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IZA DP No. 16779

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Causal Evidence from East Germany after  
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## ABSTRACT

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# Can Voluntary Adult Education Reduce Unemployment? Causal Evidence from East Germany after Reunification\*

After the German Reunification in 1990, East Germany transitioned from a centrally planned economic system to a market economy. At the time, upskilling through adult education was deemed essential for the successful integration of the workforce into the labor market. Besides substantial mandatory training programs provided by active labor market policies, Volkshochschulen (VHS) were the most important providers of voluntary adult education. The economic effects of their courses have not been analyzed so far. Based on newly digitized data, we evaluate the effects of VHS courses on unemployment in a county-level analysis of East Germany between 1991 and 2002. Our identification strategy is based on a decentralized expansion of courses, which led to substantial and quasi-random variation in course numbers. We find no evidence that VHS courses harmed labor market integrations, in contrast to some active labor market policies. Courses did not affect subsequent unemployment on average. Yet, in counties neighboring West Germany, we find that courses reduced unemployment. Low labor demand may have restricted the realization of education effects. As both work-related and purely recreational courses reduced unemployment in counties bordering West Germany, our results also hint towards the relevance of social capital for successful labor market integrations.

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

**Keywords:** unemployment, adult education, non-formal education, Volkshochschule, East Germany

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# 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 central. To that end, the German Federal Employment Agency (FEA) provided subsidized trainings and other active labor market policy (ALMP) programs on a large scale (see e.g. Lechner, 1998; Thomsen, 2007). Although these programs were expensive, they were later on found to have achieved mixed results only.<sup>1</sup> However, no quantitative evaluation has been done on the economic and in particular the labor market effects of further forms of adult education. These forms comprise among others courses provided by non-governmental institutions like unions, churches, private institutes, and *Volkshochschulen* (VHS), with the latter as most important provider (Wittenbrink and Frick, 2018). VHS courses differ from ALMP programs in central features like incentives for participation, freedom of choice for a specific course, course characteristics, and do not lead to professional certificates. On average, they also cost less per participant than any active labor market policy. Yet, both VHS courses and ALMP programs aim at upskilling and consequently may reduce unemployment. Between 1991 and 2002, East German VHS recorded more than 5 million course participations. The study at hand is the first to empirically evaluate the labor market effects of VHS education: Did their courses reduce unemployment in East Germany in the first decade after reunification?

Although different forms of adult education are prevalent and common around the world, we know relatively little about their effects on labor market outcomes (Midtsundstad, 2019). In particular non-formal adult education lacks causal impact evaluations. Non-formal learning refers to organized learning that does not necessarily lead to a degree or certificate, as for example in VHS courses. But also besides VHS education, non-formal education may help to adjust human capital to changing labor market demands and hence complement active labor market policies in important ways. For example in Germany, active labor market policies have recently started to provide partial qualifications as well. 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. Yet, retrainings are considerably more costly and time-intensive. This shows that non-formal education may

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<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).

be an economic addition to the toolbox of ALMP. Our study therefore contributes to the existing literature in the sense of Card et al. (2018) by focusing on the labor market effects of non-formal adult education. In addition, we focus on a setting with strong structural change by analyzing a transition economy.

VHS adapt their program to overall societal needs.<sup>2</sup> Due to state legislations, they exist in almost every German county, ensuring a comprehensive educational supply of the population. VHS are open to everybody and do not have any 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., 2020). Most courses do not last longer than half a year. Participation fees are small thanks to state subsidies. In cases of need, financial support for covering participation fees can be granted.

Courses cover a wide range of topics: We categorize courses on work & occupation, basic education and language courses as work-related. We expect that these work-related courses 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. Leisure-related courses serve recreational purposes and are not expected to affect labor market outcomes directly.

