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## Article

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ORIGINAL ARTICLE

Open Access



# Can voluntary adult education reduce unemployment? Causal evidence from East Germany after reunification

Li Kathrin Kaja Rupieper<sup>1</sup> and Stephan L. Thomsen<sup>1,2,3\*</sup>

## Abstract

After the German reunification in 1990, East Germany transitioned from a centrally planned economic system to a market economy. To tackle surging unemployment, upskilling through adult education was deemed essential at the time. Besides substantial mandatory training programs provided by active labor market policies, *Volkshochschulen* (VHS) were the most important providers of voluntary adult education. Based on newly digitized data, we estimate how VHS courses affected unemployment in a county-level analysis of East Germany between 1991 and 2002. Our identification strategy employs the decentralized expansion of courses, which led to substantial, quasi-random variation in their regional supply. We do not find any significant effects of VHS courses on subsequent unemployment. Lacking labor demand and low market dynamics may have restricted the realization of education effects. Regional disparities support this notion: In counties bordering West Germany, courses reduced unemployment. Our results hint towards multiple mechanisms at play, as both work-related and recreational courses were found to be effective in border counties.

**Keywords** Unemployment, Adult education, Non-formal education, Volkshochschule, East Germany

**JEL Classification** I21, J24, N34, P20, P36

## 1 Introduction

Following the German reunification in 1990, East Germany transformed from a centrally planned economic system to a market economy. Labor market turmoils and surges in unemployment accompanied this transition. For the labor market integration of East German workers, upskilling via adult education was considered pivotal. Although the Federal Employment Agency (FEA) implemented subsidized trainings and other active labor market policies (ALMP) on a large scale, these programs

were later found to have achieved mixed results only.<sup>1</sup> Education and training were, however, also provided by non-governmental institutions like unions, churches, private institutes, and *Volkshochschulen* (VHS). Empirical evaluations of their labor market effects are lacking until now. This also corresponds to a general research gap concerning the effects of non-formal education.

<sup>1</sup> Lechner (1998) states for example that in 1992, the FEA spent close to 5 % of the East German GDP on training in East Germany. The corresponding value for all of Germany was 0.5 %. Evaluations of different active labor market policies can be found for example in Bergemann et al. (2009); Fitzenberger and Prey (2000); Fitzenberger and Speckesser (2007); Lechner (1999); Lechner et al. (2007) or Hujer et al. (2006).

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Although different forms of adult education are prevalent and common in industrialized countries, we know relatively little about their effects on labor market outcomes (Midsundstad 2019; Schwerdt et al. 2012). In particular, non-formal adult education lacks causal impact evaluations. This type of education refers to organized learning, but does not lead to a degree or certificate like formal education. Non-formal education may help to adjust human capital to changing labor market demands and hence complement ALMP in important ways. Our study contributes to closing this research gap by evaluating the labor market effects of one specific type of non-formal education. To this aim, we focus on courses at East German VHS after the German reunification. We are the first to empirically assess the labor market effects of VHS education, answering the question whether their courses can reduce unemployment.

VHS are the most important provider of voluntary adult education in Germany (Wittenbrink and Frick 2018). Between 1991 and 2002, East German VHS recorded more than 5 million course participations.<sup>2</sup> Due to state legislations, VHS exist in almost every German county, ensuring a comprehensive educational supply for the population. VHS are open to everybody and have no specific target group, in contrast to courses offered by churches or unions (Süssmuth and Eisfeld 2018). The majority of courses takes place once a week in the evening, but excursions, daytime courses and onetime events are available as well (Reichart et al. 2018). Most courses last between several months and half a year. Participation fees are small thanks to state subsidies.

VHS courses cover a wide range of topics and programs are adapted to overall societal needs.<sup>3</sup> The VHS statistic lists courses in six different areas. We consider courses on work & occupation, basic education, and language courses to be work-related. We expect work-related courses to convey skills relevant for a successful labor market integration. Courses on society & politics, culture & arts, and health, on the other hand, are categorized as leisure-related. These courses serve rather recreational purposes, such as socializing, and are not expected to affect labor market outcomes directly. Course programs are exclusively administered at the local level, which means that each VHS decides autonomously which courses to offer.

VHS courses differ from ALMP programs in central features like freedom of choice, length, content, and incentives for participation. Other course characteristics and reached target audience may differ as well. Yet, both VHS courses and ALMP programs aim at upskilling and consequently may reduce unemployment. In addition,

policy makers and economists may be interested in the effects of VHS courses, as the associated costs per participant in their courses are lower than for typical ALMP. Our study therefore extends the existing literature in the sense of Card et al. (2018), which evaluates labor market effects of adult education in the realm of ALMP, by providing evidence on the effects of non-governmental and non-formal adult education on unemployment. In contrast to the programs covered by Card et al. (2018), we furthermore look at a typical transition economy of the 1990s, characterized by the comprehensive labor market shock going along with the system change.

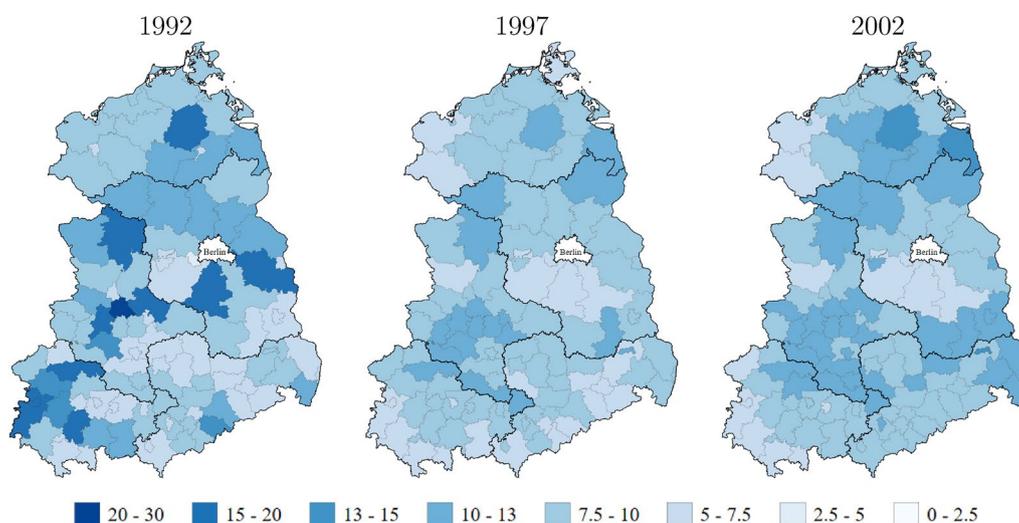
The majority of studies on German VHS have a qualitative or educational nature and refer to specific regions (e.g. Alke et al. 2019; Arnold et al. 2018; Brödel 2018). Martin and Reichart (2020) and Schrader et al. (2020) assess the association between VHS education and political outcomes like voter participation. To the best of our knowledge, only two studies look at VHS education in a labor market context: Schanne and Weyh (2014) evaluate an education consultancy program, which was provided jointly by the local VHS and the city of Dresden in 2010 and 2011. They find a positive association between the consultancy and participation in ALMP training and further education. Furthermore, they find no to small negative employment effects of the consultancy in the short run, which cannot be attributed to VHS education. Our study, in contrast, specifically assesses the labor market effects of VHS education. The second study is by Ruhose et al. (2023) and turns to one specific group on the labor market. The authors investigate the willingness to learn among older workers by combining demographic data with the VHS statistic. Using a partial retirement reform, they show that counties with relatively many affected male workers also showed increased participation in VHS adult education, in particular for cognitively demanding courses. These results are interpreted as evidence on the lasting willingness to learn among older workers, independently from external incentives like monetary ones.

A related study by Schwerdt et al. (2012) on the impact of an adult education voucher program issued in Switzerland found no effect of courses on employment probabilities. While many characteristics of the Swiss adult education system may also apply to Germany, VHS courses cost substantially less (see Fig. 2 for examples of the costs of German VHS courses). Furthermore, we use the case of a transition economy characterized by strong structural changes, where one may expect human capital adjustments to pay off even more than under “normal” conditions.

Our study is the first to provide causal evidence on the effects of VHS education on unemployment. For this purpose, we combine educational data from the VHS

<sup>2</sup> Authors' calculation based on the VHS statistic.

<sup>3</sup> See Thomsen and Weilage (2023) for a recent example.



**Fig. 1** Share of unemployed in county population in East Germany. *Notes:* County boundaries as of late 2005. The unemployment share in the county population is calculated by dividing the number of people registered unemployed at the end of June by the county population. These shares differ from the FEA's unemployment rate, which uses the number of labor force participants as denominator. As corresponding county-level data do not exist for the entire time period under observation, we rely on the population share instead. *Data Sources:* FEA, BBSR, ©GeoBasis-DE/BKG 2023.

statistic with unemployment data from administrative records of the FEA at the county-level. Since the FEA provides digital unemployment data at the county level only since 1996, we expand these data with county-level unemployment data from the FEA for earlier years that we newly digitalized. The resulting panel covers all East German counties from 1991 to 2002. Our identification approach relies on a strong and decentralized expansion of courses at East German VHS after reunification, leading to quasi-random variation in the number of courses per county. We exploit this regional and temporal variation with a two-way fixed effects estimation strategy.

Our main results show that VHS courses overall did not impact subsequent county-level unemployment. This does not change when differentiating between courses with work-related and leisure-related contents. The realization of education effects may have been, analogously to the mixed findings on ALMP effectiveness, limited by the weak development of the East German economy. However, labor demand may have differed across regions. We therefore explore regional disparities in the effect of VHS courses on subsequent unemployment and find that courses in counties bordering West Germany significantly decreased unemployment. In border counties, both work-related and to a lesser extent also recreational courses were effective in reducing unemployment. Our results therefore provide evidence that VHS education may affect labor market outcomes via multiple channels.

The remainder of this paper proceeds as follows. In Sect. 2, we characterize the institutional background by

reviewing the development of the East German labor market during the 1990s and by describing VHS as educational institution. In Sect. 3, we explain the data and the identification strategy. Section 4 entails the results of our empirical analysis. Here, we present the main results, estimates for potential heterogeneous effects over time and space, and a series of robustness checks, accompanied by a discussion of our results. The final section provides our conclusions.

## 2 Institutional background

### 2.1 The East German labor market during transition

The labor market of the German Democratic Republic (GDR) was typical for the command economies of Eastern Europe at that time. Article 24 of the GDR's constitution gave every citizen the right as well as the duty to work, such that open unemployment did not exist as such (Dahms and Wahse 1996). In principle, workers were free to choose their employers, but geographic mobility was limited by rationed housing (Krueger and Pischke 1995). Labor productivity was low, partly because of outdated production technologies (Siebert 1991; Thomsen 2007). With regard to the allocation of jobs and education, not only ability but also party membership and political alignment played a central role (Krueger and Pischke 1995). Full employment and a high female labor market participation rate are further characteristics of command economies (Thomsen 2007).

The reunification in 1990 led to profound changes on the East German labor market. As East Germany

<b>Maschinenschreiben I - Grundkurs I und II</b>	
Fähigkeit, Schreibmaschinen zu bedienen - Beherrschung der drei Buchstaben-tastenreihen einschließlich Umschaltung - Zifferntastenreihe - Schreibtraining - Fähigkeit, Regeln in der Rechtschreibung und Zeichensetzung anzuwenden - Texte abschreiben und gestalten. <b>Ziel:</b> 1200 Anschläge in der 10-Minuten-Abschrift <b>Abschluß:</b> VHS-Prüfung Maschinenschreiben I - 1200 Anschläge	
<b>63 002 B Grundkurs I</b>	
MO., ab 13. 3., 14.30-16.45 Uhr, 10 Wo., 30 Ustd. Volkshochschule	125,00 DM Monika Proksch
<b>63 004 B Grundkurs I</b>	
MO., ab 6. 3., 17-18.30 Uhr, 13 Wo., 26 Ustd. Volkshochschule	115,00 DM Dr. Hans-Peter Flamme
<b>63 006 B Grundkurs I</b>	
MI., ab 22. 3., 13-15.15 Uhr, 10 Wo., 30 Ustd. Volkshochschule	125,00 DM Doris Lahr
<b>63 900 P Maschinenschreiben, GK I (für Anfänger)</b>	
siehe auch Angebote unter „VHS in Paunsdorf“ 10 TeilnehmerInnen - Bitte Schreibpapier mitbringen. DI., ab 28. 2., 17.30-19 Uhr, 15 Wo., 30 Ustd. Thomas-Müntzer-Schule	125,00 DM Lieselotte Otto

**Fig. 2** Excerpt from the program of the VHS Leipzig in 1995. Source: Volkshochschule Leipzig (1995, p.61), from <http://www.die-bonn.de/id/15826>

formally joined West Germany, West German institutions were transferred to East Germany, including the legal and the welfare system. The task of privatizing the East German economy was assigned to a newly founded *Treuhandanstalt*. It absorbed the previously state-owned enterprises, closed unviable ones and searched buyers for the remaining enterprises. A technological catch-up process started, leading to the devaluation of previously gained work experience. Based on a standard human capital regression model, Bird et al. (1994) estimate a 50 % decrease in the return to firm experience for East German men between 1989 and 1991. Also Krueger and Pischke (1995) find flattening experience profiles between 1988 and 1991. Both studies conclude that the East German human capital stock lacked work experience in market-economy companies and hence stressed the relevance of training. Wages were converted 1:1 into the new currency. This was motivated mainly by political reasons, irrespective of productivity developments. Hence, wages were found to be above the market-clearing level. In combination with the low demand for products made in East Germany, local firms experienced severe price–cost–squeezes.

