Occupational upgrading, social inclusion and collective skill formation in the transition to the knowledge economy

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Contents

Abstract

Collective skill formation systems were central to sustaining a high-road approach to economic development in industrial societies while maintaining social inclusion. But can they still deliver in knowledge-based societies, both economically and socially? This article argues that nothing intrinsically prevents collective skill formation systems from adapting successfully to the knowledge economy. Such adaptation is not automatic, however. Rather, it depends on the willingness of key actors—unions, employers and the government—to actively adjust such systems to meet the needs of a labour market that has changed fundamentally, primarily because of technological change. Adaptation to the needs of the knowledge economy is thus likely to take country-specific forms and be politically mediated by power dynamics structuring actors' relationships. The argument is probed empirically through a panel analysis testing the effects of collective skill formation systems on a range of socio-economic outcomes and country case studies of Austria, Germany and Switzerland, which illustrate the political dynamics underpinning reforms of collective skill formation systems. Overall, the empirical evidence supports the argument, but it also points towards some difficulties that collective skill formation systems may face in maintaining social inclusion, hinting at the key role that unions may play in that respect.

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1. Introduction

Many countries in North-Western Europe – often referred to as coordinated market economies (CMEs) in the comparative political economy (CPE) literature – combined after the Second World War, putting them on a high road to economic development and to high levels of equality through a set of mutually reinforcing institutions spanning the realms of the welfare state, industrial relations, corporate governance and skill formation (Hall and Soskice 2001; Soskice 1994). The latter has often been singled out as particularly important. In several countries, including Germany, Austria, Switzerland and Denmark, skill formation systems have historically been organised around tight relationships between and a strong commitment on the part of employers, unions and governments, leading to the establishment of collective skill formation systems (Busemeyer and Trampusch 2012; Culpepper 2003; Thelen 2004). These systems simultaneously performed an *economic* and a *social* policy function: they provided high-quality skills that helped firms move 'up-market' and engage in product market strategies premised on (high) quality over (low) cost (Streeck 1997; Thelen and Culpepper 2007), while also catering for young people in the bottom half of the academic ability distribution and offering them smooth school-to-work transitions (Iversen 2005; Soskice 1994). These systems thrived in industrial societies and were particularly well-suited to creating 'intermediate' skills with a strong practical inclination, which enabled workers to attain mid-level jobs (Durazzi and Geyer 2020, 2022). In today's knowledge economies, however, these are precisely the skills that are more likely to be automatised and the jobs that are more likely to be replaced by technology, prompting the feeling that virtue may have turned into vice (Anderson and Hassel 2013; Baethge and Wolter 2015; Müller and Jacob 2008).

Against this backdrop, we ask the following question: can collective skill formation systems still be an effective vehicle of economic *and* social policy in today's knowledge economies? Building on recent literature on the topic (see, for example, contributions in Bonoli and Emmenegger 2022), we answer the question by developing a two-pronged theoretical argument. First, we argue that collective skill formation systems are, generally speaking, expected to be well able to deliver both economically and socially in the knowledge economy. In the second step of the argument, however, we emphasise that transitioning to the knowledge economy puts pressure on collective skill formation systems by biasing skill needs toward the high and cognitive end of the spectrum. These pressures result in country-specific adaptation patterns in both the economic and social realms, depending on the relative balance of power between three key actors, namely employers, unions and governments. In short, we argue that collective skill formation systems can

still be effective vehicles of economic and social policy but they need to be adapted for the purpose and the outcomes will take a country-specific shape.

We pursue this argument using a multi-method approach: in a large-N quantitative part, we employ panel regression analysis to discern the effect of collective skill formation systems on a range of socio-economic outcomes; in a small-N qualitative part, we present brief country case studies of Austria, Germany and Switzerland exploiting similarities (the three countries belong to the universe of collective skill formation) and differences (each country presents a distinct configuration in the distribution of power among employers, unions and the government) to illustrate patterns of adjustment of collective skill formation systems to the knowledge economy. Overall, this article suggests that the traditional institutions of coordinated capitalism may be reasonably resilient in changing socio-economic contexts, but that resilience is not built into institutions. Rather, it needs to be sustained by active coalitional work (Emmenegger 2021), resulting in country-specific adjustment patterns.

The rest of the article proceeds as follows: Section 2 reviews the literature; Section 3 outlines the theoretical argument; Sections 4 and 5 present the findings from the quantitative and the qualitative analyses, respectively; and finally, Section 6 discusses the results of our study in light of the broader CPE literature and offers some concluding thoughts.

2. Collective skill formation systems and the transition to the knowledge economy

The identification of a 'coordinated' model of capitalism that can combine economic success with social inclusion was a major breakthrough in contemporary CPE. Such a combination rested on several mutually reinforcing institutions and policies found in (primarily) Continental and Nordic European countries (Hall and Soskice 2001; Iversen 2005; Martin and Thelen 2007). A crucial role has been traditionally assigned in them to the 'collective' skill formation system, the 'crown jewel' of coordinated capitalism (Thelen 2007). Collective skill formation systems are a product of (pre-) industrial societies (Martin 2012; Thelen 2004) and are characterised by a strong element of practical, work-based learning, alongside a theoretical, school-based component, as embodied in *dual* apprenticeships. After the Second World War – the heyday of collective skill formation systems – these were organised around tight (cooperative and sometimes conflictual) relations between unions and business in the definition of training profiles, skill content and curricula. Governments played a facilitating role, for instance by financing the school-based component of training and offering a broader regulatory framework (Busemeyer and Trampusch 2012; Culpepper 2003). Economic and social contributions were built into the system. From an economic standpoint, high-quality training formed 'polyvalent' workers (Streeck 2012) and helped to impose 'beneficial constraints' on firms, which were pushed to target high-quality market segments (Streeck 1997). In parallel, the system produced socially inclusive outcomes because it provided high-quality training opportunities to young people who were not academically gifted (Soskice 1994: 55).