The majority of studies on German VHS have a qualitative or educational nature and are regionally limited (e.g. Alke et al., 2019; Arnold et al., 2018; Brödel, 2018). Some studies assess the influence of VHS education on political outcomes like voter participation (e.g. Martin and Reichart, 2020). There are only two studies on potential labor market effects of VHS education: 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 that the consultancy increased participation in trainings and further education in the realm of labor market policies. With respect to employment, they find small negative effects. As the analysis is limited to short-term outcomes (max. 2 years after first consultation), the authors suppose that the negative employment effect may stem from a lock-in effect into training. Turning to one specific group on the labour market, Ruhose et al. (2023) investigate the willingness to learn among older workers. Their study combines 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. They interpret their results as evidence on the lasting willingness to learn among older workers, independently from external incentives like monetary ones. Adult education may thereby help to keep workers productive, even in face of longer working lives.

Our study evaluates the labor market effects of VHS education from a regional perspective. We exploit regional and temporal variation in the expansion of VHS activities

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<sup>2</sup>See Thomsen and Weilage (2023) for a recent example.

that took place between 1991 and 2002 in a two-way fixed effects approach. Comparisons of county-year observations with many to those with few VHS courses provide evidence on the effects of VHS courses. Our dataset combines educational data from the VHS statistic with unemployment data from administrative records of the FEA. 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.

Our main results show that VHS courses overall did not impact subsequent county-level unemployment. This does not change when differentiating between courses with leisure-related and work-related contents. Analogously to the mixed findings on ALMP effectiveness, the realization of labor market effects of VHS education may have been limited by the weak development of the East German labor market. Nevertheless, there were regional differences in labor demand. We therefore look at regional disparities in the effect of VHS courses on subsequent unemployment and find that courses in counties bordering West Germany significantly decreased unemployment. For these counties, we find that both work-related and leisure-related courses decrease subsequent unemployment. While the effects of work-related courses in border counties can be explained by the opportunity to commute to jobs in West Germany and skill adjustments relevant for labor market integration, this explanation does not comply with leisure-related courses. As leisure-related courses reduced unemployment only in border counties, these courses must have promoted different social network effects from leisure-related courses in inland counties. We suspect that these courses may have helped to build new social ties between East and West German networks, with beneficial labor market effects.

The remainder of this paper proceeds as follows. Section 2 characterizes the institutional background by first describing VHS as educational institution and then the development of the East German labor market. Section 3 presents our empirical strategy: Section 3.1 describes our data and Section 3.2 and 3.3 explain and validate our identification strategy. Section 4 entails the results of our empirical analysis. The main results are presented in Section 4.1. Section 4.2 turns to heterogeneous effects over time and space. Section 4.3 shows the results of our robustness checks and Section 4.4 entails a discussion. Section 5 concludes.

## 2 Institutional Background

### 2.1 The *Volkshochschule* (VHS)

VHS are considered as the main provider of voluntary adult education in Germany (Wittenbrink and Frick, 2018). Their fundamental aim is to provide affordable education that is accessible for everyone (Süssmuth and Eisfeld, 2018). To this end, they 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).

The fees for participation in a VHS course are in general small, as illustrated by the following example: In 1995, the fee for a basic typewriting course at the VHS Leipzig was about 115 to 125 Deutschmarks (see Figure A.1). A lesson of 45 minutes 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). For unemployed persons or those with low family income, there has been additional financial support for covering course fees. This renders the financial burden that often limits access to education negligible.

Strong subsidies enable VHS to charge such low fees. On average, more than 50 % of a VHS budget is financed by some sort of public fund (Reichart et al., 2020, p. 22f.). In our dataset, this share amounts to 62 % on average (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.

Although no uniform quality management exists, VHS do receive quality certificates from independent auditors. Moreover, most VHS lecturers are highly qualified: Koscheck and Ohly (2016) state that 65 % of all VHS lecturers have graduated from university. Yet, there are no formal requirements for becoming a VHS lecturer.

