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# Collective Skill Systems, Wage Bargaining, and Labor Market Stratification

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### Introduction

The study of labor market stratification, in particular income inequality, is at the core of comparative political economy, and it has gained even more attention with the recent rise in labor market inequality. Scholarship in the last couple of decades has provided important insights into the political and institutional determinants of these changes as well as differences in inequality across countries (e.g., Iversen, 1999; Wallerstein, 1999; Moene and Wallerstein, 2001, 2003; Pontusson et al., 2002; Bradley et al., 2003; Rueda, 2008). Besides the influence of left partisanship and strong unions, the centralization of wage bargaining has been identified in this literature as a crucial variable mitigating wage inequality (Wallerstein, 1999).

Yet, it is hard to explain wage setting in isolation from the forces that shape the demand and supply of different types of labor. In the economic literature, skill-biased technological change is regarded as a key driver of demand for trained workers, which helps explain the rise in wage dispersion since the 1980s (Acemoglu, 2002; Machin and Van Reenen, 2007; Goldin and Katz, 2008). On the supply side, scholars have become interested in the role of educational institutions, in particular vocational training. In addition to some explorative empirical analyses, Estévez-Abe et al. (2001) provide an initial theoretical argument about why the prevalence of occupational skills, which raises the qualification of those at the bottom of the income distribution, should be associated with less inequality. Bradley et al. (2003) provide a more systematic test of the role of vocational training as a determinant of inequality, but they do not find a significant effect. This non-finding, as we will show

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below, might have been premature (see also Iversen and Stephens, 2008; Iversen and Soskice, 2009).

Of course, the relevance of educational institutions for processes of labor market stratification has long been discussed in the field of education and labor market sociology (Allmendinger, 1989; Müller and Gangl, 2003). A well-established finding is that the availability of strong vocational training institutions, in particular firm-based training schemes and the representation of unions and employers in the administration of the system, facilitates labor market transitions from school to training to employment, contributing to low youth unemployment (Gangl, 2003; Van der Welden and Wolbers, 2003; Breen, 2005; Wolbers, 2007). Although this work has produced many important insights, it misses two important aspects from the perspective of comparative political economy. First, labor market sociology focuses on the effects of institutions on labor market outcomes but does not look at the political coalitions supporting or undermining existing institutional arrangements. Second, scholarship in this field discusses the relevance of educational institutions and, more recently, employment protection legislation (Breen, 2005; Wolbers, 2007), but not the institutional setup of the wage-bargaining system. When we consider the wealth of evidence in the political economy literature, it is hard to imagine that unions and collective bargaining are unimportant in shaping labor market policies and outcomes. In fact, we will argue that it is not possible to understand training and wage-setting institutions in isolation from each other.

Building on these approaches, we intend to show that both vocational training and wage-bargaining centralization shape responses to skill-biased technological change and hence labor market stratification, and that there are strong interaction effects between the two. Collective skill formation regimes, such as the ones discussed in the first chapters of this volume, used to be associated with low levels of youth unemployment and comparatively low wage inequalities. But the forces of skill-biased technological change that have affected all advanced industrial democracies in recent decades, together with the erosion of coordinated wage-bargaining systems, might expose particular weaknesses in the institutional fabric of collective skill formation regimes in terms of containing labor market inequality. Empirically, we will show that, once the institutional support of collective wage bargaining erodes, vocational training systems alone do not necessarily produce the kinds of beneficial effects that the literature has come to associate with these systems. We explore our argument in various ways: after developing the argument in full in the next section, we provide some explorative, descriptive statistics and then delve into a quantitative analysis of the determinants of labor market stratification in OECD (Organisation for Economic Co-operation and Development) countries over the last decades.

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### Our argument

Wage inequality and, more generally, labor market stratification have been on the rise everywhere since the early 1980s. Most of the economic literature explains this rise as a result of skill-biased technological change, namely a secular shift in demand from low-skilled toward high-skilled labor (sometimes occurring in a nonmonotonic manner).<sup>1</sup> A prominent example of this approach is Goldin and Katz's influential study (2007, 2008) of American wage inequality, which goes all the way back to the beginning of the previous century. They show that the fastest rate of growth in the relative demand for skilled labor (5.2 percent) occurred in the 1980s, which is also the decade when wage inequality rose at the fastest pace (1.5 percent a year). Acemoglu (2002), Berman et al. (1998), Machin and Van Reenen (2007), and others likewise argue that skill-biased technological change also played a significant role in the rise of wage inequality in other developed economies (but see Mosher (2007) for a political science perspective).

Yet, if Goldin and Katz's results are viewed in their totality, the perhaps surprising finding is that most of the rise in inequality is not a demand-side story. In the two decades starting in 1960, relative wages were essentially constant, even though relative demand for skilled workers rose by an annualized rate of 3.9 percent. That rate is essentially the same as in the period of 1980–2005 (3.8 percent), when inequality increased by a very fast rate of nearly one percentage point every year. The striking difference is accounted for by the fact that the supply of skilled workers rose by almost 4 percent in the first and by only a little over 2 percent in the second period. In other words, almost the entire rise in inequality was due to a slowdown in the *supply* of skilled labor, not to acceleration in the demand for skilled labor. This fact puts the spotlight on the political economy of skill formation, which is largely outside the purview of Goldin and Katz's study (and most other economic research on wage inequality).

As important as it is to focus on the supply side, this is still insufficient from a comparative perspective because wages in many countries are not determined simply by demand and supply, but rather by agreements reached through collective bargaining (Wallerstein, 1999; Ahlquist, 2010). If unions and business associations set wages, the supply of newly skilled workers only matters for the dispersion of wages if already skilled workers adjust their wages downward. Employers in fluid and non-unionized labor markets that rely on general-skill workers will be able to replace older and better-paid skilled workers in response to rising supply. In contrast, when workers have acquired firm- or industry-specific skills or high institutional barriers against replacing workers exist, there is (often a large) cost involved in skilled labor turnover. This cost can be used by unions to block the downward adjustment of wages

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(Mosher, 2007). Consequently, to understand the relationship between training and wages we need to take account of how unions and employers set wages: the greater the role of unions and collective bargaining, the smaller is the direct effect of public spending on training.

The importance of wage setting is recognized in the comparative political economy literature, where this subject has been the focus of much research on wage inequality (see Freeman, 1988; Iversen, 1999; Wallerstein, 1999; Rueda and Pontusson, 2000). The main hypothesis in this literature is that centralization of the bargaining system causes a compression in the wage structure. While the precise political-economic explanation varies—interest in redistribution by the median union member, bargaining between low- and high-skill unions, insurance against wage losses, ideological commitments to solidarity, and so on—the limitation of all these arguments is that they do not provide an account of how wage compression is economically and politically sustainable. If wages of skilled workers decline, so will the private incentive to acquire skills, and that in turn leads to skill shortages and pressure by skilled workers and their employers to break out of the centralized system (Iversen and Soskice, 2010). Understanding how wage compression remains sustainable in a centralized system thus brings us back to the supply side of the story.