By 1990, the East German industrial output had sunk to 45.5 % of its pre-year level (Akerlof et al. 1991, p. 5f.). Especially the industrial sector, originally a core element of the GDR economy, was hit hard. In consequence, unemployment rose quickly. By 1991, the East German unemployment rate amounted to 10.2 % (Bundesagentur

für Arbeit 2021). This rate veils the true extent of under-employment, as workers on short-time work or in ALMP measures were not considered as unemployed. While the massive use of these policies cushioned the reunification's economic effects, there were still more than 15 % of the population unemployed in about 10 % of the East German counties in 1992 (see Fig. 1).

But the turbulence of transformation went beyond job losses: Between 1989 and 1992, the East German workforce diminished by more than 25 % (Dahms and Wahse 1996). This was not only due to early retirement schemes, but also due to the declining female labor force participation. In addition, migration to West Germany contributed to the reduction of the East German workforce. Of lesser importance was the repatriation of guest workers, given their small numbers at the time of reunification.<sup>4</sup>

In 1994, the East German labor market entered a period of stabilization, as employment started to increase again (Thomsen 2007).<sup>5</sup> The smaller number of people in labor market programs indicated a temporary relaxation of the tense labor market situation. East–West–migration dropped significantly, meaning that the East German

<sup>4</sup> By the end of 1989, there were about 90,000 guest workers in the GDR, which accounted for roughly 1 % of the total workforce (Dahms and Wahse 1996).

<sup>5</sup> Especially the service and the construction sector were thriving. Employment in the industrial and public sector on the other hand continued to reduce. The global recession of the early 1990's had little influence on the East German economy thanks to the weak export dependence.

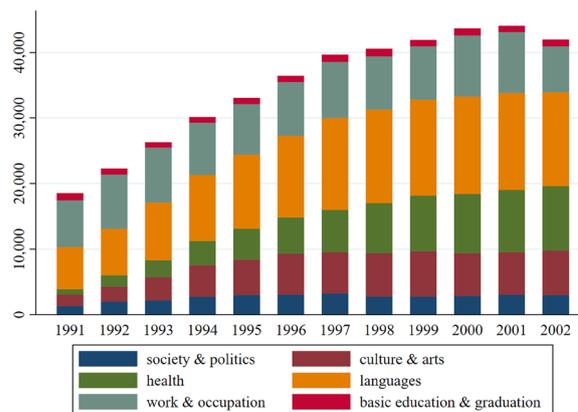
labor force potential changed only slightly in this period. Bielski et al. (1997) report a lower inter-firm mobility of workers in this period, which hints towards a consolidation of the East German firm structure.

Starting in 1996, open unemployment increased again, as well as the demand for ALMP programs (Bundesagentur für Arbeit 2021; Thomsen 2007). At this time, subsidies for the construction sector were omitted and the formerly booming sector came to a halt (Bielski et al. 1997; Thomsen 2007). Further reasons for the stagnant development include the high level of welfare benefits, suboptimal allocation of investment subsidies, and impediments to the optimal allocation of resources across sectors (Hunt 2008). As the *Treuhandanstalt* required buyers to continue operating in the same industry as before, many have delayed sectoral restructuring. Some of the causes of the initial GDP collapse may have also had long-lasting effects. This is especially true with respect to wages, as it is hard to reduce real wages in a low-inflation environment.

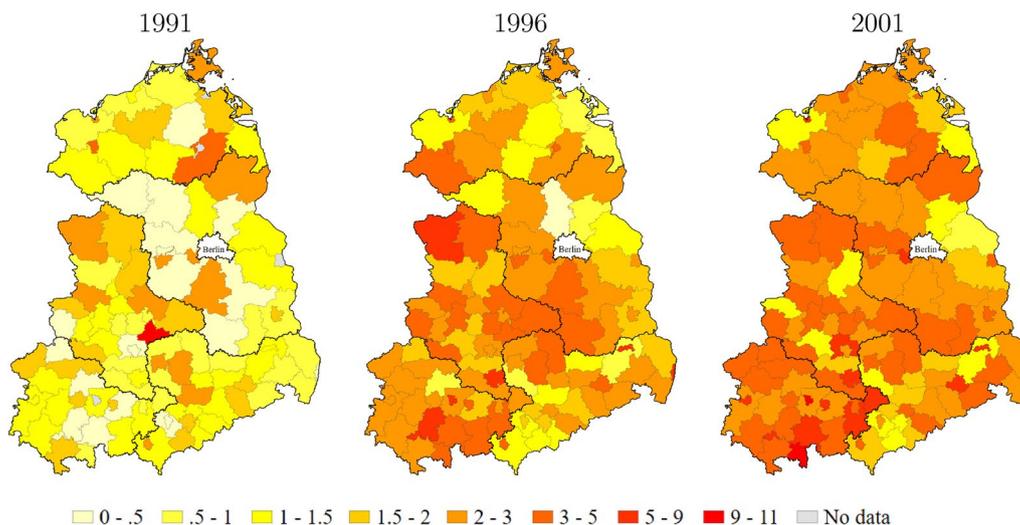
In summary, the transformation period was characterized by three phases of development in the East German labor market: Firstly, the period from 1990 to 1994 can be described as economic collapse, a time of high unemployment, collapsing industrial output and decreasing GDP. Secondly, there was a period of slight recovery and stabilization from 1994 to 1996. And thirdly, a period of stagnation began in 1996. Given the different dynamics and challenges on the East German labor market in these three phases, it can be assumed that the effects of adult education also changed over time.

### 2.2 Volkshochschulen (VHS)

VHS are considered as the main provider of voluntary adult education in Germany (Wittenbrink and Frick 2018). They aim at providing affordable education that is accessible to everyone (Süssmuth and Eisfeld 2018). To this end, VHS offer non-credit courses on a wide variety of topics. In contrast to unions or churches, they do not limit their course supply to any specific target group. Since most German states foresee a guaranteed provision of adult education at the local level, VHS exist in almost all German counties (Ruhose et al. 2023).



**Fig. 4** VHS courses by topic. *Notes:* Yearly sum of VHS courses in East Germany by topic area. The lower three bars on society & politics, culture & arts, and health denote recreational courses. The upper three bars on languages, work & occupation, and basic education denote courses considered to be work-related. *Data Sources:* VHS, BBSR.



**Fig. 3** VHS courses per 1000 inhabitants in East Germany. *Notes:* County boundaries as of late 2005. For four counties, there are no VHS reports in 1991. Figure 11 in the appendix shows the corresponding maps on leisure- and work-related courses. *Data Sources:* VHS, BBSR, ©GeoBasis-DE/BKG 2023.

The fees for participation in a VHS course are in general small. For unemployed people or those with low family income, there is financial support for covering course fees. This renders the financial burden that often limits access to education as good as negligible. Figure 2 shows an example from our sample: In 1995, the fee for a basic typewriting course at the VHS Leipzig was about 115 to 125 Deutschmarks. A lesson of 45 min consequently costed 4.17 to 4.42 Deutschmarks. In comparison, the German GDP per capita was about 45,570 Deutschmarks in 1995 (Statistisches Bundesamt 2023). Charging such low fees is only possible due to strong subsidies. In our sample, more than 60 % of a VHS budget are on average financed by some sort of public fund (see below for more information on the dataset). Fees on the other hand make up for 35 % of the budget on average in our sample. Until today, various public funds are a major contributor to VHS budgets (Reichart et al. 2018, p. 22f.).

Although there are no formal requirements for becoming a VHS lecturer, most teachers are highly qualified: Koscheck and Ohly (2016) state that 65 % of all VHS lecturers have graduated from university. In addition, VHS regularly receive quality certificates from independent auditors (Ruhose et al. 2023; Süßmuth and Eisfeld 2018).

VHS have a long history and emerged in large numbers after the foundation of the Weimar Republic in 1918 (Olbrich 2001). At that time, their pedagogical approach stressed the co-responsibility of students with respect to the learning process and success (also known as “*Neue Richtung*”). Knowledge transfer ought to empower citizens’ political participation. Therefore, the VHS of the Weimar Republic are considered as institutions fostering democracy. In the Third Reich (1933–1945), forcible-coordination affected VHS like any other civil-society organization: VHS were either shut down or adapted the Nazi ideology. In the latter case, courses addressed topics that served the National Socialists’ ideology, such as “*Gesundes Volk*” (“Healthy People”) or “*Wehrhaftes Volk*” (“Fortified People”). After World War II, VHS were reopened in all four occupation zones, drawing on their democratic tradition (Siebert 2001). While West German VHS were able to decide on their educational programs autonomously, VHS in the German Democratic Republic (GDR) experienced a strong influence from the state. From 1956 onwards, East German VHS were even subordinated to the Ministry of National Education.

For VHS in the GDR, this meant that curricula were set in a centralized and uniform way. Also the topical focus of courses changed over time: In the early 1950s, vocational trainings accounted for 40 to 50 % of courses (Süßmuth and Eisfeld 2018). Participation in these vocational

trainings was not solely by choice, as participants were delegated by their work collectives (Siebert 2001). In 1956, the GDR’s council of ministers decided to consign all vocational trainings to the Federation of Trade Unions (*Freier Deutscher Gewerkschaftsbund*). Consequently, VHS were repurposed and served mainly as night schools for adults, providing them with the chance to obtain secondary school degrees. On the side, VHS also offered language courses and typing classes.

The popularity of VHS for obtaining a formal school degree in the GDR is noteworthy. At its peak in 1971, 25,188 pupils completed the 12th grade at secondary schools, while 12,716 people participated in VHS courses leading to the corresponding school-leaving degree (Staatliche Zentralverwaltung für Statistik 1980, p. 290, 297). This popularity also rooted in the recommendations that teachers gave their students: Facing severe labor shortages in the 1960 s, students were often recommended to leave school after grade 10, start working and visit VHS courses on the side (Siebert 2001).

In the GDR, VHS broke with the pedagogical tradition of “*Neue Richtung*” and shifted to chalk and talk techniques instead. Besides the governmental predefinition of their educational program, it was also controlled for whether the implementation of courses conformed with the state ideology (Opelt 2004). The state security service, known as *Stasi*, deployed its unofficial collaborators to visit courses incognito. This shows that societal self-organization was rather feared than wished for in the GDR (Siebert 2001, p. 291).

Following the German reunification in 1990, not only the East German economic system, but also the educational system changed profoundly. Most of GDR’s state-aligned organizations that used to provide adult education were resolved. VHS were among the few institutions that persisted. While the system change implied challenges such as finding a new organizational form, funding and teaching staff for new course areas, it also allowed VHS to decide autonomously on their course programs again (Gieseke and Opelt 2003; Siebert 2001). As early as January 1990, numerous contacts were established between East and West German VHS (Süßmuth and Eisfeld 2018). In the same year, state level associations were founded in all East German federal states. In 1991, these associations then joined the national umbrella organization of their West German counterparts.

In the years following the reunification, the number of VHS courses in East Germany increased steeply (see Fig. 3). While in 1991, there were on average 268 VHS courses per county, this number had more than doubled by 2001 to 580 courses per county (see yearly boxplots in Fig. 9). Increases in the number of participations reflect

**Table 1** Summary statistics

	Mean	Sd	Min	Max	N
<u>Dependent variable</u>					
Share unemployed in county population	8.59	2.56	1.14	29.78	1,118
<u>Treatments (all per 1000 inhabitants)</u>					
VHS courses	2.53	1.45	0.00	10.34	1,226
Work-related courses	1.54	0.80	0.00	9.48	1,226
- Courses on languages	0.85	0.53	0.00	4.23	1,226
- Courses on work & occupation	0.62	0.33	0.00	3.42	1,226
- Courses on basic education	0.07	0.12	0.00	2.21	1,226
Recreational courses	0.99	0.83	0.00	6.31	1,226
- Courses on society & politics	0.19	0.19	0.00	1.96	1,226
- Courses on culture & arts	0.38	0.37	0.00	4.51	1,226
- Courses on health	0.42	0.45	0.00	4.20	1,226
Participations	31.42	16.69	0.01	143.18	1,226
<u>VHS controls</u>					
Mean number of exams per course	0.48	0.80	0.00	8.88	1,226
Mean hours per course	43.30	18.79	3.40	211.38	1,226
Mean hours per leisure-related course	22.83	17.87	0.00	284.80	1,226
Mean hours per work-related course	54.76	22.53	3.39	206.00	1,226
Share of participants > 50 years	0.20	0.10	0.00	0.74	1,139
Share of female participants	0.71	0.11	0.00	0.91	1,193
<u>Regional controls</u>					
County next to West Germany	0.18	0.38	0	1	1,226
County next to Berlin	0.08	0.27	0	1	1,226
Surface share with builtup	0.17	0.09	0.03	0.52	1,226
Surface share with crops	0.37	0.15	0.03	0.75	1,226
Surface share with forest	0.20	0.13	0.00	0.69	1,226
Surface share with grass	0.18	0.06	0.03	0.38	1,226
Surface share without vegetation	0.03	0.03	0.00	0.25	1,226
Surface share with water	0.05	0.04	0.01	0.30	1,226
<u>Further variables</u>					
Share of VHS budget from public funds	0.62	0.16	0.02	0.95	1,226
Share of VHS budget from fees	0.34	0.15	0.03	0.98	1,226
Absolute unemployment	10,555	5,456	1,730	42,448	1,118
County population	126,347	67,763	44,240	560,116	1,226

*Data Sources:* FEA, BBSR, VHS, Lehnert et al. (2023).

*Notes:* Data on unemployment cover the time period 1992–2002. All remaining data cover the time period 1991–2002. The minimum values for VHS courses, work-related courses and those on work & occupation are so small that they round down to zero.

this expansion: They increased from an average value of roughly 4,000 per county in 1991 to 6,750 in 2001 (see Fig. 10). By 2001, this expansion came to a halt.

