employment: how bridge and trap functions differ by task complexity. *European Sociological Review*, 31(5), 558–572.
Rodrik, D. and Stantcheva, S. (2021), Fixing capitalism's good jobs problem. *Oxford Review of Economic Policy*, 37(4), 824–837.
Spitz-Oener, A. (2006), Technical change, job tasks, and rising educational demands: Looking outside the wage structure. *Journal of Labor Economics*, 24(2), 235–270.
Taylor-Gooby, P. (ed.) (2004), *New Risks, New Welfare: The Transformation of the European Welfare State*. Oxford: Oxford University Press.
Thewissen, S. and Rueda, D. (2019), 'Automation and the Welfare State: Technological Change as a Determinant of Redistribution Preferences', *Comparative Political Studies*, 52, 2, 171–208.
Valletta, R.G., Bengali, L. and Van der List, C. (2020), Cyclical and Market Determinants of Involuntary Part-Time Employment. *Journal of Labor Economics*, 38(1), 67–93.
Van Vliet, O. and Koster, F. (2011), Europeanization and the political economy of active labour market policies. *European Union Politics*, 12(2), 217–239.

Van Vliet, O., Bakker, V. and Van Doorn, L. (2021), From Social Protection to Social Investment: European Responses to Globalization, Technological Change, Labour Market Flexibilization, and Migration. Fischer, G. and Strauss, R. (eds.), *Europe's Income, Wealth, Consumption, and Inequality*. Oxford: Oxford University Press.
Verdugo, G. and Allègre, G. (2020), Labour force participation and job polarization: Evidence from europe during the great recession. *Labour Economics*, 66, 101881.
Vlandas, T. (2013), Mixing apples with oranges? Partisanship and active labour market policies in Europe. *Journal of European Social Policy*, 23(1), 3–20.
Wang, X. (2020), Labor market polarization in Britain and Germany: A cross-national comparison using longitudinal household data. *Labour Economics*, 65, 101862.
Weisstanner, D. (2021), Insiders under pressure: Flexibilization at the margins and wage inequality. *Journal of Social Policy*, 50(4), 725–744.
Williams, L.K. and Whitten, G.D. (2012), But wait, there's more! Maximizing substantive inferences from TSCS models. *The Journal of Politics*, 74(3), 685–693.
Wren, A. (2013), Introduction: The political economy of post-industrial societies. A. Wren (ed.), *The political economy of the service transition*. Oxford: Oxford University Press, pp. 1–70.