The ability to perform an economic or social policy function, however, was highly contingent on the configuration of labour markets in industrial societies. The latter were characterised by large industrial sectors that, in turn, fuelled demand for intermediate skills feeding into mid-level occupations (for example, assembly line work) (Durazzi and Geyer 2020, 2022). Over the past 30 years, that world has morphed into something very different as advanced capitalist countries entered the knowledge economy (Diessner et al. 2022; Thelen 2019). The extent and pace of technological change underpinned much of this transformation in that it is precisely those industrial jobs in the middle of the skill distribution, traditionally linked with collective skill formation systems, that have become increasingly at risk from automation (Acemoglu 2002). As technology has replaced workers in the middle of the skill distribution, scholars have painted a rather bleak picture for apprenticeship systems and vocational education and training (Anderson and Hassel 2013; Baethge and Wolter 2015). In short, the view is that collective skill formation systems are likely to come under pressure from both the supply and demand sides. From the supply side, young people and their families are likely

to be increasingly attracted toward general-academic paths (hence, general post-secondary school, followed by a university education). From the demand side, firms are likely to look increasingly for high-cognitive skills typically found in higher education graduates. Therefore, vocational education and training is likely to end up between a rock and a hard place, ultimately losing relevance in contemporary societies.

More recent contributions have challenged earlier assessments of the unviability of collective skill formation systems in the knowledge economy, however. As aptly put by Emmenegger and Haslberger, these pessimistic assessments are often based on 'outdated views' of skill formation systems (Emmenegger and Haslberger 2023). The changing socio-economic context undoubtedly poses a challenge for collective skill formation systems, but standing still in the face of such challenges and letting them 'drift' (Streeck and Thelen 2005) is not the only option. Actors might instead seek to adjust skill formation systems to the new knowledge economy. Scholars have documented the pursuit of this route, pointing to active political-coalitional work (Emmenegger 2021) carried out by social partners and governments to adapt collective skill formation systems to the knowledge economy in both the economic (Busemeyer and Thelen 2022; Carstensen and Ibsen 2021; Durazzi and Benassi 2020; Emmenegger et al. 2023) and social domains (Bonoli and Emmenegger 2021; Carstensen, Emmenegger et al. 2022; Carstensen and Ibsen 2021; Durazzi and Geyer 2020). Why and how is it plausible to assume that collective skill formation systems are still able to deliver economically efficient and socially inclusive outcomes in today's knowledge economies?

3. Theorising the viability of collective skill formation systems in the knowledge economy

This section develops a twofold theoretical proposition: (i) collective skill formation systems may remain viable in the knowledge economy both economically and socially, and (ii) they may do so via country-specific patterns of adjustment that result from the distribution of power between the three main actors in this policy area, namely employers, unions and the government. We discuss each part of the argument in turn.

First, the transition to the knowledge economy, particularly the technological change that underpins it, biases skill needs in important ways: it triggers demand for more complex skill sets and makes cognitive skills more important than manual ones (Acemoglu 2002). While these two trends have traditionally been seen as militating against collective skill formation systems because of their historical affinity with intermediate and practice-oriented training, we suggest that collective skill formation systems should not be expected to be intrinsically inferior to other types of education and training systems. In some respects, they may be even better placed to meet the skill demands of fast-changing labour markets as they are re-shaped by technological change. A traditional strength of collective skill formation systems was their responsiveness to skills needs, given the proximity of social partners to the labour market and their institutionalised ability to shape training systems accordingly (Thelen and Culpepper 2007). In the context of the knowledge economy, this feature may, in fact, turn to the advantage of collective skill formation systems. As skill requirements change more often and more quickly than ever before, it is plausible to expect that the ability of employers and/or unions to directly 'translate' such requirements into training programmes is greater than that of the two other models of skill formation predominant in Europe, namely the statist model (with a strong role for governments but weak involvement of non-state actors) and the liberal model (characterised by a strong role for private training providers but weak state involvement) (Busemeyer and Trampusch 2012). The former might need – at the very least – to gather adequate information from social partners on how skill requirements are changing, and thereby be slower to react than collective skill formation systems (Busemeyer and Thelen 2022; Carstensen and Ibsen 2021). The latter are characterised instead by private actors' attempts to maximise profits from training provision. They are thus disincentivised from updating training profiles, especially when designing more complex – and therefore more expensive and less lucrative – training (Benassi et al. 2022). Collective skill formation systems are expected to be not only agile in responding to more complex skill requirements but also to be able to accommodate increasingly theoretically oriented training. Indeed, the strength of the theoretical learning that takes place in dual systems is an often overlooked but crucial part

of the system, as pointed out by Streeck in a seminal contribution: employers and unions have been pursuing 'a strengthening of the "theoretical" content of training as provided above all by vocational schools [...]. While employers were seeking high skills [...] unions strove to maximize their members' employment and earning opportunities by enhancing the portability of their personal work skills' (Streeck 2012: 327). If the arguments presented thus far are correct, it follows that collective skill formation systems can provide complex and theoretically oriented skills feeding into occupations that are crucial in today's knowledge economy. The destiny of collective skill formation systems may thus not be tied to that of occupations in the middle of the skill distribution, which are being progressively wiped out by technological change.