Also the composition of courses changed over time. Figure 4 shows that shortly after reunification, courses on work & occupation as well as languages constituted the majority of the curricula. Over time, recreational courses on health topics or culture & arts gained more relevance. In contrast to VHS programs in the GDR, courses leading to secondary school degrees were relatively scarce. This elimination of second-chance education is also denoted by Süssmuth and Eisfeld (2018).

Schrader (2011) describes the following process for setting a VHS's course program: Typically, a local full-time manager with pedagogical training takes care of designing next semester's course program at their VHS. For this task, managers need to balance out conflicting demands and requirements of various kinds. They have great leeway in doing so. While some well-established courses are regularly copied into the program of the next semester, innovations such as the introduction of new courses are more of a coincidental nature. Such innovations depend heavily on personal likes and interests of managers. Managers do not consider the task of designing a course program to

be a macrodidactic task, but an organizational one. How a new course program is designed is not a standardized process (Fleige et al. 2019). Teachers or participants are not systematically included in designing the new course program (Schrader 2011). There is some coordination of activities via the umbrella organizations at the state and national level, but with a voluntary nature (Süssmuth and Eisfeld 2018). The actual design and organization of course programs lies entirely in the responsibility of local VHS managers (Schrader 2011). For potential participants, the supply of VHS courses is therefore as good as random and orthogonal to their own labor market status.

One might suspect that regional factors influenced course supply systematically. However, a thorough inquiry found no systematic links. Take, for example, their funding: VHS rely on a variety of funding sources (Reichart et al. 2018, p. 25). While financial support by the county may vary with the county's economic situation, this will not affect funding from other sources, as for example EU funds. Hence, no single funding source steers the course supply on its own. Due to the absence of regional factors influencing the course supply systematically, we consider the expansion in courses to be of a decentralized and quasi-random nature from the perspective of potential participants. How VHS arrive at their course supply strongly depends on individual local actors and coincidences.

### 3 Empirical strategy

#### 3.1 Data

For the empirical analysis, we build a novel county-level dataset by combining the VHS statistic with official labor market statistics from the Federal Employment Agency (FEA). The resulting panel contains information on all 112 East German counties from 1991 to 2002, using county boundaries as of late 2005. Table 1 presents the summary statistics. Since former East and West Berlin are not differentiated in the data sources, we exclude Berlin from our analysis. This is also warranted by the special situation of the Berlin labor market, that vastly differed from the labor markets in other East German counties.

For post-unification East Germany, administrative regional labor market data are relatively scarce, as the reunification implied a profound institutional change and required the foundation of local employment agencies. Given that the employment status is a reliable and available indicator for successful labor market integration, we use county-level unemployment as our outcome of interest. The FEA provides such data digitally for the period from 1996 (Bundesagentur für Arbeit 2005). County-level figures for the years from 1992 onward can be found in printed journals (Bundesanstalt für Arbeit 1993a, b, 1994, 1995). Digitizing these data enabled the temporal

extension of our panel.<sup>6</sup> The resulting panel gives the total number of persons registered as unemployed per county as of June 30 for the years 1992 to 2002.<sup>7</sup>

To measure local educational activities, we use the VHS statistic, an administrative dataset provided on an annual basis by the German Institute for Adult Education (DIE 2018). This dataset comprises detailed information about courses and organizational features of each VHS. For East Germany, data are first available for 1991. We aggregate the school-level data to the county-level, following the procedure used in Ruhose et al. (2023) including their solution for school mergers, divisions and openings. A few East German VHS started to report after 1991. This leads to missing information for 4 out of 112 East German counties in 1991 (see Table 3). We assume these missings to be as good as random. The number of counties with missing VHS data declined quickly in the following years. By 1994, the VHS statistic provided information on all East German counties.

Aggregating the VHS data to the county level yields the yearly number of VHS courses.<sup>8</sup> We have this information by course areas as well, which allows us to distinguish between the yearly number of work-related courses and recreational courses. Work-related courses address topics like languages, work & occupation, and basic education. Recreational courses teach about society & politics, culture & arts, and health. Additional variables capture the mean length of VHS courses in a given year measured in hours, the mean number of exams per course,<sup>9</sup> the share of females among participants or the share of participants older than 50 years.

We created dummy variables indicating whether a county neighbors the former inner-German border or Berlin for analyzing regional differences. Further regional covariates proxy county-level economic activity following Lehnert et al. (2023): Daytime-satellite data provide information on the type of surface that any geographic

<sup>6</sup> Unfortunately, the digital dataset from the FEA (Bundesagentur für Arbeit 2005) missed information on a single county in 1996 and 1997. The county town of Eisenach was only founded in 1998. Although the respective tables in the digital dataset rely on county boundaries as of 2000 and therefore should list data for Eisenach, the recent change in county boundaries may have caused the missing entry. We therefore decided to digitize the printed tables for 1996 and 1997 as well (Bundesanstalt für Arbeit 1996, 1998). Transferring these data to more recent county shapefiles enabled us to provide unemployment figures for all East German counties in 1996 and 1997.

<sup>7</sup> Unemployment data by gender are only available from 1996 onwards, which prevents a gender-specific evaluation.

<sup>8</sup> As VHS also execute courses commissioned by local job agencies or plants, we excluded all courses that were labeled as *Auftrags- und Vertragsmaßnahmen* from our analysis and use only those freely accessible to the public for our analysis.

<sup>9</sup> This variable entails school-leaving degrees gained at VHS, examinations by Chambers of Commerce and Industry, Chambers of Craft and other professional associations but excludes VHS certificates.

**Table 2** Balancing table

	(1) Below median	(2) Above median	(3) Difference
County next to Berlin	0.09 (0.29)	0.07 (0.26)	-0.02 (0.05)
County next to West Germany	0.19 (0.39)	0.19 (0.39)	0.00 (0.08)
County area (in km <sup>2</sup> )	986.59 (695.55)	1,000.91 (761.85)	14.33 (140.38)
County population (in thousands)	123.16 (48.57)	139.83 (90.44)	16.67 (13.97)
Unemployment share in 1992	8.73 (2.69)	9.50 (3.70)	0.77 (0.62)
Log of surface share with builtup	0.17 (0.07)	0.17 (0.08)	-0.00 (0.01)
Log of surface share with crops	0.30 (0.11)	0.31 (0.11)	0.01 (0.02)
Log of surface share with forest	0.17 (0.10)	0.16 (0.08)	-0.01 (0.02)
Log of surface share with grass	0.14 (0.05)	0.15 (0.06)	0.01 (0.01)
Log of surface share without vegetation	0.04 (0.04)	0.04 (0.03)	-0.01 (0.01)
Log of surface share with water	0.04 (0.03)	0.05 (0.04)	0.00 (0.01)
Share of VHS budget from public funds	0.55 (0.20)	0.58 (0.22)	0.03 (0.04)
Share of VHS budget from fees	0.39 (0.18)	0.40 (0.21)	0.01 (0.04)
Number of local branch offices	1.21 (1.87)	2.57 (2.87)	1.36*** (0.47)
Sum of events and lecture series at VHS	7.65 (17.53)	15.26 (29.48)	7.60 (4.67)
Number of one-day study trips and excursions by VHS	0.85 (4.35)	2.92 (5.71)	2.07** (0.98)
Number of study trips over several days by VHS	0.22 (0.63)	1.06 (1.90)	0.84*** (0.27)
Mean hours per course	63.79 (24.95)	56.74 (17.42)	-7.04* (4.14)
Mean number of exams per course	1.31 (1.45)	1.12 (0.93)	-0.20 (0.23)
Share of female participants	0.67 (0.16)	0.69 (0.14)	0.02 (0.03)
Share of participants > 50 years	0.06 (0.04)	0.09 (0.05)	0.03*** (0.01)
Observations	54	54	108

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: Sample split at the median value for VHS courses per 1,000 inhabitants. Table considers only the first year in our sample, 1991. Four East German counties have no VHS reports in 1991 and are therefore not included in this analysis. Standard errors are given in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

area consists of. As some surface groups are more closely related to economic activities than others, these data are well suited to predict regional GDP and also capture changes in local GDP.<sup>10</sup> Yet, instead of controlling for predicted GDP, we add each county's surface share belonging to the different surface groups in any given year to the dataset. Using the full set of proxy variables minimizes the noise and error that may result from prediction. Outlier values are defined following the authors' recommendation and set to missing.

To allow for comparisons across counties of different population size, we scale both the number of unemployed persons and VHS courses relatively to the county's population. This means that our treatment is defined as number of VHS courses per 1,000 inhabitants and our outcome is defined as the proportion of unemployed in

the county population. Data on county population stem from the BBSR and provide the stock of inhabitants at the end of each year.

The manifold reorganizations of county borders in East Germany required to transfer all data to a harmonized set of county borders. For doing so, we use a population key provided by the German *Bundesinstitut für Bau-, Stadt- und Raumforschung* (BBSR). When two counties were merged, their respective data were added up. When parts of a county were reassigned to another county, we reassigned data based on the respective population shares. Over time, many of the East German counties completely merged into another one. In order to minimize the number of county splits, we use the county borders as of December 31, 2005.

### 3.2 Identification strategy

For identifying the causal effect of VHS courses on unemployment, we estimate a two-way fixed effects model that uses the number of courses per 1,000 inhabitants as continuous treatment variable. This approach exploits the temporal and spatial variation in VHS educational

<sup>10</sup> Daytime satellite data are preferred over nighttime light data for several reasons. Firstly, nighttime data are only available since 1992 and do not cover our entire sample period. Daytime data also have a higher resolution, which means that the deduced information is more precise. Furthermore, daytime satellite data predict GDP better than nighttime data.

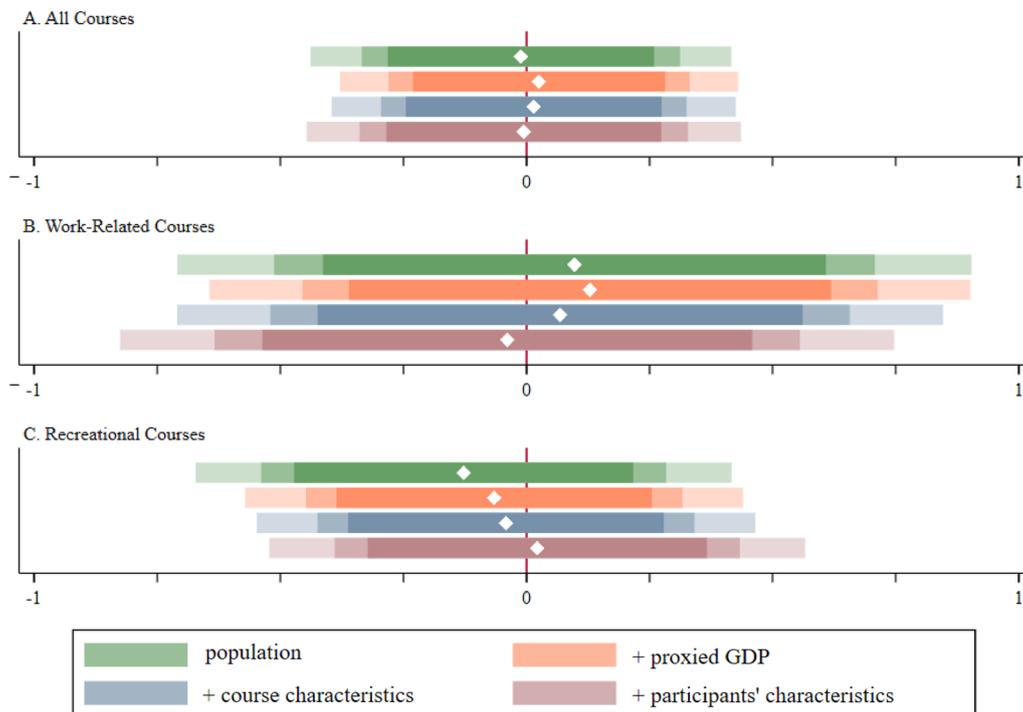
activities in the context of their course expansion. Several studies have taken a similar approach for evaluating the effects of childcare expansion on various outcomes (Berlinski et al. 2009; Bauernschuster et al. 2016; Sandner et al. 2023). We specify the following linear panel model:

$$y_{c,t+1} = \alpha + D_c + D_t + \beta \times courses_{ct} + \gamma \times X_{ct} + \epsilon_{c,t+1}, \tag{1}$$