In some countries, organized business also plays a central role not only in wage-setting institutions but in the training system itself. Apprenticeship and dual training schemes depend on employers providing enough training spots to accommodate demand, and public subsidies therefore only affect wages indirectly through employers' decisions to train at a higher rate.

The way in which wage-setting and training systems are organized has important political consequences. In market-based systems, the private incentive to train is equal to the wage premium of skilled workers. Public spending on training reduces this premium, but that is not in the interest of either skilled workers or those who can finance their own education and appropriate the full (wage) return of that investment for themselves. In a centralized wage-setting system, however, compression of wages produces its own demand for government spending to cover the cost of training and to expand the opportunities for skilled work. Even in countries where unions are weak but employers exert control in the training system (such as Switzerland), opportunities for skilled employment might be promoted by public subsidies as individuals cannot purchase their own training privately. So, while the capacity of the government to directly affect wages is lower in systems with strong unions and business organizations, the political demand for public spending is higher.

In addition to the relationship between spending, on the one hand, and wage setting and firm involvement in training, on the other, the training and collective wage-bargaining systems are also connected. These are related to the

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two dimensions of variation in skill regimes outlined in the introductory chapter (Busemeyer and Trampusch in this volume).

### *Firm involvement in training*

First, when firms are strongly involved in the provision, administration, and reform of workplace-based training in the form of apprenticeship and dual training schemes, the institutions of collective wage bargaining act as “beneficial constraints” (Streck, 1989, 1992, 1994), forcing firms to invest in the training of low-skilled employees, as they have to be paid wages similar to those of workers with higher levels of skills. At the same time, the compression of wages allows firms to recoup training investments, because the wages of highly productive workers are lower than they would be in a flexible setting. Thus, when the “beneficial constraints” are at work, we would expect bargaining centralization to be associated with a high involvement of firms in training and low levels of labor market stratification. These are the characteristics evident in German-speaking countries during the 1970s and 1980s.<sup>2</sup>

Unions also matter in these systems. While they cannot force employers to hire trainees, they can significantly affect the training decisions of firms, for example by requiring that all skilled workers in a particular occupation are paid the same or that all apprentices have to be offered continued employment after the completion of training. Deals reached in the wage-bargaining system thus affect the intake of trainees and hence the stratification that results from the ability of young people to find spaces in the training system. The fact whether the bargaining system is centralized and solidaristic or semi-decentralized and dominated by skilled worker interests determines the extent of educational rationing and hence also the degree to which the labor market is stratified along skills. Thus, despite the fact that transitions from training to employment continue to be easier in dual training countries, the decentralization and “de-solidarization” (*Entsolidarisierung*) of collective wage bargaining over time leads to an increasingly frictional transition from general schooling to training, that is, a high number of young people without access to training. The economic reason is simple: as skilled wages rise, more young people want to acquire the skills, but the demand for skilled workers declines and hence also the intake into the system. The result is rationing. The weakness of this arrangement is that the government has no direct way of influencing the intake of apprentices, because this falls within the domain of firm autonomy (Busemeyer, 2009a).

### *Public investment in vocational training*

Secondly, in countries with high levels of bargaining centralization and corporatism, unions and business associations can effectively lobby the state to

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promote vocational training in various ways, for example, by expanding the intake to vocational schools, through active labor market policies (ALMP), or via subsidies to firm-based training. The difference to countries dominated by dual training is that the availability of schooling is politically determined, and the government can increase the intake in line with demand for training spots, where the latter is rising in the skilled wage premium. As the government is understood to be directly responsible for training, it is not easy to ignore such demand politically. Still, for major public investments in skills to have a significant effect on relative wages, there has to be cooperation from skilled unions and the employers. Such cooperation is essentially what is implied in the neo-corporatist literature when bargaining is centralized and solidaristic. It is thus the combination of centralization and effective, publicly supported, collective training systems that enables the sustainable compression of wages—a pattern that has been particularly prevalent in the Scandinavian countries.

By contrast, if skilled wages are not adjusted downward to accommodate a greater supply, the result will be (youth) unemployment. This is likely to happen when the government seeks to increase the supply of skilled workers in a decentralized bargaining system where there is no coordination between skilled and semi-skilled unions. While skilled unions will be under some market pressure to adjust their wages downward, they are likely to respond by demanding higher job security (by making it costlier for employers to fire skilled workers). Such job protection makes it even harder for newly skilled workers to find jobs and thus limits the incentive to acquire skills. Yet, skilled youth unemployment can be persistently high in equilibrium because the combination of high wages and high job security makes it worthwhile for many young people to wait for a job opening, especially when the government subsidizes training and provides unemployment benefits. Politically, the system is sustainable because many young un- or underemployed people will stay at home until they find a permanent job, which means that they become dependent on the income and job security of the (usually male) breadwinner. This logic also applies to the spouse who may desire better opportunities in the labor market but will not vote for policies that put the jobs of the breadwinner at risk (Iversen and Rosenbluth, 2010: ch. 5). We see this “bad” equilibrium of strong skilled unions and public subsidization of training as emblematic of the southern European economies.

The implication of this argument is that the effect of investment in training depends on the structure of the wage-setting system. When wages are flexible and market-determined, increasing the supply of skilled workers will reduce the skill premium and thus inequality. Yet, as we noted above, public investment in training is not likely to be politically feasible as individuals with high skills or the private means to acquire such skills have no interest in reducing

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the skilled wage premium. In centralized bargaining systems where solidaristic wage policies facilitate and are facilitated by investment in public training, political demand for spending will be high (also among employers) as the skilled wage premium does not justify high private spending on training. While spending only affects wages indirectly, the combination of solidaristic wage policies and high spending is what sustains a very compressed structure. In the intermediate cases where skilled unions are strong and collective bargaining is pervasive, the wage-equalizing effects of investment in training are muted. Yet, despite the resulting problem of youth unemployment, demand for publicly provided training can be high.

### **Exploring the argument: Exemplary country cases and descriptive statistics**

As the previous discussion makes clear, it is necessary to consider the interaction between the training system and the wage-setting system and to see how this interaction has changed over time if we are to understand the effect of skill-biased technological change (see Table 8.1). What causes rising labor market stratification in continental European countries, we argue, is the extent to which employers are institutionally represented in the skill system combined with the extent to which the collective bargaining system is dominated by strong unions of skilled workers (“semi-decentralized” bargaining). A decline in bargaining centralization is a strong incentive for skilled workers to bargain up their wages in response to rising demand for their labor, and as both unions and employers will prefer to ration the intake of young workers in the training system (despite the rising demand for training spots), the results are rising inequality and skill-biased dualism. This combination is highlighted in the middle cell in Table 8.1.