Moreover, they are still expected to pass such skills on to pupils from relatively disadvantaged backgrounds because the expansion of higher education has proceeded with a strong socio-economic gradient (Bonoli et al. 2017: 72). The logical complement of the socio-economically uneven expansion of higher education is that pupils from disadvantaged backgrounds are today still a core constituency of vocational training, which thus retains – at least in principle – a pivotal role in offering them high-quality training.

The second part of our argument, however, maintains that while it is plausible to expect collective skill formation systems to adjust to the knowledge economy successfully, such adjustment is politically mediated. The ability of collective skill formation systems to offer more complex and more theoretically oriented training is likely to be affected by political tensions within the employer camp (Busemeyer 2012; Culpepper 2007; Trampusch 2010). At the core of such an inter-employer cleavage lie differences in the demand for skills and the use of apprenticeships by SMEs and large firms. The former traditionally think of apprenticeships not only as skill formation but also as a source of cheap labour. As such, they seek highly standardised apprenticeships and are reluctant to step up the theoretical (school-based) component, which would come at the detriment of the practical (work-based) component. Large firms, on the other hand, are more likely to pursue sophisticated and complex skill profiles, often with a stronger theoretical component, and they will seek to 'de-standardise' training programmes to adapt training more flexibly to their needs. Unions are caught in between: they would side with small firms as far as standardised training goes, fearing that differentiation in training would spill over into wage differentials in the labour market, but they would also favour more theoretically oriented training as that would enhance the portability of skills. The transition to the knowledge economy, by biasing skill needs more towards the general-cognitive end of the spectrum, might therefore exacerbate inter-employer cleavages and spark political conflict over how to align collective skill formation to new socio-economic contexts, while making it difficult for a cross-class coalition to emerge, given that unions' preferences do not overlap with those of SMEs or large firms.

The process of adjustment is also politically mediated as far as social inclusion is concerned. Again, the type of skills required in the knowledge economy is central to understanding why political tensions would emerge on this dimension, too. As general cognitive abilities tend to be increasingly important, firms might be more

reluctant to offer apprenticeship places to low-achieving pupils. This challenge was not overly problematic in the industrial age, when cognitive skills were not central. In this context, a particular conflict might emerge between unions and firms – the former would want to push for employers to take on young people and, where appropriate, offer them the support they need to succeed in apprenticeships for ever more complex occupations (Durazzi and Geyer 2020, 2022). On the other hand, employers might think that in this scenario costs outweigh benefits and would not offer an apprenticeship place to academic low-achievers. As a result, these pupils would be excluded from the training system and therefore struggle to acquire relevant skills and transition to good jobs. Governments are expected to take a somewhat intermediate position (Geyer and Durazzi 2022), as they are obviously interested in offering young people good training and educational opportunities to keep social exclusion at bay. But they will also be wary of forcing employers' hand, given that the latter's threat to disinvest in training altogether has traditionally allowed them to curb government demands in this policy area (Bonoli and Emmenegger 2021; Busemeyer 2012; Carstensen et al. 2022; Carstensen and Ibsen 2021).

To conclude, we reiterate our twofold theoretical expectation: (i) we expect collective skill formation systems to be able to adjust to the challenges of the knowledge economy in both the economic and social domains, and (ii) we expect such adjustment to take country-specific forms in both areas, depending, respectively, on how inter-employer cleavages and employer–union conflicts play out in different political-economic contexts. The first part of our theoretical proposition is tested in Section 4, while Section 5 probes the second part of the argument.

4. Collective skill formation systems and socio-economic outcomes in the knowledge economy

This section tests empirically whether collective skill formation systems can still deliver economically efficient and socially inclusive outcomes in the context of the knowledge economy. We outline, in turn, how we capture these two dimensions. On the economic side, we are interested in whether collective skill formation systems can support a high road to economic development, as they did in the industrial era. In the context of the knowledge economy, we posit that such a high road is characterised by occupational upgrading rather than polarisation (Oesch and Rodríguez Menés 2010). The growing use of information and communication technologies (ICT) in the workplace has replaced many routine tasks previously carried out by middle-skilled workers, reducing the demand for their labour. A shrinking labour market in the middle of the skill distribution may, in turn, be accompanied by occupational growth at the low and/or high ends (Kurer and Palier 2019). At the low end, expansion may occur in low-skilled, low-paid, non-routine manual (NRM) occupations that are neither replaced nor complemented by technology because they require agility, communication and common sense and are, for the time being, impossible to codify. These occupations are typically found in the retail, hospitality and care sectors (Autor 2022). At the upper end, there is also a growing demand for workers who can carry out tasks that involve complex cognitive abilities and problem-solving skills and do not follow predictable or repetitive patterns. These jobs typically require individuals to adapt to new and unique situations, think critically and apply creativity and innovation. Crucially, these jobs are complementary to, not replaced by technology. We call these non-routine cognitive (NRC) workers, who tend to be found in knowledge-intensive sectors, such as dynamics services (for example, finance, insurance, consultancy) or in advanced manufacturing (Diessner, Durazzi, and Hope 2022; Wren 2013). In the context of the knowledge economy, some countries have seen a polarisation of their labour markets (Goos, Manning, and Salomons 2009), whereby both NRM and NRC jobs have grown. In contrast, other countries have followed an upgrading pattern (Haslberger 2021; Oesch and Rodríguez-Menés 2010), where the growth of NRC jobs has been predominant over that of NRM ones. However, these studies do not examine the role played by the training system. For our purposes, we consider collective skill formation systems as able to uphold the pursuit of a high-road approach in the transition to the knowledge economy if they support a process of 'upgrading' of the labour market. This entails promoting a steady supply of workers equipped with the skills needed for those NRC jobs that are complementary to technology, favouring therefore a shift from routine employment into NRC occupations rather than into NRM employment.