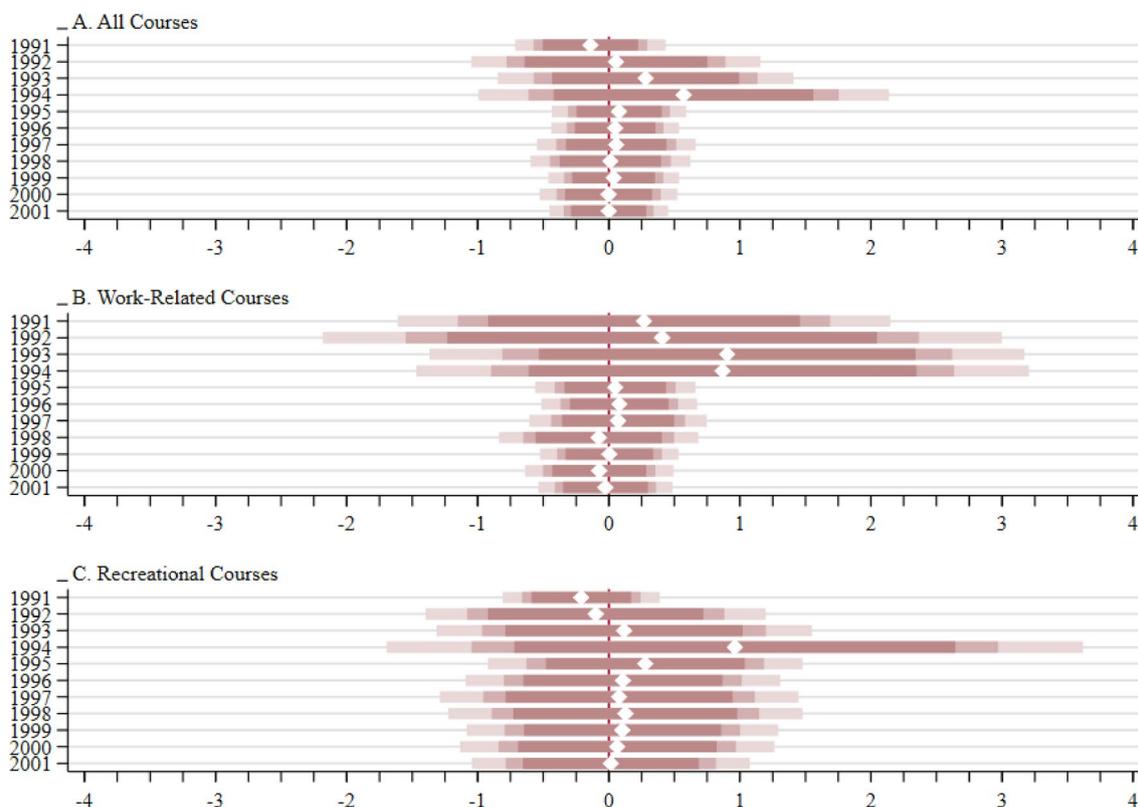
where  $y_{ct}$  denotes the share of unemployed in county  $c$ 's population in year  $t$ .  $D_c$  denotes county fixed effects, which account for time-invariant heterogeneity between counties.  $D_t$  denotes year-specific fixed effects, capturing shocks common to all counties in year  $t$ . The explanatory variable  $courses_{ct}$  acts as a placeholder for different measures of educational activities at VHS. The time lag between dependent and treatment variables ensures that only completed education can affect labor market outcomes. The matrix of covariates  $X_{ct}$  includes a set of time-varying control variables on course characteristics, participants characteristics, proxied GDP and the county's total population in year  $t$ . Regressing the outcome on population holds both the denominator of the outcome and the denominator of the treatment constant. Potential changes thus capture the effect of VHS education on subsequent unemployment while making counties of varying population size comparable. Standard errors are clustered at the county level.

The control variables on course characteristics ensure that potential effects do not arise because of changes in the organizational aspects of courses constant. We consider the mean course length measured in hours and the average number of examinations per course as relevant organizational course characteristics. Exams captured by the VHS statistic entail school-leaving degrees, certificates from the German Chambers of Commerce and Industry, the Chambers of Craft and other professional associations as examinations. Holding the number of examinations per course constant allows us to rule out potential sheepskin effects in the sense of Jaeger and Page (1996).

Controlling for participants' characteristics ensures that effects do not arise from changes in the composition of participants. These control variables are defined as share of females among participants and share of persons older than 50 years. Both groups were overproportionately affected by unemployment (Bielenski et al. 1997) and are known to show different participation patterns in adult education (OECD 2023). Unfortunately, providing information about the characteristics of participants was not mandatory for VHS (Huntemann et al. 2021), leading to a slightly smaller number of observations in the specifications with participants' characteristics.



**Fig. 5** Marginal effect of VHS courses on unemployment. *Notes:* Confidence intervals are shown at the 90, 95 and 99 % level. The lightest confidence interval refers to the 99 % level. Color intensity increases with lower significance levels. Table 4 shows the corresponding estimation results. Standard errors are clustered at the county level. *Data Sources:* VHS, FEA, BBSR, Lehnert et al. (2023).



**Fig. 6** Year-specific marginal effect of VHS courses on unemployment. *Notes:* This figure is based on regression estimates for the specification controlling for population, proxied GDP, course characteristics and participants’ characteristics (see Table 5). Confidence intervals are shown at the 90, 95 and 99 % level. The lightest confidence interval refers to the 99 % level. Color intensity increases with lower significance levels. Standard errors are clustered at the county level. *Data Sources:* VHS, FEA, BBSR, Lehnert et al. (2023).

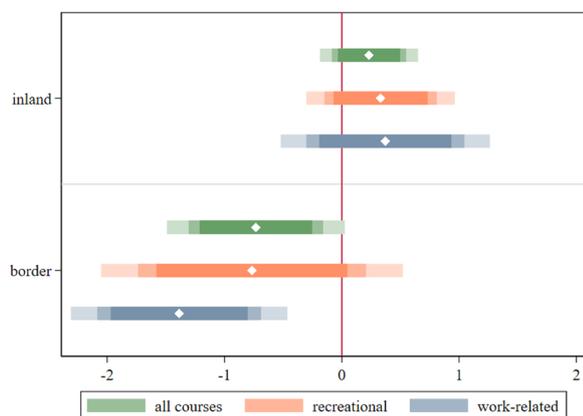
We measure VHS’ educational activity as number of courses per 1,000 inhabitants and distinguish courses by content. Successively, we estimate the effect of all freely accessible courses, recreational courses only, and work-related courses only. Recreational courses cover topics in the realm of society & politics, culture & arts, and health. These courses do not necessarily affect labor market outcomes, especially if they serve recreational purposes. Nevertheless, they could induce labor market effects thanks to new social contacts, access to new information, soft human capital effects or increased social trust. Work-related courses on the other hand directly target human capital adjustments relevant for labor market integration. These can be courses on work & occupation,<sup>11</sup> basic education, which includes courses leading to school degrees, and language courses.

The parameter of interest  $\beta$  captures an average treatment effect on the treated (ATT) at the county level. This is due to the observational nature of this evaluation and because all units receive the treatment in

varying intensity.<sup>12</sup> A causal interpretation of our estimates requires that our treatment variable (the number of courses per 1,000 inhabitants) is exogenous to the outcome of interest (the share of unemployed in the population). This assumption is based on the substantive arguments made in Sect. 2.2. Ideally, one would additionally test for pre-treatment differences between the treatment and control group. Finding significant differences would falsify the identification assumption. Such a falsification exercise is unfeasible in our setting because pre-treatment data, especially on unemployment, do not exist. Instead, we restrict this analysis to the earliest data available for our sample, that is 1992 for unemployment data and 1991 for the remaining data. Because our treatment variable is continuous, we contrast counties with an above-median number of courses in 1991 to those with a below-median number of courses. This allows us

<sup>11</sup> Courses in the realm of work & occupation taught for example how to apply for jobs, accounting or typewriting.

<sup>12</sup> As we cannot track individuals’ participation in VHS, it may be the case that people visited VHS courses for example in a neighboring county. This may undermine the stable unit treatment value assumption (SUTVA) and bias our estimates towards zero. Yet, we expect mobility patterns to be relatively stable over time, implying that county-fixed effects will absorb this variation.



**Fig. 7** Marginal effect of VHS courses on unemployment by region. Notes: Specification includes the full set of control variables. Confidence intervals at the 90, 95 and 99 % level. Standard errors are clustered at the county level. Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

to compare counties just at the beginning of the course expansion.

Table 2 shows that observations with above-median and below-median course numbers in 1991 are rather similar. They are equiprobable of being located next to Berlin or next to West Germany, they are comparably large in terms of square km and population, and show a similar share of unemployed in their county population in 1992, the first year for which we have unemployment data. There are no significant differences in the surface cover of these counties neither, which we use as GDP proxies.

Turning to the internal aspects of VHS, we find no differences in the sourcing of funds. Yet, counties with above-median course numbers have significantly more local branch offices. Having a well-established VHS infrastructure may have eased to expand the number of courses. As this infrastructure is rather stable over time, county-fixed effects should absorb that variation. Counties with above-median course numbers also have significantly more study trips and excursions. This aligns with an overall stronger activity of VHS. Interestingly, we find that courses in counties with an above-median course number are on average shorter and have a larger share of older participants. We will use these characteristics as control variables.

## 4 Empirical results

### 4.1 Main results

Figure 5 presents our main estimation results. Panel A shows the effects of one additional VHS course on the subsequent share of unemployed in the county population. In the first specification, we control for county population only. Here, we find that an additional VHS course per 1,000 inhabitants decreases the subsequent

unemployment share by 0.01 percentage points. Additionally controlling for GDP renders the effect slightly positive to +0.03 percentage points. When controlling for course characteristics, that is the mean length of courses and the mean number of exams per course, the effect reduces to +0.01 percentage points. Adding controls on participants' characteristics (i.e. the share of females and participants older than 50 years), the effect turns negative again, but remains close to zero. Here, one additional course per 1,000 inhabitants leads to a 0.01 percentage point reduction in the unemployment share. While the direction of the effect changes between specifications, all results are close to zero and insignificant. Table 4 presents the corresponding regression estimates.

VHS offer courses on a broad range of topics, which are expected to affect individual employment chances differently. For this reason, we distinguish between recreational and work-related courses and estimate their effects separately. Panel B presents the results for work-related courses. When controlling only for population, an additional course increases unemployment by 0.1 percentage points. This effect is insignificantly different from zero. Also the alternative specifications find statistically insignificant effects that are close to zero. In our preferred specification, i.e. the one with the full set of control variables, one additional work-related course reduces unemployment in the population by 0.04 percentage points.

Panel C presents the results for recreational courses. Again, we find statistically insignificant effects close to zero across all specifications. When controlling only for population, one additional recreational course reduces unemployment by 0.13 percentage points. When controlling for population, proxied GDP, course characteristics and participants' characteristics, this effect becomes slightly positive but remains statistically insignificant. To sum up, neither work-related nor recreational courses significantly affect unemployment.

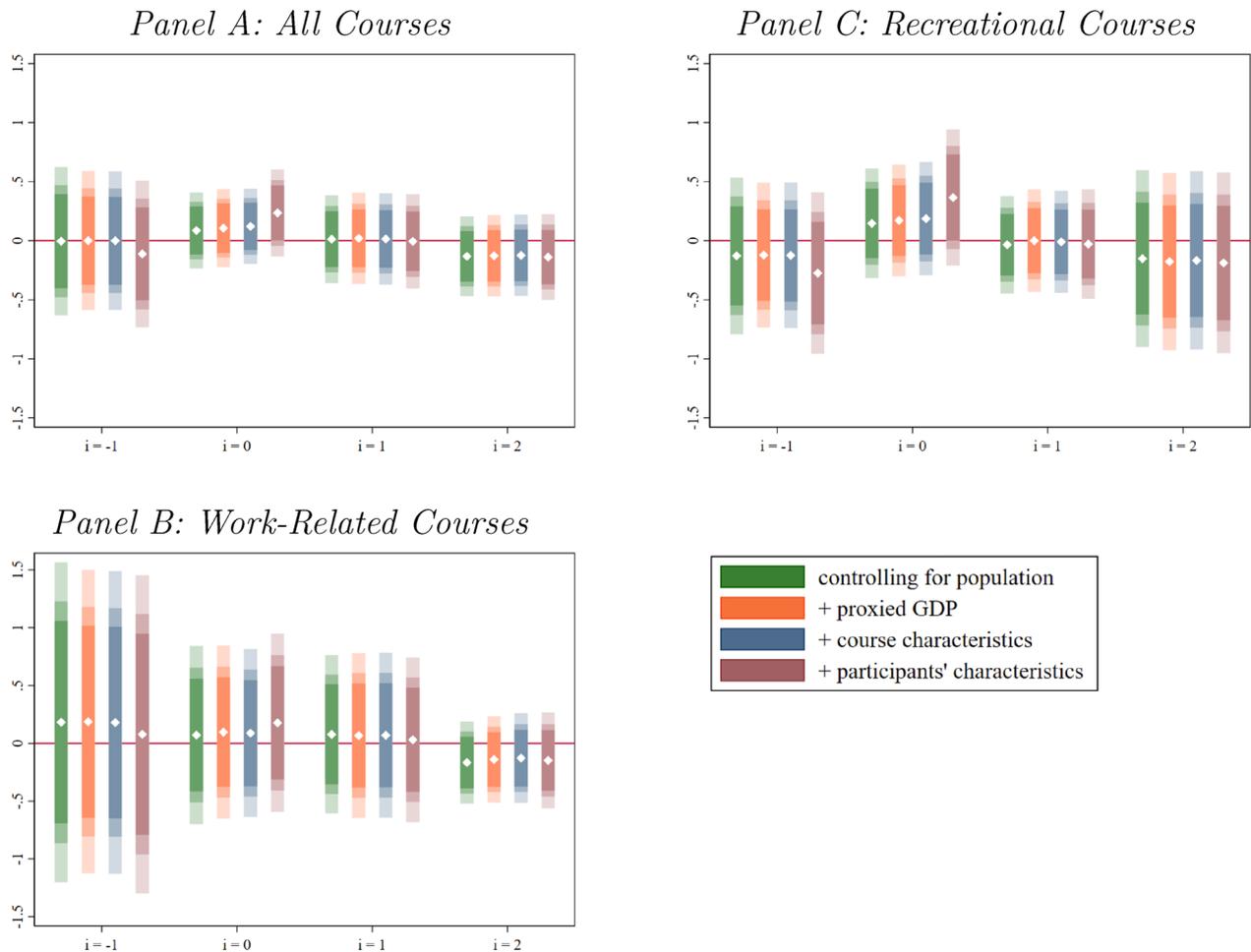
## 4.2 Effect heterogeneity

### 4.2.1 Time-heterogeneous effects

Following the reunification, the East German labor market underwent different periods of adjustment (see Sect. 2.1). In response, the effects of education on labor market integration may have differed over time. We investigate this by adding an interaction term between year dummies and the course variable to the regression model:

$$y_{c,t+1} = \alpha + D_c + D_t + \beta \times courses_{ct} + \theta(D_t \times courses_{ct}) + \gamma X_{ct} + \epsilon_{c,t+1}. \quad (2)$$