This outcome marks an important departure from the first three decades after the World War II, when most continental European bargaining systems functioned in a much more coordinated and solidaristic fashion (Thelen and Busemeyer in this volume). To understand why, we have to take into account the widespread use of Fordist production technologies (albeit skill-intensive varieties of Fordism) in most industrial economies, which created complementarities between skilled and semi-skilled workers in production and encouraged encompassing bargaining for both groups (Wallerstein, 1990; Iversen and Soskice, 2009). In turn, coordination and solidarism led to increased demand for “cheap” skilled workers, and that gave both (encompassing) unions and employers an incentive to expand the intake of trainees in order to satisfy this demand (the bottom middle cell in Table 8.1). Because of the direct coordination between demand and supply, the dual training system is

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exceptionally efficient in ensuring that demand and supply of skills match each other, and it was easy to satisfy the demand for apprenticeships by keeping skilled wages down. The salutary results were low youth unemployment and high wage equality.

What brought this equilibrium to an end may be related, in part, to an acceleration in skill-biased technological change, which caused an unanticipated rise in skilled wages. However, we think it is probably more important that the decline of Fordism and deindustrialization undermined complementarities between skilled and semi-skilled workers in production and hence chipped away at the foundation of solidarism in the industrial relations system. As this process unfolded, the training system turned into a source of wage inequality and labor market dualism (though less a source of youth unemployment).

The Scandinavian training and wage-setting systems once worked in a manner not unlike the old Continental ones, although with greater centralization in the wage-setting system and more emphasis on publicly provided, school-based vocational training. Over time, the school component became more prominent (even in a country like Denmark whose training system comes closest to the German “dual” training system; see Nelson in this volume), and this made skill matching and effective labor market transitions from training to employment harder to accomplish. At its most efficient, the German dual system produced less youth unemployment than the Scandinavian school-based system.

Now the roles have been reversed. Firstly, while centralization in the wage-setting system has declined in Scandinavia, macrocoordination continues to play a significant role (Martin and Thelen, 2007). The reason for this is not entirely unrelated to the heavy public subsidization of training and ALMP because such subsidies have helped increase the supply of skilled workers and reduce the supply of semi-skilled workers; a combination that makes it harder for skilled unions to pursue a decentralized strategy. In addition, center-left governments expanded the public service sector, which helped keep up wages and unionization rates among semi-skilled workers. In such a setting, it is harder for private-sector skilled unions to bargain higher wages without the public sector following suit. In that specific sense, the end of Fordism and deindustrialization has not spelled the end of complementarities between skilled and semi-skilled workers. The net result is higher centralization and less inequality and dualism in response to skill-biased technological change (as indicated in the bottom left cell of Table 8.1).

The southern European combination of public training systems—typically with free, universally accessible vocational tracks in the secondary school system—and a decentralized bargaining system completely dominated by skilled unions tends to create an oversupply of (modestly) skilled young workers, high levels of job protection for skilled workers (with the accompanying insider-outsider divisions), and considerable wage inequality (middle left



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cell in Table 8.1). It may be viewed as the worst possible world in terms of economic efficiency, but it is politically sustainable because, first, the prospect of an insider job is high enough and the cost of training low enough to incentivize many young people to go through the secondary vocational track, and second, there is no real possibility of forging an anti-insider coalition given the dependence of women and young people on the male breadwinner.

All the European cases differ sharply from the Anglo-Saxon countries, especially the United States, in terms of both wage-setting and training institutions (indicated in the top right cell in Table 8.1). In the United States, the market plays a much greater role in determining relative wages (this became increasingly true with the end of Fordism), and trainees tend to shoulder a much larger share of the cost of training in a highly fragmented and often privately run training system. Employers have no incentives to train beyond the provision of basic on-the-job skills as firms that do not train can capture the investment through poaching (Finegold and Soskice, 1988). In these cases, wage relativities are determined by the cost of training, as well as by the ability of young people to secure financing. If the skill premium is not sufficiently high, it does not pay to invest in training, and financial institutions will be reluctant to fund such investments. So the equilibrium in these cases is one in which the wage premium largely covers the cost of training. This still leaves a role for politics because costs can be more or less subsidized, which will affect wage dispersion. But public spending has not kept up with rising costs of training over the past two decades (Clotfelter, 1996), and the result has been sharply rising inequality as documented by Goldin and Katz. We have suggested above that the politics of market-based systems militate against heavy public subsidization of training, but why the political climate has become less conducive to the expansion of public education is an important question for future research.

There are other logically feasible combinations of training and wage-setting systems than the five we have discussed, but they are not observed empirically. Training systems that involve labor market organizations in the administration do not exist in market-based systems because associations and unions are weak in these, and because these economies are not built around deep investments in vocational skills. Conversely, practically all countries with strong unions and employer associations have developed vocational training systems of some sort, which historically co-evolved in the early twentieth century (Thelen, 2004) with subsequent modifications (in most cases by an increased role of school-based public training). As a consequence, fragmented private systems do not exist in these countries.

Also, the classification of countries can change over time. As discussed above, this is most relevant for the case of collective skill formation systems,

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**Table 8.1** The effects of skill-biased technological change depending on the wage-setting and training systems

		<i>Training system</i>		
		High levels of public investment in vocational training	High levels of firm involvement with public support "dual system"	Private (but partially subsidized) system
<i>Wage-setting system</i>	Market-based wage setting	n.a.	n.a.	Youth unemployment: $11.7 \pm 1.5$ Wage inequality: $3.35 \pm 0.17$
	"Semi-decentralized" collective bargaining	Youth unemployment: $19.6 \pm 2.9$ Wage inequality: $3.14 \pm 0.34$	Youth unemployment: $7.4 \pm 2.5$ Wage inequality: $2.86 \pm 0.24$	n.a.
	"Centralized" collective bargaining with solidarism	Youth unemployment: $10.9 \pm 2.3$ Wage inequality: $2.31 \pm 0.19$	Youth unemployment: $5.9 \pm 3.0$ [Data lacking for wage inequality]	n.a.

which, with the erosion of collective wage bargaining, are moving from the bottom cell in the middle column to the middle cell in the same column of Table 8.1. The case of Germany (see Bussemeyer, 2009b; Thelen and Bussemeyer in this volume) exemplifies this trend very clearly. Furthermore, it can be supposed that bargaining institutions are more likely to change over time than are educational institutions. The latter are more entrenched, whereas the former often partly rest on informal practices of coordination, which are more prone to erosion. Given the limitations of our quantitative research design, however, we focus on comparative statics and neglect the analysis of change over time for now.

The simplest way to illustrate our argument empirically is to show the mean levels of inequality and youth unemployment for each of the institutional combinations in Table 8.1. Here, we simply divide countries into three groups corresponding to this table:

1. Countries with no separate vocational training system, except for vocational tracks in the general school system, as are found in all Anglo-Saxon countries and Ireland;
2. Countries with an integrated system of dedicated school- and firm-based training systems that feature heavy firm involvement and include the dual systems of the German-speaking countries;

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3. Countries with “public” systems featuring separate, more or less developed vocational training systems that are either entirely school-based or mixed with a “dual” training tier (such as exists in Denmark).

Then, we carry out an analysis of variance where dummies are used as predictors for each of the (observed) combinations. As the distinction between decentralized and centralized dual training systems is over time, and not across countries, we also include a period dummy (not significant), and we correct for AR1 correlation (the full results are in Table 8.2). To calculate the confidence intervals, we use panel-corrected standard errors.