Turning to social inclusion, we examine the ability of collective skill formation systems to provide high-quality training, which translates into good employment opportunities for low-achieving pupils. The growing demand for cognitive skills in the knowledge economy carries the risk of leaving behind pupils from the bottom half of the distribution as socioeconomic status is the most important determinant of academic achievement (Sirin 2005). To the extent that academic achievement is a precondition of participation in higher education, pupils from disadvantaged backgrounds may be less likely to attend university or be able to compete credibly for NRC jobs. Indeed, a significant risk factor attached to being neither in employment, education or training (NEET) is performing poorly in school (Plenty et al. 2021) and coming from a low socioeconomic background (Odoardi 2020). Thus, as demand for routine workers declines and in the absence of a high-quality training path alternative to university, the transition to the knowledge economy risks generating higher youth unemployment rates and a higher NEET rate, disproportionately concentrated among pupils from relatively disadvantaged backgrounds. Thus we argue that collective skill formation systems in the knowledge economy can be considered socially inclusive if they lead to lower youth unemployment and NEET rates.

4.1 Data and methods

We conducted longitudinal macro-econometric analysis in 18 OECD countries[1] nbetween 2001 and 2021 with the objective of testing whether collective skill formation systems are associated with occupational upgrading among workers with an upper secondary education and lower average youth unemployment and inactivity rates. We use the EU Labour Force Survey (EU countries) and the IPUMS Current Population Survey (United States) to calculate the share of NRM and NRC occupations, youth unemployment and NEET shares. NRC employment is the number of workers in the International Standard Classification of Occupations (ISCO) categories 1, 2 or 3 as a share of total employment, and NRM employment is the number of workers in ISCO categories 5 and 9 as a share of total employment (Kurer and Palier 2019). The youth unemployment rate is based on unemployed individuals aged between 20 and 24 as a share of those in the same age brackets, and the youth NEET rate refers to individuals aged 15 to 24 who are inactive and not enrolled in formal or informal education or training as a share of the population in the same age brackets. We also calculated the NRC and NRM employment shares for the population with upper secondary education (ISCED 4) only. More information on operationalisation is to be found in the appendix.

We chose the 20–24 age bracket for the unemployment rate because pupils can enrol in the collective skill formation system at age 15, and average training lasts three years. Because young people need to complete their training and find an occupation to be counted in the employment statistics, we do not expect to see an

1. Austria, Belgium, Switzerland, Czech Republic, Germany, Denmark, Spain, Finland, France, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Sweden, Slovakia, United States.

effect of the collective skill formation system earlier. Instead, we chose brackets 15–24 years old for the NEET rate because to cease to be classified as NEET it is enough for someone to enrol in the collective skill formation system, and thus we expect to find an effect already at age 15 and above.

Using data from Emmenegger and Haslberger (2023), we measure collective skill formation systems counting the number of pupils enrolled in dual VET as a share of total pupils in upper secondary education (dual VET share). We also follow the example of Bolli et al. (2021) and lag dual VET share by three years when estimating its effects on employment and unemployment rates because it is the average training scheme time, and we do not expect to find an impact before young people complete it. We also ran the analysis with dual VET share lagged by one and two years as a robustness check, however, and the results remain unaltered (see Table A3). Instead, we lag the dual VET share by one year when estimating its effect on the NEET rate because it is enough for a young person to enrol in the programme to cease to be classified as NEET. Then, we control for several factors expected to impact our outcomes. We control for tertiary education attainment (EULFS 2024; IPUMS CPS 2024). More highly educated graduates are likely to be associated with NRC and NRM employment, and university graduates are also less likely to be unemployed or NEET. We also control for public expenditure in active labour market policies focused on training (OECD 2023a), as we expect the investment of more resources in these training schemes to affect the supply of skills and, possibly, the employment structure. Instead, we use total public expenditure in active labour market policies (OECD 2023b) as control when estimating the effect on the unemployment and NEET rates, as other infrastructures, such as employment services besides training, are likely to impact the unemployment rate. We also control for the share of employment in the service sector (EULFS 2024; IPUMS CPS 2024), as we expect the share of NRC and NRM, often found in the service sector, to be a function of fluctuating service employment levels overall. Finally, when estimating the effect of dual VET share on youth unemployment and NEET, we control for the analogous adult variables to control for the possibility that variation in these indicators is linked to the overall state of the economy (EULFS 2024). In all specifications, we add macroeconomic controls that could impact employment outcomes and, indirectly, poverty rates. We include GDP (OECD 2023c), labour market productivity growth (OECD 2023d), and inflation rate (OECD 2023e). Finally, we control for ICT intensity as we expect more investment in ICT technology to be associated with more demand for high-end skills and use the total gross fixed capital formation of 'information and communication equipment' and 'computer software and databases', as defined by the System of National Accounts 2008 as a share of GDP (OECD 2023f). We use heteroskedasticity and autocorrelation consistent standard errors (Stock and Watson 2008; Arellano 1987). We include country and time-fixed effects to control for unobserved heterogeneity, contemporaneous shocks and time trends. We run the analysis using STATA 18 and the command 'xtreg, fe r'.