VHS have a long history and emerged during the Weimar Republic (1918-1933) (Olbrich, 2001). At that time, their pedagogical approach stressed the co-responsibility of students with respect to the learning process and learning successes (also known as “*Neue Richtung*”). Knowledge transfer ought to empower citizens’ political participation. Therefore, the VHS of the Weimar Republic are considered as institutions that fostered 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 later case, courses addressed topics such as “*Gesundes Volk*” (Healthy People) or “*Wehrhaftes Volk*” (Fortified People), that served the National Socialists’ ideology. After WWII, 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 by the state. Their curricula were set in a centralized and uniform way. Starting in 1956, East German VHS were subordinated to the Ministry of National Education.

The topical focus of courses at East German VHS 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. This opportunity was very popular and often used. To give a numerical example: 25,188 pupils completed the 12<sup>th</sup> grade at secondary schools in 1971, while VHS courses leading to the corresponding school-leaving degree had 12,716 participants (Staatliche Zentralverwaltung für Statistik, 1980, p. 290, 297). The great popularity was also rooted in the recommendations that teachers gave their students: Facing severe labor shortages in the 1960s, students were often recommended to leave school after grade 10, start working and visit VHS courses on the side (Siebert, 2001). Language courses and typing classes were also very popular.

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

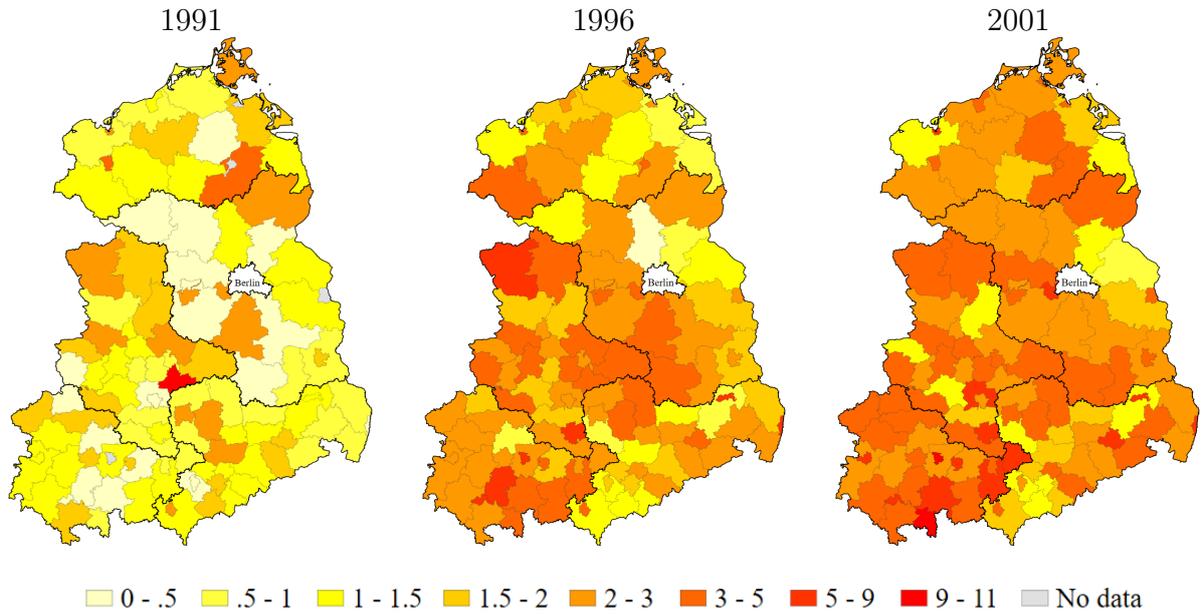
Following the German reunification (1990), not only the East German economic system, but also the educational system changed profoundly. Most of the GDR's state-aligned organizations that used to provide adult education were resolved. VHS were among the few institutions in this field that persisted. They could decide on their course program autonomously again while simultaneously facing challenges such as finding a new organizational form, funding and teaching staff for the new course areas (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 1991, the East German VHS joined the national umbrella organization of their West German counterparts. VHS still coordinate voluntarily at both the federal and the national level until today.