The pattern is largely what we would expect. Youth unemployment is very high in public training systems with decentralized bargaining (almost 20 percent) and very low in dual training systems with centralized systems (less than 6 percent). Market-based and centralized systems with school-based training systems fall in between. These differences are statistically significant.

In terms of wage inequality, the public training systems with decentralized bargaining are statistically indistinguishable from the market-based systems at the inegalitarian end of the spectrum (with a ratio of wages at the ninth to the first decile between 3.1 and 3.4), while the centralized systems with public training are by far the most egalitarian (2.3). Countries with dual training systems are intermediate, but we cannot distinguish the effect of centralization for these countries because of the lack of wage data prior to 1980.

In terms of variance accounted for, the categories pick up over 80 percent of the total variance in wage inequality, which, in our relatively short panels, does not change much over time. Still, in the case studies for this volume it is evident that significant changes *have* taken place, especially when we look outside the restricted sample of full-time employees.

**Table 8.2** Averages of youth unemployment and wage inequality in advanced industrial democracies

Models	(1)	(2)
Dependent variables	Youth unemployment	Wage dispersion
Centralized wage bargaining and public vocational training system	-0.756 (1.121)	-1.051*** (0.112)
Centralized wage bargaining and dual training system	-4.166*** (1.401)	-0.539*** (0.139)
Decentralized wage bargaining and dual training system	-4.751*** (1.249)	-0.488*** (0.131)
Decentralized wage bargaining and public vocational training system	8.034*** (1.421)	-0.209 (0.185)
Constant	11.76*** (0.641)	3.369*** (0.0962)
Observations	653	391
R <sup>2</sup>	0.113	0.807
Number of countries	21	18

Standard errors in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

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In contrast to wage inequality, most of the variation in youth unemployment is intertemporal (78 percent), and we cannot capture this variance with a mostly stable set of institutional categories. In terms of the observed cross-sectional variance, however, these categories do pick up about 50 percent of the total variance.

### A multivariate statistical test

Whereas above, we explored our argument with the help of descriptive statistics and illustrative discussions of some country cases, this section contains a more rigorous statistical analysis. We first discuss data measurement and sources and then follow up with a brief section on methods. Subsequently, we present our findings in a nontechnical way. Interested readers are directed to the detailed regression tables.

#### *Data*

We use data on wage inequality and youth unemployment from the OECD Labor Force Statistics and the OECD Earnings Database to measure different kinds of labor market stratification. Wage inequality refers to the average wage for a full-time worker in the top decile of the distribution, relative to the average wage of a worker in the bottom decile (D9/D1 ratio). Youth unemployment is defined as the unemployment rate of young persons between the ages of 15 and 24; the figures are provided in the OECD Labor Force Statistics. We have time series data going back to the early 1980s (at least for some countries). Missing values in each series are interpolated. For details on availability and sources, see Table 8.A1 in the Appendix.

The key independent variables are the centralization of wage bargaining and the institutional setup of the training system. For the former, we rely on the extensive dataset compiled by Miriam Golden, Peter Lange, and Michael Wallerstein (Golden et al., 2009). In particular, we use an indicator capturing the dominant level of wage bargaining in a given country and year, where “plant-level wage-setting” equals 1, “industry-level wage-setting” equals 2, “central wage-setting without sanctions” equals 3, and “central wage-setting with sanctions” equals 4. Unfortunately, this measure is only available until 2000, which limits the length of our time series. Also, data for Greece, Ireland, New Zealand, and Portugal are missing. We use the logarithm of this measure, because it can be assumed that the difference between lower values of this indicator (i.e., plant-level wage-setting versus industry-level wage-setting) matters more than the difference between high values (comparing central wage-setting with and without sanctions).

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Quantitative or qualitative measures of the institutional setup of the training system are hard to come by. In other work, the share of students in vocational and technical education at the level of secondary education was used as a potential indicator of firm involvement in training (Iversen and Soskice, 2001; Bradley et al., 2003; Cusack et al., 2006). The downside of this measure is that it overlooks important differences in the institutional setup of the training system, specifically, whether vocational training is provided in the form of dual training, school-based education, or training on the job. Another indicator of skill specificity is given by Culpepper (2007), who argues that the “specificity” of a training system can be read off the relative availability of vocational training on the tertiary level (e.g., universities of applied science). Yet, our concern is not specificity per se, but rather the presence of a fully fledged vocational training system and the extent to which the school-to-work transition is coordinated with employers.

A similar problem is that reliable and high-quality data on public investments in vocational training is not easily available. The OECD, the best data source in terms of education statistics, provides data on spending for tertiary education, on the one hand, and primary, secondary, and nontertiary post-secondary education, on the other. Vocational training clearly falls in the latter category, but this is a heterogeneous category that does not clearly distinguish between vocational and general education. The OECD also provides data on spending for active labor market programs for youths (see Armingeon et al., 2009), but again, it is not clear to what extent this kind of spending really relates to vocational training.

Given this state of affairs, we use the following measures for firm involvement and public investment in vocational education and training (VET), respectively. Firm involvement is captured with OECD data on the share of students at the upper secondary level in “dual training” schemes (i.e., vocational training schemes that combine school- and workplace-based VET). Unfortunately, this data is available only for a subset of countries, which reduces the number of countries that can be included in the analysis. The measure for public investment in training is constructed by multiplying public spending on upper secondary education (as percentage of GDP) with the share of upper secondary students in vocational training, regardless of whether training is located in schools or in firms.<sup>3</sup> Therefore, countries with extensive school-based VET score high on this measure, as do countries with strong apprenticeship training systems.

The OECD data for these two measures go back to the mid-1990s for some countries. There is very little change over time, because the two indicators capture basic institutional structures of educational systems, which are very unlikely to change in the relatively brief span of ten years. Because of this, we

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used the older data to generate long-term averages, which is preferable to simply using values for one particular year.

Because of missing data for wage bargaining (Greece, Ireland, New Zealand, and Portugal), firm involvement (Australia, Japan, New Zealand, Portugal, and the United Kingdom), and public investment in VET (Canada, New Zealand), the total number of country cases covered is reduced to thirteen. These countries are Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United States. The panel is unbalanced, because data for youth unemployment and wage dispersion for some countries is missing in the 1980s.<sup>4</sup>

Figure 8.1 shows how countries are distributed across the two dimensions.<sup>5</sup> The grouping of countries largely confirms the more qualitative classification laid out in the introduction to this volume. Four of our five collective skill formation systems (Germany, Austria, Switzerland, and Denmark) are located in the upper right corner of Figure 8.1, which means that these countries combine strong firm involvement with high levels of public investment in VET. Also, following up on one of the main themes of this volume, we find quite a bit of variation within this group of countries, which makes it worthwhile to explore the particular combinations of firm involvement and public commitment to be found in the individual country cases. In contrast, the Scandinavian countries, France, and Belgium are located in the upper left corner of Figure 8.1. These “statist” skill formation systems exhibit high levels of public investment in VET, but little firm involvement. The Netherlands occupy an outlier position between statist and collective skill formation systems. Compared with the other collective skill formation systems, school-based VET is more important and firms are involved less, although to a stronger extent than in statist or liberal systems. Liberal skill formation systems (which in this sample are only the United States and Ireland) are found in the lower left corner of Figure 8.1. They combine low levels of public investment in VET with little firm involvement. In these educational systems, VET is subordinated to academic education. Finally, the southern European countries (Italy, Greece, and Spain) form a group of their own. The data indicate that public investment on VET in these countries is higher than in the liberal skill regimes, but the countries fail to expand firm involvement.