4.2 Findings

Table 1 presents the estimated coefficients of our two-way fixed effects models. Models 1, 2 and 3 estimate the effect of the dual VET share on the share of non-routine cognitive employment and test the upgrading mechanism. In line with our theoretical expectations, in model 1, we find that a higher share of pupils enrolling in collective skill formation systems is associated with a significantly higher share of NRC employment three years later. In model 2, we introduce the share of NRC workers with upper secondary education as a share of total employment. We find that it fully mediates the effect of dual VET, which is reduced to 1/16th of its size and becomes insignificant. Model 3 tests the effect on NRC employment with upper secondary education to further test whether it mediates the relationship modelled in 1 and 2. A 1 percentage point increase in dual VET share is associated with a significant rise in NRC employment of 0.10 percentage points. In other words, a 10 per cent difference in the share of pupils enrolled in collective skill formation systems is associated with a 1 per cent difference in non-routine cognitive employment three years later. Given that this increase is concentrated among new workers with upper secondary education, and that country differences in the share of pupils enrolled in dual VET can be as large as 60 percentage points, it can be regarded as a substantial effect.

Model 4 examines the association between the size of collective skill formation systems and non-routine manual employment and assesses whether dual VET may reduce employment polarisation. The significantly negative coefficient indicates that a larger share of pupils enrolled in a collective skill formation system is associated with a lower share of NRM employment three years later. In contrast to the share of NRC, however, such a decline is not mediated by a lower share of workers with upper secondary education in NRM occupations (see Table A2) because nowadays very few people have a low level of education. Instead, we argue that if a large share of the population graduate either from university or collective skill formation systems and are employed in NRC occupations, it indicates a transformation of the employment structure that is less reliant on NRM employment and thus the overall number of NRM occupations in the economy declines. In other words, collective skill formation systems allow upper-secondary educated persons to be employed in NRC occupations rather than NRM ones, resulting in a diminishing share of the latter over time. This is evidence that a collective skill formation system may prevent employment polarisation by allowing workers in the middle of the skill distribution to be employed in skilled NRC occupations rather than in lower-paid NRM ones.

Models 5 and 6 assess the relationship between the size of collective skill formation systems and equity outcomes. Model 5 estimates the effect of dual VET on the youth unemployment rate, defined as unemployed people between 20 and 24 years old. The coefficient is negative and significant, indicating that a larger share of pupils enrolling in collective skill formation systems is associated with a lower unemployment rate in the youth population three years later. Model 6 estimates the effect of collective skill formation systems on the NEET rate among young people between 15 and 24 years of age. In contrast to model 5, the size of dual VET systems does not appear to influence the NEET rate.

Table 1 **Multiple regression estimates**

Variables	(1) NRC	(2) NRC	(3) Upper secondary NRC	(4) NRM	(5) Unemployment rate (20–24)	(6) NEET rate (18–24)
Share of dual VET	0.113** (0.051)	0.007 (0.021)	0.100*** (0.034)	-0.057** (0.025)	-0.064** (0.027)	-0.023 (0.020)
Upper secondary NRC		1.057*** (0.076)				
Tertiary education attainment	0.513*** (0.116)	0.657*** (0.069)	-0.136* (0.065)	-0.178*** (0.045)	-0.051 (0.076)	-0.077** (0.032)
ALMP expenditure (Training)	-1.873 (1.831)	0.535 (1.378)	-2.279 (1.516)	2.192 (1.988)		
ALMP expenditure (Total)					-1.108*** (0.371)	0.379* (0.203)
ICT capital stock	-1.631 (1.057)	-0.857* (0.473)	-0.733 (0.760)	1.481** (0.549)	-1.077* (0.565)	0.042 (0.278)
Share of service employment	0.105 (0.225)	-0.374*** (0.124)	0.453*** (0.122)	0.085 (0.095)		
GDP growth	0.121 (0.149)	-0.028 (0.088)	0.141 (0.086)	-0.090 (0.075)	0.014 (0.090)	-0.042 (0.068)
Labour productivity growth	-0.021 (0.173)	-0.040 (0.095)	0.018 (0.087)	0.040 (0.107)	-0.023 (0.064)	0.125** (0.061)
Inflation rate	0.512*** (0.065)	0.240** (0.085)	0.258*** (0.080)	-0.231*** (0.061)	-0.215* (0.102)	-0.011 (0.065)
Unemployment rate (25–64)					2.022*** (0.091)	0.500*** (0.042)
Inactivity rate (25–64)						0.056 (0.054)
Constant	19.190 (14.733)	31.565*** (7.662)	-11.712 (8.135)	17.957** (6.386)	7.514*** (2.456)	7.587*** (2.048)
Country and year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	355	355	355	355	356	323
R-squared	0.669	0.856	0.518	0.509	0.903	0.588
Number of countries	18	18	18	18	18	18

Note: robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

On balance, our quantitative analysis indicates that collective skill formation systems still play an important role in opening up a high road to economic development in the transition to the knowledge economy by favouring occupational upgrading over polarisation. We find that larger dual VET systems are associated with increased NRC employment and decreased NRM. In contrast, when it comes to the ability of collective skill formation systems to provide socially inclusive outcomes our findings are more mixed. We find that dual VET share is associated with reduced youth unemployment. We have not seen an equivalent effect on the NEET rate, however. As NEETs tend to come from low socioeconomic backgrounds (Odoardi 2020) and perform poorly in school (Plenty et al. 2021), we interpret these results as indicating the inability of collective skill formation systems to cater for the bottom half of the distribution as a whole. Indeed, it is

plausible to expect that the NEET indicator captures a more severe context of socio-economic disadvantage compared with our youth unemployment indicator, hinting that collective skill formation systems may be inclusive but 'only up to a point' (Bonoli and Emmenegger 2021: 230).