$courses_{ct}$  acts again as a placeholder for varying types of courses, that are considered in different model



**Fig. 8** Dynamic effects. *Notes:* Figures show dynamic treatment effects of VHS courses on unemployment. The x-axis shows the temporal difference between treatment and outcome, denoted by  $i$ . The point estimates in  $i = -1$  refers to the effect of next year's courses on unemployment in year  $t$ . The point estimates in  $i = 2$  show the effect of courses on unemployment two years later. Tables 15–17 present the corresponding regression estimates. Confidence intervals are shown at the 90, 95 and 99 % level. The lightest confidence interval refers to the 99 % level. Color intensity increases with lower significance levels. Standard errors are clustered at county level. *Data Sources:* VHS, FEA, BBSR, Lehnert et al. (2023).

specifications. If effects changed over time, this would imply significant estimates for  $\theta$ . Yet, this coefficient does not exactly represent what we are looking for: We are interested in the marginal effect of an additional course on unemployment in a given year  $t$ , which is given by  $\delta y_{c,t+1} / \delta courses_{c,t} = \beta + \theta D_t$ . Assessing its statistical significance requires the calculation of the corresponding standard error. The standard error of that quantity is defined as

$$\hat{\sigma}_{\delta y_{c,t+1} / \delta courses_{c,t}} = \sqrt{var(\hat{\beta}) + D_t^2 var(\hat{\theta}) + 2D_t cov(\hat{\beta}, \hat{\theta})}. \tag{3}$$

Estimations of the marginal effect are based on the specification with the full set of control variables. Panel A in Fig. 6 shows the marginal effect of one additional course on the subsequent unemployment share specific to any

given year from our sample. Both effect size and direction change over time. However, the marginal effects remain statistically insignificant in any year. Panel B and C show that the same is true when distinguishing courses by content: Neither work-related nor recreational courses significantly affect unemployment in any year. Table 5 presents the corresponding results.

Given the small number of county-level observations per year, the statistical power of this analysis may be too low for finding significant effects. We therefore repeat this analysis on a more aggregate level and estimate period-specific effects. The definition of periods follows Sect. 2.1. The first time period refers to the years 1991 to 1993, which is associated with the collapse of the former East German economy. The second period from 1994 to 1996 is described as a period of slight recovery

and stabilization. The third and fourth periods (1997–1999 and 2000–2002) are characterized by stagnation and worsening labor market prospects. Consequently, we consider four periods of equal length.

The following regression model interacts courses with period dummies instead of year dummies. Year fixed effects are replaced by period fixed effects, denoted by  $D_p$ . The rest is analogous to the previous analysis:

$$y_{c,t+1} = \alpha + D_c + D_p + \beta \times courses_{ct} + \theta(D_p \times courses_{ct}) + \gamma X_{ct} + \epsilon_{c,t+1} \quad (4)$$

If effects changed over periods, this would imply significant estimates for  $\theta$ . The marginal effect of an additional course in period  $p$  equals  $\beta + \theta D_p$  and requires the calculation of corresponding standard errors. Figure 12 in the appendix shows that also when considering the different periods of labor market development, there is no effect of VHS courses on subsequent unemployment. This finding holds for courses overall, recreational courses and work-related courses. While effect directions may change over time, all estimates remain close to zero and insignificantly different from zero. Table 6 in the appendix presents the corresponding marginal effects and their standard errors.

#### 4.2.2 Spatial differences

The return on investments in education arguably depends on the overall level and the composition of labor demand. For example, Card et al. (2018) denote an association between cyclical conditions and ALMP effectiveness.<sup>13</sup> The relevance of the composition of labor demand is well illustrated by the example of the East German construction sector: Retraining for a job in the construction sector was especially popular for men in the early 1990s. Given the strong backlog in demand and massive subsidies, this sector boomed in the early 1990s (Thomsen 2007). Yet, caseworkers severely misjudged future demand for skills and once subsidies came to a halt in 1996, the unemployment rate in the construction sector was 8 percentage points above the average one (Lechner et al. 2007).

Relatedly, also the realization of labor market effects of VHS education may depend on overall level and composition of labor demand. Given that the available unemployment data cannot be distinguished by employment sector, we are not able to consider the labor demand composition. However, we can test whether the overall demand level matters for the realization of education effects by contrasting different regions: As labor is not perfectly mobile across space, it is especially the local labor demand that matters. Among the East German counties, those located next to the former inner-German border are of special

interest. It can be argued that the local labor demand in these border counties was higher than in the rest of East Germany, due to commuting possibilities to nearby jobs in West Germany. After the German unification, West Germany saw an increase in employment in all sectors, except the primary one (Thomsen 2007). Throughout the 1990s, unemployment rates in West Germany were only half as large than those in East Germany.

We therefore empirically investigate whether VHS courses had a different effect on subsequent unemployment in these border counties. To this aim, we interact the course variable with a border dummy<sup>14</sup>:

$$y_{c,t+1} = \alpha + D_c + D_t + \beta \times courses_{ct} + \theta(courses_{ct} \times border_c) + \gamma X_{ct} + \epsilon_{c,t+1} \quad (5)$$

If courses had a different impact in East German counties bordering West Germany, we would find significant estimates for  $\theta$ . The total marginal effect of an additional course in these border counties equals  $\beta + \theta$ . To assess the statistical significance of this combined effect, we conduct a Wald test for the null hypothesis of  $\beta + \theta = 0$ .

Figure 7 shows the marginal effect of one additional course by content and region based on our preferred specification. Table 7 in the appendix presents the underlying regression estimates, also for the less conservative specifications. We find that courses in inland counties increase subsequent unemployment at the 10 % level in two specifications. This effect becomes insignificant when adding more control variables to the regression model. Distinguishing courses by content yields similar results: Work-related courses are found to be ineffective in inland counties. Only the specification with the smallest set of control variables finds a positive effect significant at the 10% level (see Column 1 of Table 7). This effect vanishes when adding more control variables. Recreational courses remain ineffective in inland counties throughout all specifications.

For counties at the inner-German border, we find different results: In these counties, VHS courses significantly decrease unemployment. This effect is robust across all specifications and significant at the 1–5 % level. In our preferred specification, an additional VHS course per 1,000 inhabitants reduces the share of unemployed in the following year by 0.73 percentage points (see Column 4 of Table 7). On average, 8.59 % of a county's population are unemployed in our sample. For border counties, an additional VHS course therefore translates to a 8.5 % reduction of unemployment.

<sup>13</sup> They find that programs in recessionary periods have larger average impacts, especially if the downturn is relatively short-lived.

<sup>14</sup> It is not necessary to include a standalone border dummy in the regression model because this information gets absorbed by the county fixed effects.

Distinguishing courses by content shows that this effect is driven by work-related courses. In counties bordering West Germany, work-related courses significantly reduce the subsequent share of unemployed in all specifications. This effect is highly significant at the 1% level. In our preferred specification, an additional work-related course reduces the unemployment share by 1.39 percentage points. For recreational courses, we find less clear results: While the interaction term is significantly negative in all specifications, the significance and size of the marginal effect varies across specifications (see Panel C in Table 7). Solely the first specification that controls for county population only finds a significant marginal effect of recreational courses on unemployment at the 5% level. When adding more control variables, the marginal effect becomes smaller and loses its significance.

This analysis confirms the previously found null results, at least for the inland counties. In counties bordering West Germany, VHS courses significantly reduced unemployment. Distinguishing courses by their content shows that this effect is driven by work-related courses. The effect of recreational courses is not robust to the addition of control variables and smaller than the effect of work-related courses.

Turning to the mechanisms at work, work-related courses may have conveyed skills directly beneficial for labor market integration. But this upskilling only translated into reduced unemployment in counties bordering West Germany. This supports our hypothesis on the relevance of local labor demand. However, data limitations prevent us from proving that these unemployment reductions were based on increased commuting to jobs in the West. Alternatively, participants may have succeeded in finding employment in their county of residence, transitioned into retirement or withdrew from the labor market (e.g. by becoming a stay-at-home parent). Yet, we do not expect that proximity to West Germany affects the propensity to retire or withdraw from the labor market systematically. We consequently suspect the opportunity to commute or better employment prospects to be the main driver of effect in border counties. In line with this, Koller and Jung-Hammon (1993) denote that the share of commuters was especially high in the catchment area of employment agencies located next to the inner German border.

Recreational courses reduced unemployment only in some specifications and only in border counties. Their effect cannot be explained with the skill-adjustment argument. The skills conveyed in courses on society & politics, culture & arts, and health may have affected labor market integration indirectly at the most. Instead, such courses may have led to changes in social networks, improved well-being or fostered information exchange, for example

about job opportunities. Given the differential impact of courses in border counties, courses may have provided an opportunity to build new social ties between East and West Germans. However, the evidence on an unemployment-reducing effect of recreational courses is not as strong as the one for work-related courses.

To inspect potential heterogeneities in VHS education, Table 8 contrasts VHS' activities in inland and border counties. While unemployment was significantly lower in border counties, we also see that these counties had more VHS courses per 1,000 inhabitants. This larger prevalence of courses was driven by courses on work & occupation and recreational courses (especially health courses). There were significantly less courses on basic education per 1,000 inhabitants in border counties. Differences in the composition of VHS courses could explain why only courses in border counties were effective in reducing unemployment.

The comparison also shows that courses were on average 7 h longer in border counties. There are no differences in the prevalence of exams or the share of females among participants. However, courses in border counties attracted significantly less participants older than 50 years. As argued by Bielenski et al. (1997), older workers regained employment less often compared to younger workers. Border counties also have more local branch offices and more one-time events and lecture series at VHS. Study trips and excursion are equally prevalent. We furthermore see that revenues came in larger proportions from public funds. A smaller share of revenues comes from participation fees. Differences in the composition of participants and the characteristics of courses may also explain why courses in border counties were effective, but those in inland counties not.

### 4.3 Robustness checks

We conduct several additional analyses to check the robustness of our findings. First, we alternate the definition of our treatment variable by using the number of participations in VHS courses instead of the number of courses. The correlation between courses and participations is very high with a Pearson's correlation coefficient of 0.96. This has practical reasons, as the number of enrolments per course has both an upper and a lower limit. Table 9 presents the results, which are similar to our main results: Again, all estimates are close to zero and insignificant.

A second robustness check looks into the classification of language courses. In our main analysis, we consider language courses to be work-related. Yet, language courses may also serve recreational purposes such as preparing for a holiday. We therefore classify language courses to be leisure-related in this additional

analysis. This leaves work-related courses to consist only of courses on basic education and those on work & occupation. Table 10 in the appendix shows that also with these alternative definitions applied in our main analysis, there are no effects of leisure- nor work-related courses on the share of unemployed in the following year.

For a closer inspection of effects by course content, we further estimate the effects of courses of each specific area individually. Table 11 in the appendix presents the corresponding regression estimates from this third robustness check. Overall, the estimates are close to zero and most of them are insignificant. Only courses on health-topics were found to reduce subsequent unemployment at the 10 % level in the specification that controls for population. When adding more controls, this effect becomes insignificant. One shortcoming of this analysis is the small number of courses in single areas such as basic education, which may render estimation results imprecise.

A fourth robustness check looks into the model specification. In order to account for potential non-linear effects, we add the square term of VHS courses to our model. Figure 13 in the appendix shows the linear prediction of our outcome variable, the share unemployed, at different levels of our treatment variable, the number of VHS courses per 1,000 inhabitants. Predictions are based on estimates from the model with the full set of control variables (see Column 4 in Table 12 in the appendix). Panel A shows that unemployment is a slightly concave function of VHS courses. When there are only few courses per 1,000 inhabitants, one additional course increases the share of unemployed persons in a county's population in the following year. The effect reverses once the threshold of 4.3 courses per 1,000 inhabitants is surpassed. Now, additional courses decrease unemployment in the following year. Panel A in Table 12 in the appendix shows that both the number of VHS courses and the squared number of VHS courses significantly affect unemployment in all specifications except the last one. Throughout all specifications, the coefficient of the treatment variable is positive, while the coefficient of the square term is of the opposite sign. Panel B shows the predicted share of unemployed in a county's population given different levels of work-related courses. Here, we find a strongly concave function. The predicted share of unemployment is highest with 3.14 work-related courses per 1,000 inhabitants. Beyond that, additional work-related courses decrease unemployment. Panel B in Table 12 in the appendix shows that in all specifications, the coefficient of work-related courses is positive and significant, whereas its square term is negative and significant. For recreational courses, we find no effect at all. Panel C in Fig. 13 in the appendix shows that the

predicted share of unemployed remains relatively stable between 8 and 9 percent, regardless of how many recreational courses take place. The regression results in Panel C of Table 12 endorse this graphic analysis as both recreational courses and their square term have no significant effect on subsequent unemployment in any specification. This check implies that the effects of work-related courses and potentially courses overall are non-linear. Non-linearity may arise if VHS courses gain signal strength with stronger prevalence. Alternatively, knowledge spillovers to non-participants or network effects may explain the non-linear effects.