Some important cases are missing from Figure 8.1 because of the lack of data or more substantial problems with classification. For example, according to the OECD (2010: 305), about 32 percent of upper secondary students are enrolled in vocational programs in the United Kingdom. Because of the heterogeneous and decentralized character of the United Kingdom’s training system and the associated multitude of training providers, however, it is very hard to determine the degree of real firm involvement in training (see Rainbird, 2010, for an overview). Probably, it could be said that firm involvement is

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**Figure 8.1** Firm involvement and public investment in VET in OECD countries  
*Note:* For exact definitions and data sources of the two indicators, see Table 8.A1 in the Appendix.

higher than in other liberal skill formation systems, which would put the United Kingdom somewhere below the Netherlands.

Another important case that is missing is, of course, Japan. In the introduction, Japan was classified as a segmentalist skill formation system, combining strong involvement of firms with little public investment in training. Furthermore, firms in Japan rely on firm-based training schemes and internal labor markets, whereas in collective skill formation systems, firms are involved in VET via apprenticeship training. Nevertheless, a sizable share of a Japanese youth cohort undergoes firm-based training (Dore and Sako, 1998). In the general education system, however, VET does not play a significant role, also because it is modeled on the US educational system. There is a distinction between general and vocational high schools, but the content of curricula in the latter is quite general as well, and firms do not distinguish systematically between graduates of the two school types when hiring workers (Bussemeyer, 2009a: 389). Therefore, if we had exact data on firm involvement in VET, Japan would probably be located in the lower right corner of Figure 8.1.

For our control variables, we rely mostly on the Comparative Political Data Set (Armingeon et al., 2009). In particular, we control for GDP growth, the general level of unemployment, net union density (from Golden et al., 2009), deindustrialization (defined as the share of people working in the service sector),

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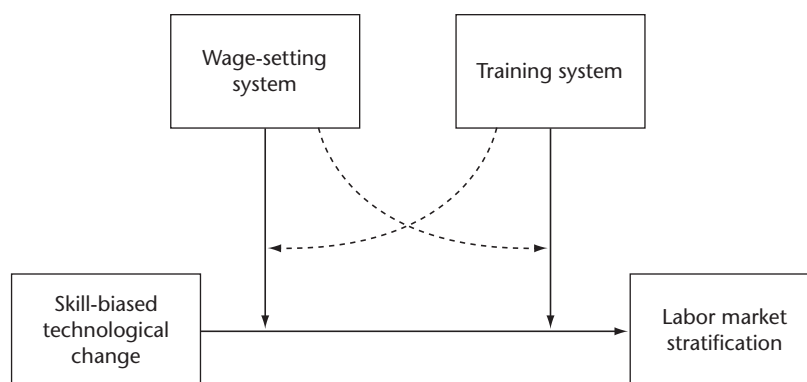
and the strictness of employment protection legislation (measured by the pertinent index developed by the OECD). These variables have been identified as core determinants of youth unemployment and wage inequality, respectively (Wallerstein, 1999; Pontusson et al., 2002; Bradley et al., 2003; Breen, 2005). We refrain from including political variables such as partisanship or social spending at this point, because we would like to focus on the effects of institutions.

### *Methods and hypotheses*

The analysis in the previous section provides essentially a first pass for our argument, and it gives a good description of the magnitude of differences in outcomes across countries. In this section we try to move a bit closer to testing our causal argument, using more differentiated measures of our independent variables across time and space and controlling for potentially confounding variables.

The causal argument can be summarized in a very simple diagram (see Figure 8.2). The exogenous force of change is skill-biased technological change. Such change has an inequalizing effect on the labor market, as emphasized by economists, but the magnitude of the effect depends on the structure of wage-setting institutions and the training system (see Table 8.1).

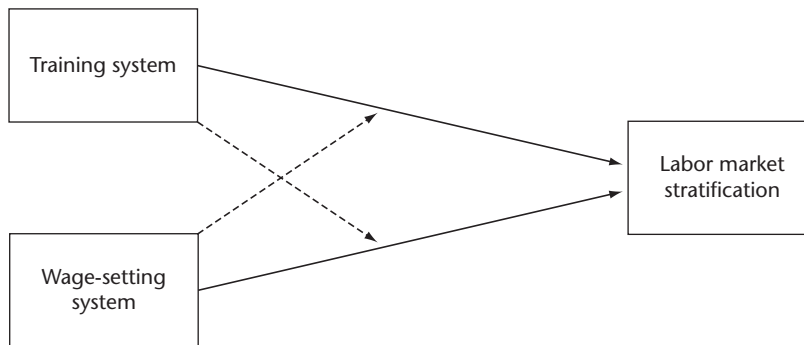
In principle, it is possible to estimate this model directly through nonlinear modeling, but in practice, data limitations make it nearly impossible. Time-series measures for skill-biased technological change do not exist on a country-by-country basis, and for the period we look at, the Goldin–Katz data suggest that the speed of change was fairly constant. As noted above, their estimate is 2.85 percent for the period 1960–80 and 2.76 percent for the period 1980–2005. While technological change produces constant pressures on the labor market,



**Figure 8.2** The effect of skill-biased technological change on labor market stratification depending on wage-setting and training systems



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**Figure 8.3** Labor market stratification as a function of wage-setting and training systems

there is no reason to think that variance in the speed of such change is a major cause of changes in outcomes over time. Instead, our argument suggests that such changes are due to changes in the training system and education policies, and especially to changes in the wage-setting system.

Assuming that the rate of change in skill-biased technological change remains constant, the model reduces to the simpler one illustrated in Figure 8.3, where stratification is the direct result of the (interactive) effects of institutions. We therefore estimate this simpler model, using Prais-Winsten regression with adjustments for first-order autocorrelation and standard errors that adjust for heteroskedasticity and contemporaneous correlation (Beck and Katz, 1995).<sup>6</sup> We refrain from using country fixed effects, as these would dominate the explanatory contribution of our institutional indicators, which do not vary sufficiently across time.

#### *Findings*

With a few important qualifications, the statistical analyses support the argument outlined above. In addition to the well-known effects of the wage-setting system on labor market stratification and wage inequality, we find that the institutional setup of the training system is an important and hitherto underestimated factor shaping labor market outcomes. Furthermore, there is strong evidence for an interaction effect between wage-setting institutions and the vocational training system as implied by Figure 8.3, despite the fact that the two are not necessarily correlated. In our sample, the bivariate correlation between our indicator of firm involvement in training and wage-bargaining centralization is only around 0.06, whereas the indicator of public investment in vocational training and bargaining centralization are correlated to a stronger extent (0.21). However, as we will show below, the attenuating

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effects of training and wage-bargaining centralization on the severity of labor market stratification are more pronounced when strong training institutions come together with strong collective wage-bargaining institutions.