5. National patterns of adjustment

Turning to the second part of our argument, in this section we illustrate, through three brief country studies of Austria, Germany and Switzerland, how the distribution of power between unions, firms and the government has shaped patterns of adjustment to the knowledge economy in terms of efficiency and equity. Comparing these three countries allows us to identify similarities and differences along important dimensions of theoretical interest. The obvious similarity between the three countries is that they all belong to the universe of collective skill formation, and we therefore expect them to confront similar challenges (Busemeyer and Trampusch 2012). However, each country is unique in terms of the distribution of power between the key actors. In Austria, trade unions have significant (institutional) power over training (Durazzi and Geyer 2020) and the state has a long tradition of public training provision (Graf et al. 2012). The employers' camp is characterised by the pre-eminence of SMEs over large firms (Trampusch 2010). In Germany the constellation of actors is rather different. Unions and large firms both enjoy a position of power in the training system (Busemeyer 2012; Culpepper 2007; Durazzi and Geyer 2020; Emmenegger et al. 2023; Trampusch 2010), while SMEs and the state are relatively weak (Durazzi and Geyer 2020; Trampusch 2010). The Swiss case offers yet another configuration with a strong presence of large firms (Culpepper 2007), coupled with significant organisational capacity among SMEs (Emmenegger and Seitzl 2019; Trampusch 2010). Unions and state actors are instead relatively weak vis-à-vis capital (Di Maio et al. 2020; Emmenegger et al. 2023; Emmenegger et al. 2020). Table 2 summarises how each country represents a unique distribution of power between capital, labour and the state. In line with our interest in both the economic and social dimensions, we focus on the introduction of ICT training to proxy the ability of collective skill formation systems to provide a skill set that is intrinsically related to the knowledge economy (the economic dimension) and on the introduction of measures to support the inclusion of unsuccessful apprenticeship seekers in the training system (the social dimension). The case studies are based on secondary sources and cover major policy initiatives launched since the late 1990s, namely when pressures started to mount on collective skill formation systems to adapt to the knowledge economy.

Table 2 **Distribution of power between unions, firms and the government as regards training policy**

	Unions	Large firms	Small firms	Government
Austria	Strong	Weak	Strong	Strong
Germany	Strong	Strong	Weak	Weak
Switzerland	Weak	Strong	Strong	Weak

Source: authors' own elaboration

5.1 Austria

In Austria an alliance emerged between trade unions and the government in reforming the system in both the economic and social dimensions, while the employers, dominated by small firms, played a relatively marginal role. The relationship between government and unions varied depending on partisanship, ranging from a tight alliance under centre-left cabinets to a rather reluctant cooperation when the centre-right were in power (Geyer and Durazzi 2022). Despite such a fluctuating relationship, these two actors have driven major changes in the Austrian collective skill formation system since the late 1990s. In terms of equity, the inability of the apprenticeship system to offer a training place to all applicants became a salient issue at the end of the 1990s. Trade unions and employers offered widely different solutions to the problem. Unions pushed for the introduction of 'supra-company' apprenticeships, which are training programmes that mimic the dual system by combining theoretical and practical learning. The difference is that the latter takes place in publicly-funded training workshops rather than in-firm. Importantly, supra-company apprenticeships lead to the same certification as regular apprenticeships (Carstensen et al. 2022; Durazzi and Geyer 2020; Seitzl and Unterweger 2022). Employers, on the other hand, favoured government intervention in the form of financial incentives for firms hat agreed to take on more apprentices. Unions strongly opposed the employers' plans because the decision to offer training would remain in the hands of firms and they would not guarantee an expansion of apprenticeship places. A compromise was reached through the introduction of supra-company apprenticeships, as advocated by the unions, but only as a temporary measure to tame employers' scepticism (Durazzi and Geyer 2020). Over time, however, supra-company apprenticeships proved to work well and, as a consequence, they even garnered support from employers (Seitzl and Unterweger 2022). This resulted in their institutionalisation as a permanent feature of the Austrian skill formation system, with a state guarantee that every young person who unsuccessfully seeks an apprenticeship in the 'regular' system must be offered a supra-company apprenticeship place, if they want it (Schlögl et al. 2020). The unions pushed strongly for this option, believing that a publicly-funded supra-company apprenticeship system would work, given Austria's historical precedents (Durazzi and Geyer 2020). Indeed, Austria has a successful tradition of government intervention in training policy (Graf et al. 2012) that stands out by comparison with its peers (see Section 5.2 on Germany for a sharp contrast). This makes the government an ideal partner for the unions to translate their equity-enhancing preferences into concrete policy measures.

Similarly, as hypothesised in Section 3, small firms were reluctant, on economic grounds, to contribute significantly to upgrading training profiles to meet the needs of the knowledge economy. ICT training is a case in point. Government and unions sought to strengthen apprenticeships in this field, but while employer associations concurred, individual firms were reluctant to participate (Seitzl and Unterweger 2022). As a result, it was again down to unions and the government to lead the adjustment of the training system to meet the skill needs of this crucial sector in the transition to the knowledge economy. Indeed, most ICT training (roughly 70 per cent) at the post-secondary non-tertiary level in Austria takes place outside the 'regular' dual system. It is the system of supra-company apprenticeships and school-based vocational training that provides the lion's share of such training (Seitzl and Unterweger 2022). Looking at the distribution of apprentices by sector between the regular dual system and the supra-company apprenticeship system it appears that in 'traditional' manufacturing occupations the former is predominant, while the latter is the most important in the future-oriented ICT sector[2] (WKO 2023). This testifies to the primary role of unions and government in adjusting the Austrian system to the needs of the knowledge economy.