Since some organizational and financial aspects of VHS are set at the state-level, the fifth robustness check allows for state-specific trends. State-year fixed effects account for different linear time trends in the East German federal states. If our results differed from our main analysis, this would cast doubt on the validity of the parallel trends assumption. Table 13 in the appendix shows the regression results: Even when allowing for state-specific linear time trends, there are no significant effects of VHS courses on subsequent employment. One additional course per 100,000 inhabitants, which is roughly the average population per county in our sample, increases the share of unemployed in the county population by 0.001 percentage points. Although all estimates are positive when allowing for state-specific trends, all estimates are very close to zero and insignificant, regardless of the type of course and the set of control variables.

A sixth robustness check (see Table 14 in the appendix) deals with potentially different time trends in the counties bordering West Germany. For this purpose, border-year fixed effects allow for border-specific linear trends. This leads to a significantly positive marginal effect of VHS courses on subsequent unemployment in inland counties. When adding more control variables, the significance level reduces from 5 to 10 %. While the interaction term remains significantly negative, the total marginal effect of one additional course in a border county is now insignificantly different from zero. As before, work-related courses have no significant impact on subsequent unemployment in inland counties, except for the specification with the least control variables. Work-related courses also remain to significantly reduce unemployment in border counties. The effects of recreational courses on the other hand appear to be less robust to border-specific time trends: In three out of four specifications, the estimated effects are statistically insignificant for inland counties. In border counties, the effect also vanishes when accounting for border-specific time trends.

Lastly, we investigate the empirical relevance of reversed causality and dynamic treatment effects.

Reversed causality implies that the outcome variable impacts the treatment variable, which would bias our estimates. Dynamic treatment effects would violate the common trends assumption required for a causal interpretation of our results (see for example De Chaisemartin and D'Haultfœuille (2020)). We therefore regress our outcome variable on future, contemporaneous and past values of the treatment variable. This intertemporal structure reduces the number of county-year observations used for the estimation compared to previous models.

$$y_{ct} = \alpha + D_c + D_t + \sum_{i=-2}^1 \beta_{t+i} \times courses_{c,t+i} + \gamma \times X_{ct} + \epsilon_{ct} \quad (6)$$

If future VHS courses affected unemployment, this would hint towards reversed causality. Insignificant coefficients on the other hand would strengthen the credibility of our identification strategy. Dynamic treatment effects occur when treatment effects fade out over time or when effects realize with a delay (lock-in effects).

Figure 8 shows that we do not find significant effects of future courses on unemployment, regardless of the type of course and under varying sets of control variables. The coefficients of the leads are very small and statistically indistinguishable from zero (see Tables 15–17 in the appendix for the corresponding regression estimates). We find no evidence for cross-county variation in course numbers induced by local labor market developments. As both the first and the second lag estimates are statistically insignificant across all specifications, there is no evidence on effects fading out nor on lock-in effects. Both findings strengthen the plausibility of our identification strategy and confirm our previously found null-results.

#### 4.4 Discussion

Because both VHS courses and ALMP measures may have led to human capital adjustments beneficial for labor market integration, we compare our findings to evaluations of ALMP measures in East Germany after reunification. Lechner and Wunsch (2009) provide an overview on the evolution of studies assessing the effectiveness of ALMP in East Germany. Early studies relied on survey data and found negative or insignificant short- to medium-term employment effects. For some programs, studies also found positive effects. That the results of these early studies lack robustness is linked to variation in datasets, assumptions, and methodological approaches. Later studies used administrative data in combination with matching techniques. These studies also increased the time horizon by looking at medium- to long-term effects of program participation. All of these studies find significant negative employment effects in

the short run (lock-in-effects) and significant positive effects in the medium- to long-run.

ALMP measures at the time did not only consist of trainings and courses of various lengths and contents, but also of jobseeker assessment and assistance as well as of job subsidies to create additional, non-market jobs. Regarding the latter, Hujer and Thomsen (2006) report that such job creation schemes reduced the labor market chances for most participants. FEA-sponsored trainings and courses come closest to VHS education. Overall, also these trainings failed to increase the employment chances of participants in the regular labor market. While some studies find that trainings had zero to positive employment and wage effects (see for example Fitzenberger and Prey 2000, or Bergemann et al. 2009), others find that participation led foremost to further program participation, prolonged unemployment, and increased costs for the unemployment insurance system (e.g. Lechner and Wunsch 2009). Longer trainings were often associated with lock-in effects, meaning that positive employment or wage effects often only realized in the medium or long term.

By and large, both VHS courses and ALMP measures failed at bringing people into jobs. While certain ALMP programs were found to harm participants' labor market integration, our findings do not indicate such harmful effects for VHS courses. Specifically, ALMP programs often led to reduced short-term employment via lock-in effects, a phenomenon not observed for VHS education. This difference aligns with the typically lower number of course hours in VHS courses. One possible explanation for the ineffectiveness of both ALMP and VHS education in reducing unemployment could be lacking labor demand and low market dynamics in East Germany. The results from our heterogeneity analysis support this notion, showing that VHS courses reduced unemployment only in counties neighboring West Germany, where labor demand was arguably stronger.

The analysis of the border regions hints us towards multiple mechanisms by which voluntary adult education may affect unemployment. Depending on course content, VHS education can improve individual labor market prospects via upskilling. Evidence for this mechanism can be found in the effect of work-related courses in border counties. But there must be at least one more mechanism at play, as also recreational courses reduced unemployment in these border counties. For example, recreational courses may have led to new social contacts and networks. This social-capital-mechanism is also suggested by Ruhose et al. (2019). In our context, recreational courses in the border region may have also fostered new social ties between East and West Germans. Recreational courses may have also improved participants' well-being, signalled potential employers about their characteristics or eased

the information exchange about job opportunities (the latter may have been especially important, given that private households have not had internet access in the 1990s). Based on the freedom of choice for participation in general and for specific courses, VHS may even have a comparative advantage over ALMP in attracting and building social capital.

However, it should be noted that unemployment reductions do not necessarily imply additional employment. Participants may have succeeded in finding employment in their county of residence, commuted to West Germany, retired or withdrawn from the labor market. Evaluation results may therefore differ with the choice and measurement of labor market outcomes. Lechner and Wunsch (2006) look at a variety of labor market outcomes and show that ALMP trainings in East Germany had positive long-run employment effects but failed to reduce unemployment.<sup>15</sup> Given the strong turbulences on the East German labor market, Bergemann et al. (2009) consider employment as a state- and duration-dependent process and argue that transition rates between non-employment and employment would be the most informative outcome to look at. With the data at hand, we cannot further explore this empirically. Theoretical and logical considerations may help to get a better understanding of the mechanisms at play. In particular, proximity to West Germany should not affect the propensity to retire or withdraw from the labor market systematically. We consequently suspect the opportunity to commute and better employment prospects to be the main driver of the effect in border counties.

At this point, we also want to reflect some limitations of our data. Firstly, the FEA's working definition of unemployment changed slightly over time. We consider the resulting changes in unemployment numbers to be negligible as well as equally distributed across counties. A second point concerns potential systematic differences in the use of ALMP. By law, participants were and still are not considered as unemployed. In view of the pressing situation on the labor market, several new measures were introduced over the course of the 1990s. Regional differences in the usage of these new measures could have affected unemployment numbers in a systematic way. While data on ALMP participation exist in bulk at the regional level of the FEA's geographical structure (i.e. at the level of job agencies districts ("*Arbeitsamtsbezirke*") or their local offices ("*Dienststellen*")), there is currently no way of transferring these data to other geographical units such as counties. In consequence, we cannot control for regional differences in the use of new ALMP measures.

This prevents an empirical investigation of potential interaction effects between ALMP and VHS education. Thirdly, data limitations also prevent a closer analysis of group-specific effects, for example by age or gender.

## 5 Conclusion

The German reunification in 1990 led to a rapid and comprehensive restructuring of the East German economic system. This transition posed tremendous challenges on the labor market, as unemployment surged. At the time, training and education were considered to be central for improving the situation on the labor market by adjusting human capital. Several studies have investigated the effectiveness of ALMP measures, including trainings and courses, to this aim (see, for example, Lechner and Wunsch 2009 for an overview). We extend this literature by evaluating the labor market effects of another popular form of adult education, namely voluntary and non-formal education provided by VHS.

VHS provide courses on a wide range of topics. The effect of courses on labor market outcomes is expected to vary by their content: Only work-related courses directly target human capital adjustments beneficial for labor market integration. Recreational courses on the other hand may affect labor market outcomes indirectly at the most, for example via social capital effects, soft skill training, improved well-being or information exchange. Participation in these courses may have also signalled potential employers about participant's characteristics.

The results of our main analysis do not support these hypotheses. The effect of VHS courses on the subsequent unemployment share in the county population is close to zero and statistically insignificant. We find the same results when distinguishing courses by content. These null effects are shown to be robust across a set of additional checks. Although the East German labor market underwent different phases after reunification, the effects did not change over time.

But why did additional education not translate into labor market effects? A core reason for these findings may have been the weak development of the East German labor market. For comparison: Also most of the FEA's training in this region and time were found to be ineffective with respect to bringing people into jobs. As Card et al. (2018) point out, the effectiveness of adult education in the sense of ALMP depends on the cyclical condition of the respective economy. Especially programs in short-lived recessions are successful, implying that participants enter a program during a cyclical downturn and exit it during an economic upswing. The East German labor market instead experienced a prolonged period of stagnation and low market dynamics. These macroeconomic conditions may have reduced the effectiveness of ALMP

<sup>15</sup> They explain that program participation increases benefit receipt and that therefore, ALMP trainings also target persons who would otherwise leave the workforce.

and other forms of education alike. To paraphrase Lechner and Wunsch (2009, p.665), training may not have been a strong enough cure to solve the problem of unemployment in the setting of a depressed labor market.

Analyzing the spatial heterogeneity of effects supports this notion. As labor is not perfectly mobile, it is especially the level and composition of local labor demand that matter for the realization of education effects. Across East Germany, the region next to the former inner-German border differed from the rest, as West German labor markets with higher demand and dynamics were within easy reach. We find that courses in counties bordering the former inner-German border significantly decreased unemployment. If met by favourable economic conditions, also non-formal and voluntary adult education can reduce unemployment. That both work- and leisure-related courses were effective in these border counties hints towards the existence of multiple mechanisms, by which VHS education reduces unemployment.

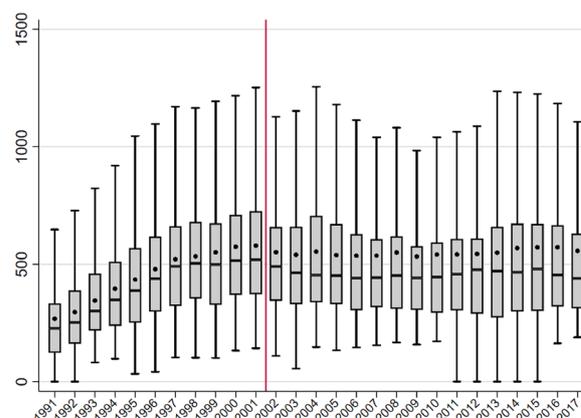
Investigating the labor market effects of further forms of non-formal education is a valuable task for future research. Which type of education can achieve what? How do surrounding economic conditions limit or enable education effects? As Midsundstad (2019) denotes, the heterogeneity of courses, learners, and providers exacerbate the generalization of the few study results that exist. Effects may also change over time periods or vary across countries. For gaining a better understanding of the labor market effects of non-formal education, we need more evaluation studies and to compare their results. Another interesting research question is whether subsidizing non-formal education may pay off, even if its primary aim deviates from improving labor market prospects. Some of our results suggest so. But they also underline that the interplay with local labor market demand and overall macroeconomic conditions is crucial in this regard. Non-monetary effects as denoted by Ruhose et al. (2019) may also be desirable from a social planner's perspective. A better understanding of the underlying mechanisms would allow to assess the transferability of our findings to other forms of education and settings.

Our main finding is that even non-formal and voluntary adult education can reduce unemployment. The realization of such education effects depends on the content of courses and local labor demand. At least in East Germany after reunification, non-formal education achieved comparable labor market effects to ALMP. When it comes to designing labor market policies, one may reconsider whether policies should focus on formal education. In some contexts, non-formal education may achieve sufficient human capital adjustments as well. This thought is somewhat in line with but more radical than the current discussion around partial qualifications in the German dual apprenticeship system (see for example

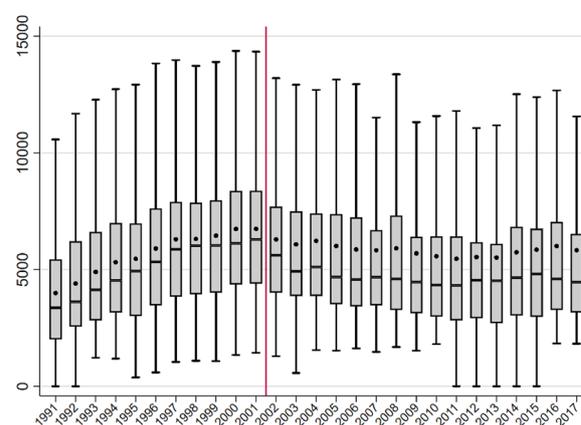
Kruppe et al. 2024).<sup>16</sup> Given the different target groups and objectives of both forms of adult education, these results underline the importance of non-governmental providers of voluntary adult education, especially in addition to governmental efforts like ALMP.

## Appendix: Figures

See Figs. 9, 10, 11, 12 and 13.