We begin by considering the effects of training and bargaining centralization on youth unemployment. A strong involvement of firms in vocational training has a negative impact on levels of youth unemployment (see model 1 in Table 8.3). Increasing the share of upper secondary students in dual training schemes by about 30 percentage points (the difference between Finland and Germany) is associated with a decrease in youth unemployment by almost 5 percentage points with an overall average of 13.2 percent in the sample. Our indicator of public investments in vocational training, in contrast, is positively associated with youth unemployment, although the effect is not robust across all model specifications. These findings corroborate one of the core arguments in the sociological literature on labor market transitions (Allmendinger, 1989; Gangl, 2003; Breen, 2005; Wolbers, 2007), which is that dual training systems facilitate smooth transition from training to employment, thus contributing to lower levels of youth unemployment. In contrast, school-based vocational education systems tend to be associated with rougher transitions from training to employment.

**Table 8.3** The determinants of youth unemployment

Models	(1)	(2)	(3)
Dependent variable	Youth unemployment		
Firm involvement in training	-0.160*** (0.0209)	-0.112 (0.0770)	-0.169*** (0.0294)
Public investment in vocational training	1.936 (2.177)	1.024 (2.935)	11.25*** (3.236)
Log of wage bargaining centralization	1.400** (0.589)	1.960* (1.021)	13.17*** (2.132)
Firm involvement × bargaining centralization		-0.0455 (0.0615)	
Public investment × bargaining centralization			-17.30*** (3.387)
Net union density	-3.783*** (1.024)	-3.070** (1.464)	-4.878*** (1.169)
GDP growth	-0.0230 (0.0773)	-0.0238 (0.0767)	-0.0293 (0.0778)
Unemployment	1.686*** (0.0676)	1.695*** (0.0675)	1.643*** (0.0773)
Deindustrialization	-17.31*** (5.018)	-15.98*** (5.313)	-7.100 (6.951)
Strictness of employment protection legislation	-1.076*** (0.409)	-1.133*** (0.387)	-2.120*** (0.585)
Constant	18.05*** (3.583)	16.93*** (3.983)	8.837* (4.801)
Observations	188	188	188
R <sup>2</sup>	0.861	0.862	0.875
Number of countries	13	13	13

Standard errors in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

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**Table 8.4** The determinants of wage dispersion

Models	(1)	(2)	(3)
Dependent variable	Wage dispersion (D9/D1 ratio)		
Firm involvement in training	0.00124 (0.00104)	-0.00428 (0.00281)	0.00157 (0.00121)
Public investment in vocational training	-0.846*** (0.147)	-0.745*** (0.150)	-1.019*** (0.187)
Log of wage bargaining centralization	-0.153*** (0.0470)	-0.225*** (0.0727)	-0.293** (0.124)
Firm involvement × bargaining centralization		0.00540* (0.00285)	
Public investment × bargaining centralization			0.323* (0.175)
Net union density	-1.609*** (0.129)	-1.665*** (0.126)	-1.652*** (0.134)
GDP growth	0.00376 (0.00519)	0.00453 (0.00522)	0.00521 (0.00435)
Unemployment	-0.0168* (0.00874)	-0.0169* (0.00871)	-0.0138* (0.00830)
Deindustrialization	-1.998*** (0.323)	-2.092*** (0.307)	-2.125*** (0.319)
Constant	5.548*** (0.245)	5.638*** (0.240)	5.655*** (0.239)
Observations	245	245	245
R <sup>2</sup>	0.856	0.856	0.877
Number of countries	13	13	13

Standard errors in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 8.5** Nonlinear interaction between training, wage bargaining centralization, and wage dispersion

Models	(1)	(2)
Dependent variable	Wage dispersion (D9/D1 ratio)	
Firm involvement in training (FI)	-0.0462* (0.0238)	0.000574 (0.00138)
Public investment in vocational training (PI)	-0.624*** (0.153)	-2.862*** (0.559)
Bargaining centralization (BC)	-0.769*** (0.192)	-1.491*** (0.321)
BC <sup>2</sup>	0.126*** (0.0319)	0.275*** (0.0608)
FI × BC	0.0351* (0.0180)	
FI × BC <sup>2</sup>	-0.00584* (0.00300)	
PI × BC		2.020*** (0.505)
PI × BC <sup>2</sup>		-0.377*** (0.0942)
Net union density	-1.595*** (0.156)	-1.621*** (0.159)
GDP growth	0.00510 (0.00477)	0.00557 (0.00380)
Unemployment	-0.0114 (0.00880)	-0.00636 (0.00865)
Deindustrialization	-2.311*** (0.301)	-2.230*** (0.359)
Constant	6.462*** (0.330)	6.998*** (0.379)
Observations	245	245
R <sup>2</sup>	0.872	0.896
Number of countries	13	13

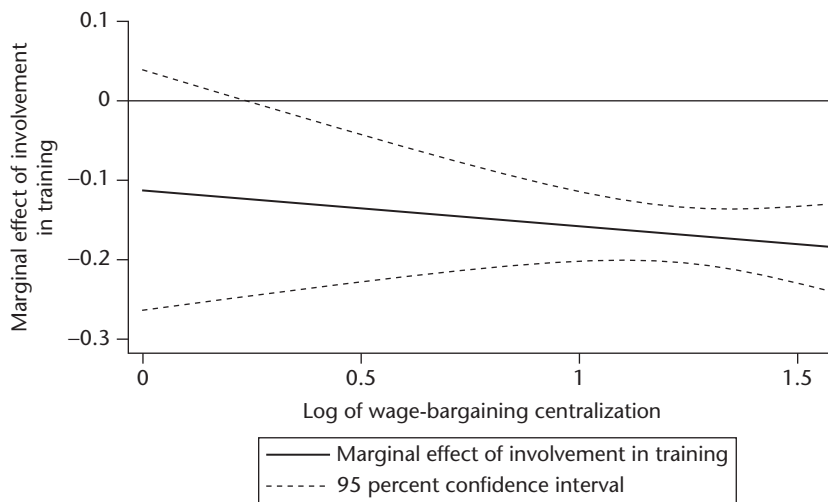
Standard errors in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

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We have argued above that the effects of wage bargaining and training institutions must be assessed together, because one variable conditions the effects of the other (Figure 8.3). We therefore explore the interaction between training institutions and collective wage bargaining. In order to provide a tangible interpretation of the findings, we chose a graphical representation, but details on the coefficient estimates can be gleaned from Tables 8.3 and 8.4.

Figure 8.4 shows changes in the impact of firm involvement in training across different levels of bargaining centralization. Clearly, there is an interaction effect between the two. At low levels of bargaining centralization, the effect of firm involvement in training on youth unemployment cannot be distinguished from zero. With increasing bargaining centralization, the negative effect of firm involvement on youth unemployment increases in magnitude and becomes highly significant. When bargaining centralization is at its highest level, the average impact of firm involvement on youth unemployment is  $-2$  percentage points for each 10 percentage-point increase in the share of students in dual training schemes. This is a strong confirmation of our initial findings in Table 8.3.