5.2 Germany

The German case is different. Large firms, enjoying relative power within the employer camp, have been very active in reforming the skill formation system (Busemeyer 2012; Thelen and Busemeyer 2012; Trampusch 2010). Their preferences, however, clashed with those of another strong actor, trade unions (Durazzi and Geyer 2020). Since the turn of the century, large firms have pushed for a de-standardisation of the training system, which they claim is needed to better cope with a fast-changing labour market, while also welcoming higher-level, more theoretically-oriented skills (Busemeyer 2012). While unions did not object to the latter, they have forcefully opposed de-standardising reforms, fearing that this would result in labour market segmentation, undermining solidarity and collective action among workers (Geyer and Durazzi 2022). Although many of the employers' demands were met (for example, the re-introduction of shorter two-year apprenticeships and the modularisation of training), the presence of strong unions as (potential) veto-players also incentivised employers to look for unilateral 'segmentalist' solutions outside the 'regular' apprenticeship system (Emmenegger et al. 2023). A major development in this respect has involved meeting the skills needs of knowledge-intensive sectors increasingly through 'dual study programmes', which are based on cooperation agreements between individual (usually large) firms and universities (usually of the applied sciences), under which students learn in a dual setting, but the theoretical component is delivered at the level of higher education (Durazzi and Benassi 2020). Dual study programmes proved to be a valuable source of ICT skill provision. For example, such training is the second most popular discipline among students enrolled in dual study programmes after engineering. While a sizeable amount of ICT training takes place within the 'regular' dual system, enrolments in ICT apprenticeships

2. We thank Leonard Geyer for pointing this out to us.

have been roughly stable over the past decade (Schwarz et al. 2017). The number of students in ICT-related dual study programmes, by contrast, has seen an eightfold increase (BIBB 2022). The different pace of expansion of ICT-related training between dual system and dual study programmes testifies to the increasing importance of segmentalist solutions in satisfying the skill needs of the knowledge economy in the German system.

With regard to social inclusion, actors' preferences mirrored those in Austria, but the ability to translate preferences into policies was radically different. In Germany, too, in the late 1990s and early 2000s an increasing number of young people were unable to find an apprenticeship. The unions were particularly vocal in wanting to address this issue, but unlike in Austria, they did not want to strengthen a public alternative to the regular system. The German government's position in training policy is weaker than that of its Austrian counterpart, and such historical weaknesses made unions sceptical of greater government involvement in training policy (Durazzi and Geyer 2020). It was feared that it would lead to more training in occupations for which teachers were available in schools rather than to meet the needs of the labour market (Geyer and Durazzi 2022). Rather, unions wanted to introduce a training levy to force firms to train more (Durazzi and Geyer 2020). The government entertained the idea for some time but ultimately declined to legislate, fearing the employers' threat to withdraw from the dual system (Busemeyer 2012). The outcome was therefore the expansion of the so-called 'transition system', publicly-provided training that, unlike in Austria, does not have buy-in from either unions or employers and does not lead to standardised certification (Durazzi and Geyer 2020; Geyer and Durazzi 2022). While the transition system is somewhat inclusive because it provides some form of training for unsuccessful apprenticeship seekers, the risk of subsequent social exclusion remains, given the uncertain – and generally poor – prospects of these qualifications in the labour market (Durazzi and Geyer 2022). Acknowledging the sub-optimality of this solution, successive governments have in recent years tried to step up the quality of equity-enhancing measures (Busemeyer et al. 2022), for example, by passing a law in 2023 that lays the ground for the introduction of a training guarantee (Eckelt 2023). The latter, however, does not seem to enjoy (at least not yet) the same degree of support from other actors (notably the unions), and it is far less comprehensive than the Austrian model. It should be noted, however, that advocates of a training guarantee in Germany tend to bring up the Austrian supra-company apprenticeship system as the ideal-typical policy to be pursued (Euler and Seeber 2023).

5.3 Switzerland

Switzerland has its own distinctive distribution of power between actors. As in Germany, training policy is firmly in the hands of collective actors, leaving the government only limited authority. But within this structure, employers enjoy more power than the unions in what has been labelled a *liberal* collective skill formation system (Emmenegger et al. 2020) characterised by 'polite employer domination' (Di Maio et al. 2020). As a consequence, measures related to both economic upgrading and social inclusion were introduced on 'employers' terms'

(Carstensen et al. 2022). Because Swiss employers are not confronted by unions with countervailing power, they had no incentive to seek segmentalist solutions *outside* the 'regular' system (as in Germany). A credible coalition between unions and the government (as in Austria) was not likely to emerge either to create alternative 'public' solutions, given the structural weakness of both actors vis-à-vis employers in the realm of training policy (Emmenegger et al. 2023). Hence, when in the late 1990s Switzerland also faced a lack of apprenticeship places, leading to the exclusion of young people, the solution was to introduce shorter, two-year apprenticeships with less demanding entry requirements, thereby catering for academically weaker candidates (Di Maio et al. 2019, 2020). These apprenticeships are also characterised by additional remedial measures to ensure that participants at the low end of the ability range can successfully complete their training programmes, unlike two-year apprenticeships in Germany, which were introduced entirely as an additional form of flexibility within the system and not to enhance social inclusion (Di Maio et al. 2019). The government designed this reform in anticipation of employer preferences and, in particular, to enable employers to decide how many apprenticeships to offer and to whom, although explicit provisions were included to enhance the system's inclusivity (Di Maio et al. 2020). In terms of policy design, there are differences from both Germany and Austria. The Swiss solution is less exclusionary than the German one because its equity-enhancing two-year apprenticeships have employers' buy-in and are therefore expected to lead to positive labour market outcomes (Durazzi and Geyer 2022). It is, however, more exclusionary than the Austria policy option because access to shorter apprenticeships is not guaranteed, but rather depends on firms' willingness. These policy differences arguably map onto the 'performance' of the three countries with regard to social inclusion (see Table 3). While the differences are not major, it appears that the Austrian 'public' solution guarantees more 'stable' outcomes because they are underpinned by a state guarantee, while in the Swiss and German cases, inclusion in high-quality training for disadvantaged young people is still to a large extent a matter of the employers' discretion. This is indicated by the more widely fluctuating youth unemployment and NEET rates.