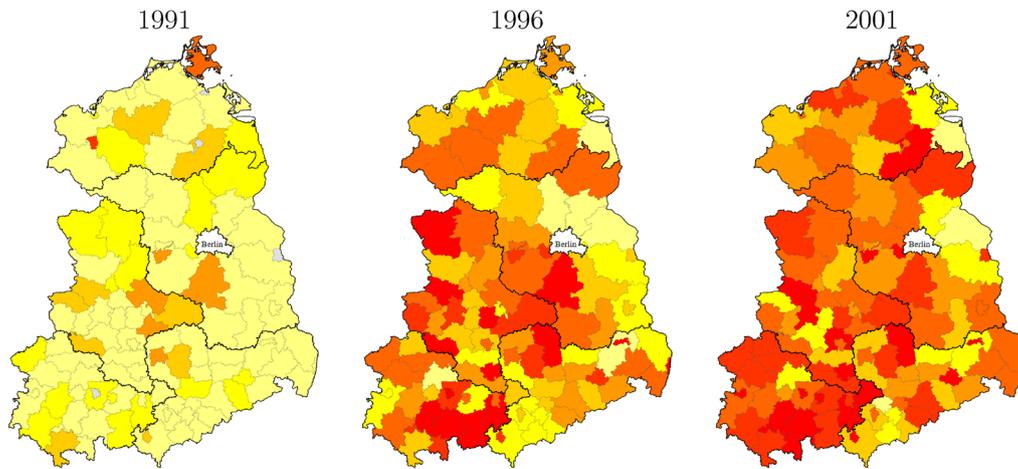
**Fig. 9** VHS courses per county. *Notes:* Yearly boxplots show the evolution of freely accessible VHS courses in East Germany over time. Courses are summarized at the county level, given the boundaries at the end of 2020. Outlier values are blinded out. *Data Sources:* VHS, BBSR.



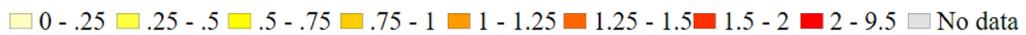
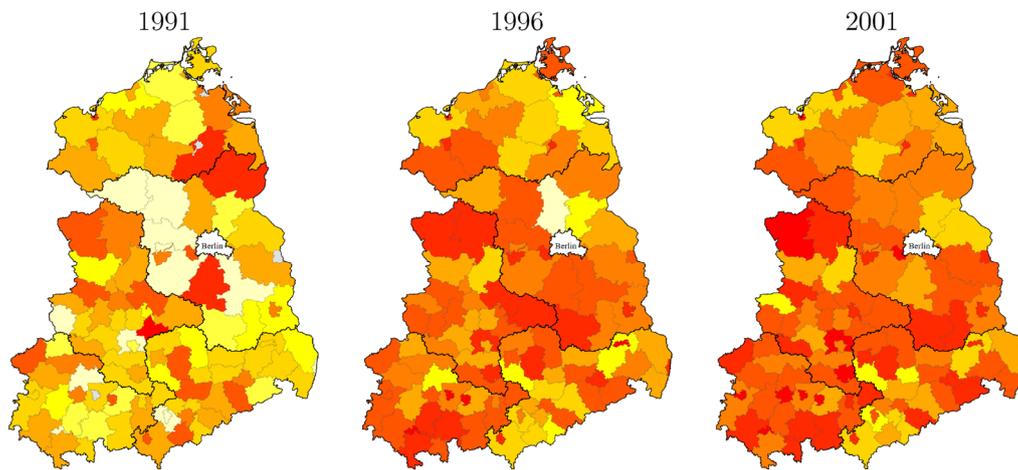
**Fig. 10** VHS course participations per county. *Notes:* Yearly boxplots show the evolution of participations in freely accessible VHS courses in East Germany over time. Courses are summarized at the county level, given the boundaries at the end of 2020. Outlier values are blinded out. *Data Sources:* VHS, BBSR.

<sup>16</sup> Deviating from the usual dual apprenticeship system, these partial qualifications allow participants to acquire vocational qualifications in individual modules. Accomplishing all required modules may lead to a professional certification, but only few participants use this opportunity. Kruppe et al. (2024) find that this type of non-formal education reaches comparable employment effects to retrainings while requiring substantially smaller time and financial investments.

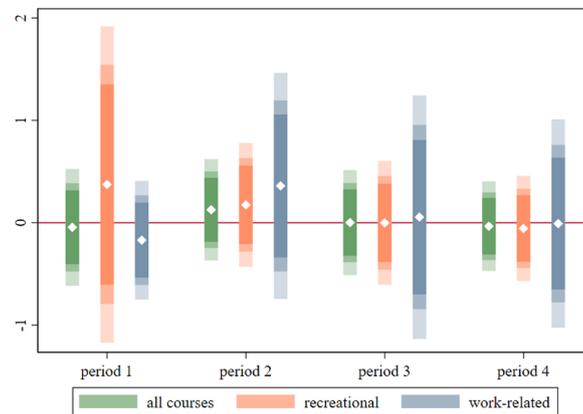
*Panel A: Recreational Courses*



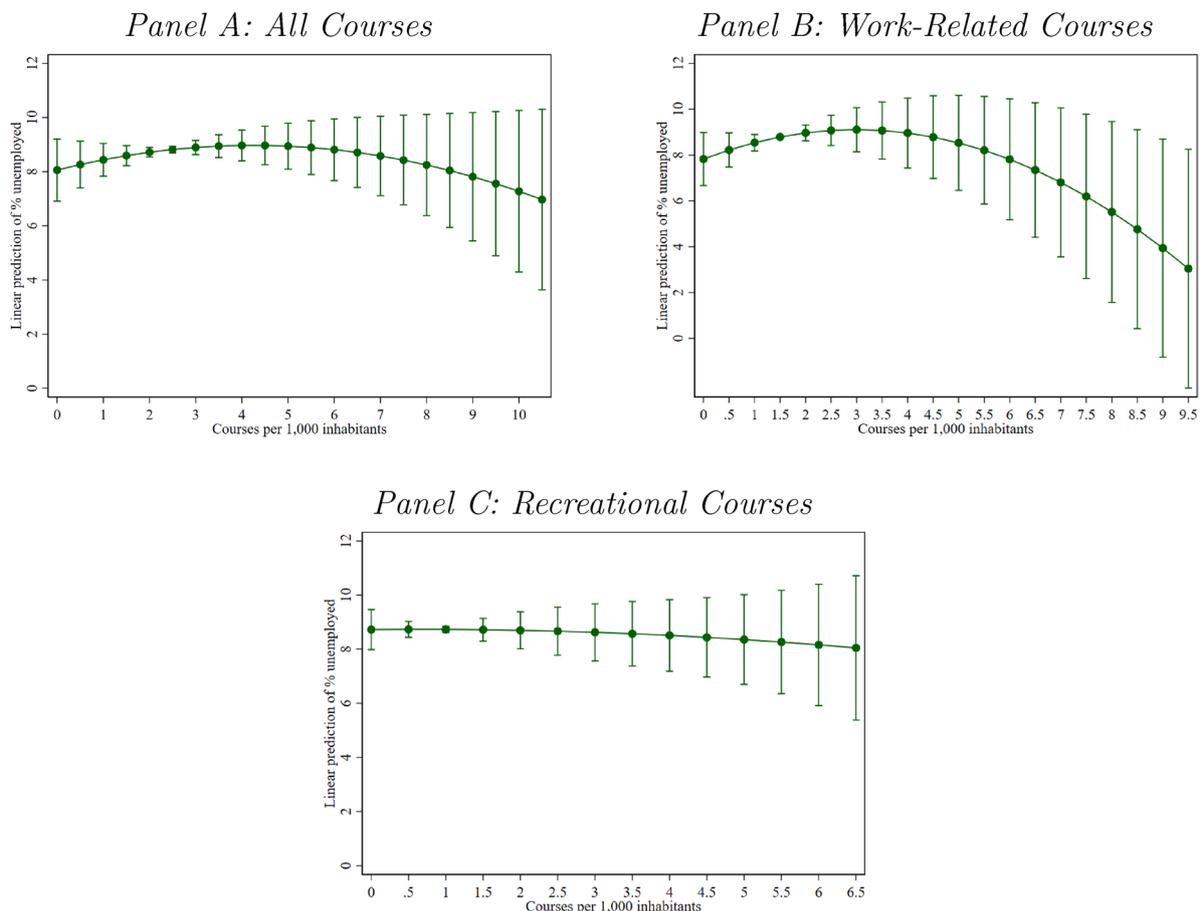
*Panel B: Work-Related Courses*



**Fig. 11** VHS courses per 1000 inhabitants by content. *Notes:* Recreational courses encompass those on society & politics, culture & arts, and health. Work-related courses encompass those on work & occupation, basic education and language courses. County boundaries as of late 2005. *Data Sources:* VHS, BBSR, ©GeoBasis-DE/BKG 2023.



**Fig. 12** Period-specific marginal effect of VHS courses. *Notes:* This figure is based on regression estimates for the specification controlling for population, proxied GDP, course characteristics and participants’ characteristics (see Table 6). Confidence intervals are shown at the 90, 95 and 99 % level. The lightest confidence interval refers to the 99 % level. Color intensity increases with lower significance levels. Standard errors are clustered at the county level. Period 1 refers to the years 1991–1993, which are associated with the collapse of the former East German economy. The second period from 1994 to 1996 is described as a period of slight recovery and stabilization. The third and fourth periods (1997–1999 and 2000–2002) are characterized by stagnation and worsening labor market prospects. *Data Sources:* VHS, FEA, BBSR, Lehnert et al. (2023).



**Fig. 13** Non-linear effects. *Notes:* Based on a model with a square term of the treatment, these graphs show the linear prediction of the outcome variables at different levels of the treatment. All estimates refer to the specification with the full set of control variables (see Table 12). The span of treatment levels is given by the range of course numbers observed in the sample (see Table 1). Confidence intervals are reported at the 95% level. Standard errors are clustered at county level. *Data Sources:* VHS, FEA, BBSR, Lehnert et al. (2023).

**Appendix: Tables**

See Tables 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 and 17.

**Table 3** East German counties in VHS statistic

	Freq.	Percent	Cum.
Covered since 1991	108	96.43	96.43
... since 1992	3	2.68	99.11
... since 1993	1	0.89	100
$\Sigma$	112	100	

*Data Sources:* VHS, BBSR.*Notes:* County boundaries as of December 31, 2005.**Table 4** Main effects

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All courses</u>				
Courses per 1000 inhabitants	−0.01 (0.16)	0.03 (0.15)	0.01 (0.16)	−0.01 (0.17)
N	1,226	1,226	1,226	1,138
$R^2$	0.480	0.495	0.496	0.505
Adjusted $R^2$	0.422	0.436	0.436	0.439
<u>Panel B: Work-related courses</u>				
Courses per 1000 inhabitants	0.10 (0.31)	0.13 (0.29)	0.07 (0.30)	−0.04 (0.30)
N	1,226	1,226	1,226	1,138
$R^2$	0.481	0.495	0.498	0.507
Adjusted $R^2$	0.423	0.436	0.438	0.442
<u>Panel C: Recreational courses</u>				
Courses per 1000 inhabitants	−0.13 (0.21)	−0.07 (0.19)	−0.04 (0.19)	0.02 (0.21)
N	1,226	1,226	1,226	1,138
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

*Data Sources:* VHS, FEA, BBSR, Lehnert et al. (2023).*Notes:* Standard errors are clustered at county level and given in parentheses.\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 5** Year-specific marginal effects

	Dependent variable: Share unemployed		
	(1)	(2)	(3)
	All courses	Recreational courses	Work-related courses
Year 1991	−0.14 (0.22)	0.27 (0.72)	−0.21 (0.23)
Year 1992	0.05 (0.42)	0.41 (0.99)	−0.10 (0.50)
Year 1993	0.28 (0.43)	0.90 (0.87)	0.12 (0.55)
Year 1994	0.57 (0.60)	0.87 (0.89)	0.96 (1.01)
Year 1995	0.08 (0.20)	0.05 (0.23)	0.28 (0.46)
Year 1996	0.05 (0.19)	0.08 (0.23)	0.11 (0.46)
Year 1997	0.06 (0.23)	0.07 (0.26)	0.08 (0.52)
Year 1998	0.01 (0.23)	−0.08 (0.29)	0.13 (0.52)
Year 1999	0.04 (0.19)	0.00 (0.20)	0.10 (0.45)
Year 2000	−0.00 (0.20)	−0.07 (0.22)	0.06 (0.46)
Year 2001	−0.00 (0.17)	−0.03 (0.20)	0.01 (0.40)
N	1,138	1,138	1,138
Mean share unemployed	8.59	8.59	8.59

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: This table shows estimated year-specific marginal effects of VHS courses on the subsequent share unemployed. Estimates are based on a regression model with year-treatment interactions and the full set of control variables, that is population, proxied GDP, course characteristics and participants' characteristics. The corresponding standard errors are given in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 6** Period-specific marginal effects

	Dependent variable: Share unemployed		
	(1)	(2)	(3)
	All courses	Recreational courses	Work-related courses
1st period (1991–1993)	−0.04 (0.22)	0.37 (0.59)	−0.17 (0.22)
2nd period (1994–1996)	0.13 (0.19)	0.17 (0.23)	0.36 (0.42)
3rd period (1997–1999)	0.00 (0.20)	−0.00 (0.23)	0.05 (0.45)
4th period (2000–2002)	−0.03 (0.17)	−0.06 (0.20)	−0.01 (0.39)
N	1,138	1,138	1,138
Mean share unemployed	8.59	8.59	8.59

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: This table shows the estimated period-specific average marginal effect of an additional VHS course per 1,000 inhabitants. Estimates are based on a regression model with period-treatment interactions, period-fixed effects and the full set of control variables. Standard errors are given in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 7** Effects by region