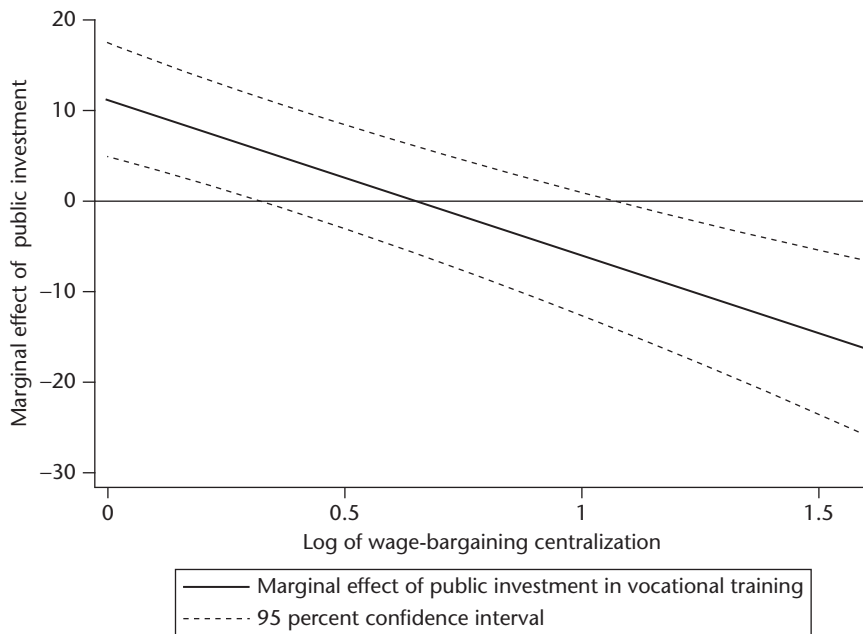
Figure 8.5 depicts the interaction between public investment in training and bargaining centralization. Similar to firm involvement, public investments in vocational training do not seem to reduce youth unemployment, when bargaining centralization is low. However, when bargaining centralization increases, the effects of public investment turn negative and are statistically significant. We interpret these findings as meaning that public investments in



**Figure 8.4** The impact of wage bargaining centralization on how firms' involvement in training affects youth unemployment

*Note:* The figure is based on model 2, Table 8.3.

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**Figure 8.5** The impact of wage bargaining centralization on how public investment in vocational training affects youth unemployment

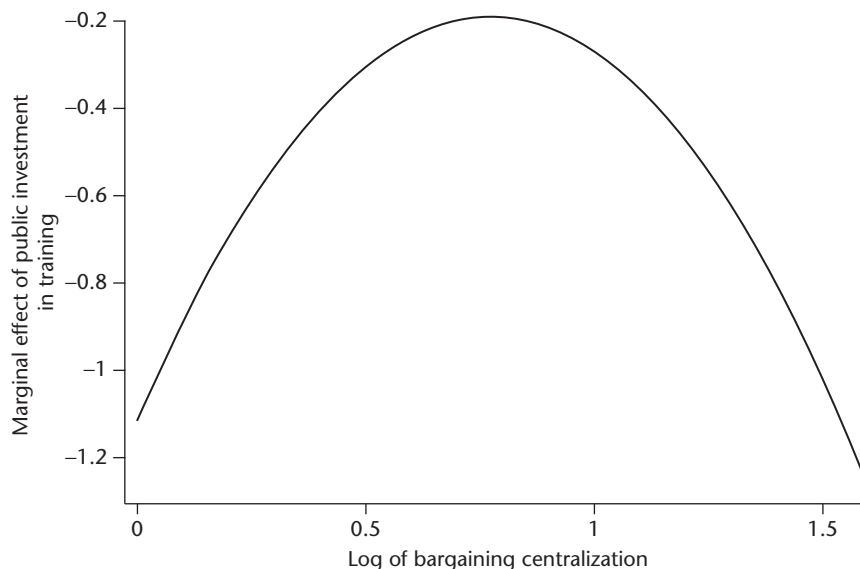
*Note:* The figure is based on model 3, Table 8.3.

VET are not an effective instrument against youth unemployment when bargaining centralization is at low or medium levels. High levels of bargaining centralization ensure an equal distribution of public investments among labor market insiders and outsiders, which then increases the effectiveness of public investments in improving skill levels in the lower half of the academic skills distribution.

When looking at the association between overall levels of wage inequality, training, and bargaining centralization (see Table 8.4), we find that this picture needs to be refined. Firm involvement in vocational training does not have any systematic impact on wage dispersion, but public investments in vocational training have a strong negative impact. The magnitude of this effect is large: based on the coefficient estimates of Table 8.4, an increase in public investments in VET by 0.65 percent of GDP (i.e., the difference between Italy and Finland) reduces the D9/D1 ratio by 0.54 points (with a sample average of 3 and a standard deviation of 0.66).

As can be seen from Table 8.4, the simple interaction effect between training and bargaining centralization is not statistically significant. Furthermore, the positive sign actually indicates that the inequality-reducing effect of public investments in VET decreases with higher levels of bargaining centralization.

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**Figure 8.6** The impact of wage bargaining centralization on how public investment in vocational training affects wage dispersion

*Note:* The figure is based on model 2, Table 8.5.

However, digging deeper, we find that this is due to a nonlinear interaction between training and bargaining centralization (see Figure 8.6 and Table 8.5). In particular, there is evidence for a nonlinear interaction effect between bargaining centralization and public investment in training, but not between firm involvement and wage-setting institutions. Figure 8.6 presents this relationship graphically. At low levels of bargaining centralization, the impact of public investments in vocational training on wage dispersion is negative, meaning it reduces inequality. The same holds true for high levels of bargaining centralization. For intermediate levels of bargaining centralization, however, the impact of public investments in vocational training is weaker and closer to zero. In this setting, moderately strong unions delimit the effectiveness of public policies aimed at improving the wage position of low-skilled workers, because unions are largely set up to protect the wages of skilled labor, fuelling labor market segmentation.

### Summary and conclusions

To sum up our argument and findings: the influential work by Goldin and Katz (2007, 2008) suggests that recent increases in inequality are a necessary consequence of the exogenous force of skill-biased technological change,

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which increases the relative demand for skilled labor. We have shown that there are important differences across countries with regard to the effect of skill-biased technological change on labor market stratification. Furthermore, these differences can only be understood if we take into account the fact that the supply of skilled labor is not determined by structural forces alone, but depends on the institutional setup of the education and training system as well as the centralization of wage bargaining. In particular, we find strong evidence for a complementary relationship between training and bargaining centralization with regard to their impact on labor market stratification.

In the case of youth unemployment, the complementarity is particularly pronounced. When bargaining centralization is high, firm involvement in training has a strongly negative impact on levels of youth unemployment. This negative impact weakens when bargaining is less centralized. Hence, encompassing bargaining institutions are needed as “beneficial constraints” (Streeck, 1989, 1992) in order to overcome the problem of rationing training places, a problem representing the flip side of high levels of firm involvement. What is more, public investments in vocational training are not as effective in lowering youth unemployment as are high levels of firm involvement, but they have a negative effect when wage bargaining is highly centralized. This finding resonates well with the sociological literature on labor market transitions (Allmendinger, 1989; Gangl, 2003).