Table 3 **NEET and youth unemployment rates in Austria, Switzerland and Germany**

	Country	Min value	Max value	Change
NEET rate (15–24 years old)	Austria	8.37	11.00	2.64
	Switzerland	7.40	13.40	6.04
	Germany	5.87	11.70	5.79
Youth unemployment rate (20–24 years old)	Austria	5.63	10.70	5.08
	Switzerland	3.84	9.36	5.51
	Germany	5.34	15.70	10.40

Note: minimum and maximum values and change are calculated over the periods 2004–2021 for Austria and 2003–2021 for Germany and Switzerland.

Source: Labour Force Survey. Authors' own elaboration.

Equally, on efficiency grounds, Swiss employers did not pursue a segmentalist route outside the system, given their pre-eminent position of power (unlike in Germany), while the strong presence of large export-oriented firms ensured that businesses were willing to upgrade the training system to meet the evolving skill needs of the knowledge economy (unlike Austria). In the ICT sector, apprenticeship

programmes developed through the 1990s and expanded fivefold in terms of participants in less than two decades (Peter et al. 2019). Interestingly, and in sharp contrast with both Austria and Germany, the provision of ICT training in Switzerland is characterised by the unchallenged primacy of the dual VET system over any other educational and training path at both the post-secondary and tertiary levels (Bundesamt für Statistik 2023). This testifies to the persistent centrality of the 'regular' apprenticeship system in the Swiss skill formation model, even in the 'new' socio-economic context of the knowledge economy (Emmenegger et al. 2023). Thus, as far as the efficiency dimension is concerned, the three countries also opted for different policy solutions. Along this dimension, however, different policy solutions do not seem to map onto particularly different patterns of outcomes. Table 4 shows average annual growth rates of NRC and NRM occupations over the period of analysis and all three countries exhibit positive values for NRC occupations and negative ones for NRM ones. The three countries therefore seem to have been roughly equally successful in upgrading their occupational structures. This can plausibly be interpreted as a case of 'functional equivalence' among the different policy options.

Table 4 **Compound annual growth rates (CAGR) of NRC and NRM employment in Austria, Switzerland and Germany, 2001–2021**

	Country	CAGR
Non-Routine Cognitive Employment	Austria	1.37
	Switzerland	0.92
	Germany	0.77
Non-Routine Manual Employment	Austria	-1.7
	Switzerland	-1.51
	Germany	-0.99

Source: Labour Force Survey. Authors' own elaboration.

6. Conclusions

This article examines the extent to which two traditional features of collective skill formation systems persist in today's knowledge economy, namely their ability to provide high-quality skills to the advanced segments of the labour market, while maintaining social inclusion. The article suggests that there is no intrinsic reason why collective skill formation systems should not adapt successfully to the challenges posed by the knowledge economy. However, their success depends on the willingness of key actors—unions, employers and government—to actively adapt these systems to meet the needs of a labour market that has fundamentally changed, primarily due to technology, since collective skill formation systems were originally developed and flourished. The argument was probed empirically through a multi-method approach. A panel regression analysis tested the effects of collective skill formation systems on a range of outcomes in the economic and social domains. With respect to the former, we hypothesised that collective skill formation systems contribute to a high-road approach to the transition to the knowledge economy if they support upgrading – rather than polarisation – of the occupational structure. The empirical evidence lent support to this claim. With regard to social inclusion, we found that dual VET systems ameliorate youth unemployment but do not have a statistically significant effect on the rate of NEETs. This suggests that collective skill formation systems are still able to contribute to social inclusion, but that their effect does not cover the entire bottom half of the ability distribution, as suggested by the lack of effect on the NEETs rate, which arguably captures more socio-economic disadvantage than the youth unemployment indicator.

The second part of the article provides a comparative analysis of how employers, unions and the government have sought to adjust collective skill formation systems to the needs of the knowledge economy in Austria, Germany and Switzerland. In line with our theoretical expectation, we found evidence that in all three countries active coalitional work has underpinned important reforms of collective skill formation systems over the past three decades. Their respective approaches were highly country-specific, however, reflecting the relative power enjoyed by different actors. In the Austrian case, unions and the government were the protagonists in promoting more state intervention in training policy; in Germany, adjustment was led by large firms seeking segmentalist solutions outside collective governance; and in Switzerland (primarily large, but also smaller) employers imposed change on their own terms within the traditional structures of collective skill formation.

In assessing the viability of collective skill formation systems in the transition to the knowledge economy, the article also delves into a broader and more

fundamental question: can relatively egalitarian forms of capitalism remain viable in contemporary societies? The evidence presented suggests that while challenging, it is not impossible. However, assuming that 'coordinated' capitalism inherently leads to 'egalitarian' outcomes would be misleading. Instead, such outcomes are more likely to emerge from active coalition-building and actors' political support, and the degree of 'success' will depend to an extent on which actors prevail. In this respect, trade unions might seize a key role: the Austrian example suggests that if the adjustment of collective skill formation systems is underpinned by a coalition between trade union and government actors, the outcome may be better from a social inclusion standpoint than employer-led options, while at the same time not being less effective economically.

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