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All courses</u>				
Courses per 1000 inhabitants	0.26* (0.14)	0.25* (0.14)	0.23 (0.14)	0.23 (0.16)
Courses # border	-1.05*** (0.27)	-0.92*** (0.27)	-0.93*** (0.27)	-0.96*** (0.29)
p-value for $\beta + \theta = 0$	0.003	0.014	0.011	0.013
N	1,226	1,226	1,226	1,138
$R^2$	0.510	0.516	0.518	0.526
Adjusted $R^2$	0.455	0.459	0.460	0.463
<u>Panel B: Work-related courses</u>				
Courses per 1000 inhabitants	0.53* (0.32)	0.51 (0.31)	0.44 (0.32)	0.37 (0.34)
Courses # border	-1.86*** (0.45)	-1.65*** (0.45)	-1.72*** (0.43)	-1.76*** (0.43)
p-value for $\beta + \theta = 0$	0.001	0.006	0.001	0.000
N	1,226	1,226	1,226	1,138
$R^2$	0.507	0.516	0.520	0.528
Adjusted $R^2$	0.451	0.458	0.462	0.465
<u>Panel C: Recreational courses</u>				
Courses per 1,000 Inhabitants	0.26 (0.24)	0.24 (0.23)	0.26 (0.23)	0.33 (0.24)
Courses # border	-1.34** (0.52)	-1.11** (0.49)	-1.08** (0.47)	-1.10** (0.50)
p-value for $\beta + \theta = 0$	0.035	0.067	0.072	0.121
N	1,226	1,226	1,226	1,138
$R^2$	0.500	0.507	0.510	0.518
Adjusted $R^2$	0.443	0.449	0.451	0.453
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: This table shows the effect of VHS courses on the subsequent share of unemployed. The interaction term shows the additional effect  $\theta$  for counties bordering West Germany. The p-value of a Wald test for  $\beta + \theta = 0$  shows whether this combined effect is significantly different from 0. Standard errors are clustered at county level and given in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 8** Comparison of border and inland counties

	(1) Inland counties	(2) Border counties	(3) Difference
VHS courses per 1000 inhabitants	2.49 (1.45)	2.71 (1.44)	0.22** (0.11)
Recreational VHS courses per 1000 inhabitants	0.97 (0.82)	1.11 (0.88)	0.14** (0.06)
- Courses on society & politics	0.19 (0.19)	0.19 (0.17)	0.01 (0.01)
- Courses on culture & arts	0.38 (0.39)	0.41 (0.31)	0.03 (0.03)
- Courses on health	0.41 (0.42)	0.50 (0.56)	0.10*** (0.03)
Work-related VHS courses per 1000 inhabitants	1.52 (0.80)	1.61 (0.76)	0.08 (0.06)
- Courses on languages	0.85 (0.54)	0.81 (0.52)	-0.05 (0.04)
- Courses on work & occupation	0.60 (0.33)	0.75 (0.32)	0.15*** (0.02)
- Courses on basic education	0.08 (0.13)	0.05 (0.06)	-0.02** (0.01)
Mean hours per course	42.08 (18.17)	48.88 (20.55)	6.70*** (1.39)
Exams per course	0.48 (0.81)	0.49 (0.78)	0.01 (0.06)
Share of females	0.71 (0.11)	0.72 (0.10)	0.01 (0.01)
Share of participants > 50 years	0.20 (0.10)	0.18 (0.09)	-0.03*** (0.01)
Revenue share from public funds	0.62 (0.16)	0.64 (0.17)	0.03** (0.01)
Revenue share from fees	0.35 (0.15)	0.31 (0.16)	-0.04*** (0.01)
Number of local branch offices	2.40 (3.24)	3.82 (3.72)	1.42*** (0.25)
Sum of events and lecture series at VHS	33.15 (62.15)	68.18 (204.04)	35.02*** (7.67)
Number of one-day study trips and excursions	2.45 (4.86)	2.01 (3.88)	-0.44 (0.35)
Number of study trips over several days	1.44 (2.71)	1.78 (3.06)	0.34 (0.21)
Observations	1,006	220	1,226

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: Standard errors are given in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 9** Effects of VHS participations on unemployment

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
<b>Panel A: All courses</b>				
Participations per 1000 inhabitants	-0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.480	0.495	0.496	0.505
Adjusted R <sup>2</sup>	0.422	0.436	0.436	0.439
<b>Panel B: Work-related courses</b>				
Participations per 1000 inhabitants	0.02 (0.03)	0.03 (0.03)	0.02 (0.03)	0.02 (0.03)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.482	0.497	0.500	0.508
Adjusted R <sup>2</sup>	0.424	0.438	0.440	0.443
<b>Panel C: Recreational courses</b>				
Participations per 1000 inhabitants	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.482	0.495	0.499	0.506
Adjusted R <sup>2</sup>	0.424	0.436	0.439	0.441
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 10** Alternative course categorization

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
<b>Panel A: Recreational courses</b>				
Courses per 1000 inhabitants	-0.05 (0.19)	-0.00 (0.18)	0.04 (0.18)	0.04 (0.19)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.480	0.495	0.497	0.505
Adjusted R <sup>2</sup>	0.422	0.436	0.437	0.439
<b>Panel B: Work-related courses</b>				
Courses per 1000 inhabitants	0.15 (0.38)	0.22 (0.37)	0.07 (0.38)	-0.10 (0.37)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.481	0.495	0.499	0.508
Adjusted R <sup>2</sup>	0.423	0.436	0.439	0.443
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: This alternative categorization considers language courses as recreational instead of work-related. Now, recreational courses consist of courses on culture & arts, society & politics, health, and languages. Work-related courses consist only of courses on work & education and those on basic education. Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 11** Effects of individual courses areas on unemployment

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
Courses on society & politics	−0.28 (0.57)	−0.27 (0.54)	−0.19 (0.56)	0.04 (0.55)
Courses on culture & arts	0.26 (0.50)	0.29 (0.50)	0.31 (0.59)	0.40 (0.55)
Courses on health	−0.52* (0.30)	−0.42 (0.27)	−0.35 (0.32)	−0.26 (0.35)
Courses on languages	0.16 (0.64)	0.14 (0.60)	0.14 (0.65)	−0.01 (0.67)
Courses on work & occupation	0.24 (0.42)	0.33 (0.39)	0.01 (0.44)	−0.19 (0.42)
Courses on basic education	−0.34 (0.90)	−0.40 (0.88)	−0.27 (0.95)	−0.18 (0.85)
N	1,226	1,226	1,054	983
R <sup>2</sup>	0.483	0.497	0.505	0.515
Adjusted R <sup>2</sup>	0.423	0.436	0.428	0.432
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: All courses are scaled per 1,000 inhabitants. Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 12** Non-linear effects

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All courses</u>				
Courses per 1000 inhabitants	0.46* (0.26)	0.47* (0.25)	0.45* (0.26)	0.43 (0.31)
Square of courses	-0.06** (0.03)	-0.05** (0.03)	-0.05* (0.03)	-0.05 (0.03)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.484	0.498	0.499	0.507
Adjusted R <sup>2</sup>	0.425	0.438	0.438	0.441
<u>Panel B: Work-related courses</u>				
Courses per 1000 Inhabitants	1.03*** (0.37)	1.07*** (0.36)	0.98*** (0.36)	0.88** (0.42)
Square of courses	-0.15*** (0.04)	-0.15*** (0.04)	-0.15*** (0.04)	-0.14*** (0.04)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.489	0.503	0.506	0.514
Adjusted R <sup>2</sup>	0.431	0.444	0.446	0.449
<u>Panel C: Recreational courses</u>				
Courses per 1000 Inhabitants	-0.05 (0.44)	0.00 (0.41)	0.05 (0.41)	0.08 (0.46)
Square of courses	-0.02 (0.07)	-0.02 (0.07)	-0.02 (0.07)	-0.01 (0.07)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.481	0.495	0.499	0.506
Adjusted R <sup>2</sup>	0.422	0.435	0.438	0.440
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 13** State-specific time trends

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All courses</u>				
Courses per 1000 inhabitants	0.14 (0.16)	0.13 (0.15)	0.13 (0.16)	0.13 (0.17)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.532	0.541	0.541	0.551
Adjusted R <sup>2</sup>	0.460	0.466	0.465	0.470
<u>Panel B: Work courses</u>				
Courses per 1000 inhabitants	0.21 (0.30)	0.20 (0.29)	0.16 (0.29)	0.06 (0.29)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.532	0.541	0.541	0.551
Adjusted R <sup>2</sup>	0.459	0.466	0.466	0.470
<u>Panel C: Recreational courses</u>				
Courses per 1000 inhabitants	0.14 (0.21)	0.12 (0.20)	0.16 (0.20)	0.28 (0.21)
N	1,226	1,226	1,226	1,138
R <sup>2</sup>	0.532	0.540	0.543	0.555
Adjusted R <sup>2</sup>	0.459	0.465	0.468	0.474
Mean share unemployed	8.59	8.59	8.59	8.59
State-year FE	✓	✓	✓	✓
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al.(2023).

Notes: Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 14** Border-specific time trends

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All courses</u>				
Courses per 1000 inhabitants	0.30** (0.15)	0.28** (0.14)	0.27* (0.14)	0.27* (0.16)
Courses # border	-0.77** (0.30)	-0.69** (0.29)	-0.70** (0.30)	-0.70** (0.33)
p-value for $\beta + \theta = 0$	0.126	0.180	0.170	0.213
N	1,226	1,226	1,226	1,138
$R^2$	0.546	0.551	0.551	0.561
Adjusted $R^2$	0.475	0.478	0.477	0.481
<u>Panel B: Work-related courses</u>				
Courses per 1000 inhabitants	0.53* (0.31)	0.50 (0.31)	0.45 (0.31)	0.37 (0.33)
Courses # border	-1.48*** (0.47)	-1.35*** (0.46)	-1.44*** (0.44)	-1.46*** (0.44)
p-value for $\beta + \theta = 0$	0.028	0.046	0.017	0.005
N	1,226	1,226	1,226	1,138
$R^2$	0.548	0.553	0.555	0.564
Adjusted $R^2$	0.477	0.480	0.481	0.484
<u>Panel C: Recreational courses</u>				
Courses per 1000 inhabitants	0.35 (0.24)	0.29 (0.22)	0.32 (0.22)	0.42* (0.23)
Courses # border	-0.86* (0.48)	-0.70 (0.46)	-0.67 (0.44)	-0.61 (0.46)
p-value for $\beta + \theta = 0$	0.265	0.345	0.398	0.680
N	1,226	1,226	1,226	1,138
$R^2$	0.538	0.544	0.547	0.558
Adjusted $R^2$	0.466	0.470	0.472	0.477
Mean share unemployed	8.59	8.59	8.59	8.59
Border-specific time trends	✓	✓	✓	✓
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: This table shows the effect of an additional VHS course on the subsequent unemployment. The interaction term shows the additional effect for counties bordering West Germany. The p-value of a Wald test for  $\beta + \theta = 0$  shows whether this combined effect is significantly different from 0. All specifications control for border-specific time trends. Standard errors are clustered at county level and given in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 15** Dynamic effects of VHS courses

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
Lead	−0.00 (0.24)	0.00 (0.22)	−0.00 (0.22)	−0.11 (0.24)
Simultaneous	0.09 (0.12)	0.11 (0.13)	0.12 (0.12)	0.23* (0.14)
Lag	0.01 (0.14)	0.02 (0.15)	0.01 (0.15)	−0.01 (0.15)
Second lag	−0.13 (0.13)	−0.13 (0.13)	−0.12 (0.13)	−0.14 (0.14)
N	1,002	1,002	1,002	930
R <sup>2</sup>	0.481	0.492	0.493	0.499
Adjusted R <sup>2</sup>	0.407	0.416	0.416	0.415
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 16** Dynamic effects of work-related courses

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
Lead	0.18 (0.53)	0.19 (0.50)	0.18 (0.50)	0.08 (0.53)
Simultaneous	0.07 (0.29)	0.10 (0.29)	0.09 (0.28)	0.18 (0.29)
Lag	0.08 (0.26)	0.07 (0.27)	0.07 (0.27)	0.03 (0.27)
Second lag	−0.17 (0.14)	−0.14 (0.14)	−0.13 (0.15)	−0.15 (0.16)
N	1,002	1,002	1,002	930
R <sup>2</sup>	0.481	0.492	0.493	0.499
Adjusted R <sup>2</sup>	0.408	0.417	0.416	0.414
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 17** Dynamic effects of recreational courses

	Dependent variable: Share unemployed			
	(1)	(2)	(3)	(4)
Lead	−0.13 (0.25)	−0.12 (0.23)	−0.12 (0.24)	−0.27 (0.26)
Simultaneous	0.15 (0.18)	0.17 (0.18)	0.19 (0.18)	0.37* (0.22)
Lag	−0.03 (0.16)	0.00 (0.17)	−0.01 (0.16)	−0.03 (0.18)
Second lag	−0.15 (0.29)	−0.18 (0.29)	−0.17 (0.29)	−0.19 (0.29)
N	1,002	1,002	1,002	930
R <sup>2</sup>	0.481	0.492	0.493	0.499
Adjusted R <sup>2</sup>	0.407	0.416	0.415	0.415
Mean share unemployed	8.59	8.59	8.59	8.59
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

Data Sources: VHS, FEA, BBSR, Lehnert et al. (2023).

Notes: Standard errors are clustered at county level and given in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

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### Author contributions

Both authors contributed to the conceptual design, the interpretation of results, and the revision of the manuscript. KR compiled the dataset, performed the analysis and wrote the initial draft. ST initiated the data cooperation with the DIE and organized funding.

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### Availability of data and materials

All data used in this study are publicly available at the cited sources.

### Declarations

### Competing interests

None.

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