With regard to wage dispersion, the findings are less clear-cut. Firm involvement in training does not have an impact on wage dispersion, but public investments in vocational training have an equalizing effect on the distribution of wages. Also, we find initial evidence for a complex interaction pattern between public investments in training and collective wage bargaining, which needs to be addressed in future research. Clearly, educational institutions can be expected to have a stronger bearing on youth unemployment than on wage dispersion in general. This is why the effects are more clear-cut and correspond to our expectations in the former case rather than in the latter. It is reasonable to assume that educational institutions will have *some* effect on wage inequality, but it would also be necessary to look at other determinants, such as continuing VET, a task that lies beyond the focus of this chapter.

Further evidence for the relationship between training and collective wage bargaining will also have to be provided in more fine-grained case studies (see Thelen and Busemeyer in this volume), but we postulate that it essentially holds across countries as well as across time. For example, because of strong vocational training and bargaining centralization, Germany exhibits less labor market stratification than, say, the United States. But the significant erosion of the German collective wage-bargaining system in the last decade is clearly related to the increasing labor market stratification and dualization (Hassel, 1999; Streeck, 2009; Palier and Thelen, 2010). This does not simply have a

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direct effect on wages. Because of the complementarity between training and wage bargaining, our analysis suggests that the role of vocational training as a force shaping labor market outcomes has changed as well. Instead of preventing stratification, the firm-based training scheme increasingly becomes a cause of stratification, for example when young persons with poor school qualifications fail to secure a training place and when low-skilled workers suffer disproportionately from unemployment. Unless the bargaining system accommodates the entry of newly trained workers, training spots will either be rationed (as in Germany), or young people with publicly acquired qualifications will end up unemployed (as in Spain).

In other countries, such as Denmark and Austria (see both Nelson and Anderson and Oude Nijhuis in this volume), the decentralization of bargaining has not been as extensive as in Germany (also because these countries were more centralized in the first place). In addition, the predominance of encompassing unions, comprised of skilled and unskilled workers, prevented the emergence of insider–outsider cleavages. Also, these countries are more willing to use public funds (and established training levies to generate revenue, as in Denmark) to subsidize firm-based training and set up fully fledged, school-based alternatives to apprenticeship training instead of creating a complex and stigmatizing “transition” system as was done in Germany. The combination of dual training with public schemes for further training and school-based vocational education thus proves to be more effective in mitigating labor market stratification than the German system, which is centered around the needs of training firms.

Our argument, however, does not imply a functional complementarity between training and wage bargaining in the sense that changes in one aspect will necessarily trigger reactions in the other domain. If anything, we argue the opposite, because otherwise we would not observe the ubiquitous trend of labor market stratification. Our notion of complementarity is based on empirical observation: wherever (and whenever) the commitment of policymakers and firms to vocational training as well as the centralization of wage bargaining is at high levels, labor market stratification is less severe. Still, our argument does not suggest that there are “inherent stabilizers” in this relationship.

Pursuing this line of thought, our argument contributes to the further development of the notion of “beneficial constraints.” Streeck (1989) emphasizes how beneficial constraints enhance and promote the involvement of firms in collective skill formation schemes. We have shown that institutions such as collective wage bargaining, namely institutions that have been regarded as an essential element in the bundle of constraints, affect not only the involvement of firms as such but also the *consequences* thereof in terms of labor market stratification. The weakening of collective constraints on individual firm behavior does not only decrease the involvement of firms in collective training schemes (see Thelen and Busemeyer in this volume) but



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also disable built-in protection mechanisms against the potentially deleterious consequences of firm involvement. In the present case, the decentralization of wage bargaining aggravates labor market stratification between insiders and outsiders, which encourages the rationing of training places and, in the long run, exacerbates youth unemployment.

**APPENDIX**

**Table 8.A1** Variable definitions and sources

Variable	Definition and source
Firm involvement in vocational education and training	Share of upper secondary students in vocational education programs combining school- and workplace-based training; <i>source</i> : OECD Education at a Glance, various years, indicator C1.4.
Public investment in vocational training	Public spending as percentage of GDP on upper secondary education (indicator B2.2) multiplied with share of upper secondary students in vocational programs (both school and dual training schemes) (indicator C1.4); <i>source</i> : OECD Education at a Glance, various years.
Youth unemployment	Unemployment rate, 15–24-year-olds; <i>source</i> : OECD Labor Force Statistics.
Wage dispersion	Ratio between wages at ninth decile to wages at first decile; <i>source</i> : OECD Earnings Database.
Bargaining centralization	Dominant level for collective wage bargaining (“barglev1” in the Golden et al. (2009) dataset); 1 = plant-level wage setting; 2 = industry-level wage setting; 3 = central wage setting without sanctions; 4 = central wage setting with sanctions; <i>source</i> : Golden et al. (2009).
Net union density	Net union density (“netden” in the Golden et al. (2009) dataset), i.e., share of union members in total number of employees; <i>source</i> : Golden et al. (2009).
GDP growth	Growth of real GDP, percentage change from previous year; <i>source</i> : Armingeon et al. (2009).
Unemployment	Unemployment rate as percentage of civilian labor force; <i>source</i> : Armingeon et al. (2009).
Deindustrialization	Share of employment in service sector; <i>source</i> : Armingeon et al. (2009).
Strictness of employment protection legislation	OECD Index of Strictness of Employment Protection Legislation (EPL); <i>source</i> : OECD Stat Extracts/Labor Force Statistics.

**Endnotes**

1. The original theoretical and empirical literature is surveyed in Katz and Autor (1999).
2. The partial exception is Switzerland, where wage setting has been more decentralized than, say, in Germany. Moreover, Switzerland is not a German-speaking country in the strict sense.
3. For Belgium and Greece, the OECD only provides data on combined spending for upper and lower secondary education. To avoid losing more cases, we multiplied

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- total spending on primary and secondary education with the OECD average of the share of upper secondary spending in this larger category (roughly one-third).
4. Missing data on youth unemployment: Austria (1980–93), Belgium (1980–2), Denmark (1980–2), Switzerland (1980–90). Missing data for wage dispersion: Belgium (1980–5), Germany (1980–3), Italy (1980–5, 1997–2000), Norway (1980–8), Spain (1980–94), Switzerland (1980–90).
  5. The bivariate correlation between the two indicators is 0.61.
  6. In this case, this approach is preferable to lagged dependent variable (LDV) regression as advocated by Beck and Katz. The LDV model has the advantage that it captures the dynamic process directly (essentially an error-correction process), but it can sometimes lead to estimated parameters that are close to 0 and statistically insignificant when the explanatory variables are highly trended and the parameter on the LDV is close to 1 (Achen, 2000).

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### **Collective Skill Systems, Wage Bargaining, and Labor Market Stratification**

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