After 1991, the number of VHS courses in East Germany increased steeply (see Figure 1, panels A and B of Figure A.4 in the appendix show maps on leisure- and work-related courses). 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 Figure A.2 for averages). By 2001, the expansion of courses came to a halt. Increases in the number of participations reflect this expansion: They increased from an average value of roughly 4,000 per county in 1991 to 6,750 in 2001 (see Figure A.3).

A second notable feature is the change in the composition of courses over time. Figure 2 shows that shortly after reunification, courses on work & occupation as well as languages constituted the majority of the curricula. Over time, leisure-related courses on health topics or culture & arts gained more relevance. In contrast to the VHS programs in the GDR, courses leading to secondary school degrees were relatively scarce.

VHS set their curricula autonomously and are exclusively administered at the local

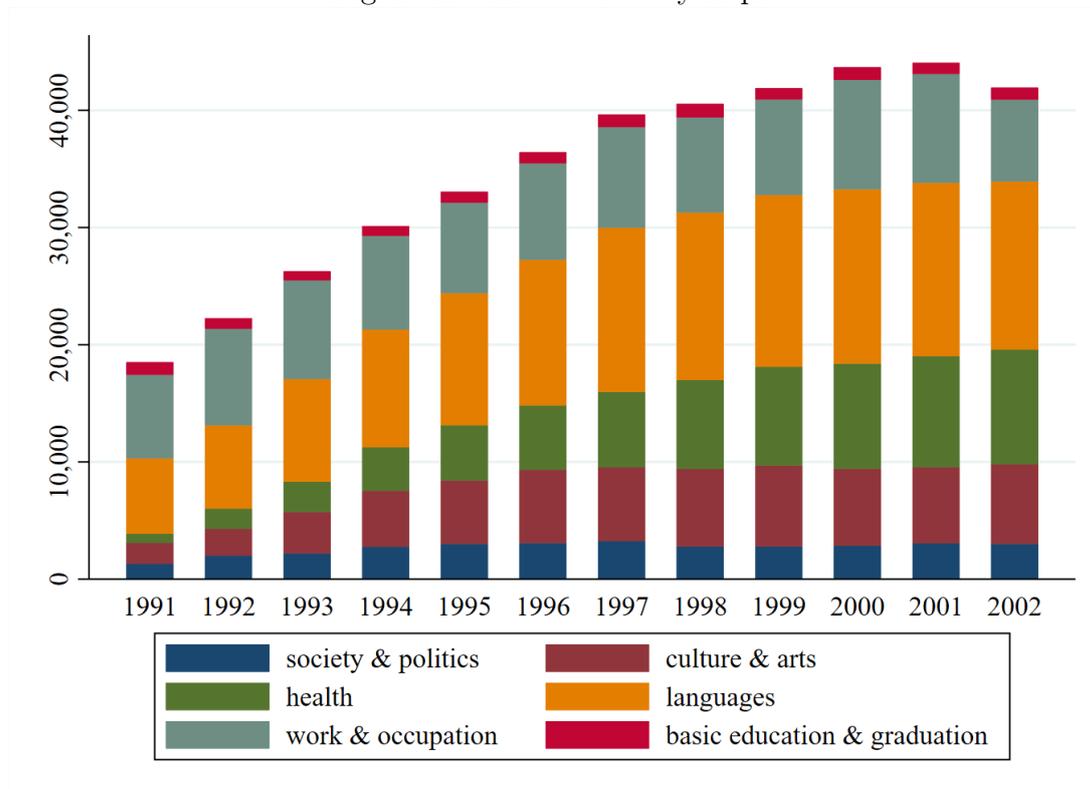
Figure 1: VHS Courses per 1,000 Inhabitants in East Germany



Data Sources: VHS, BBSR, © GeoBasis-DE/BKG 2023

Notes: County boundaries as of late 2005. For four counties, there are no VHS reports in 1991.

Figure 2: VHS Courses by Topic



Data Sources: VHS, BBSR.

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

level. The before-mentioned expansion of courses was shaped by the engagement of local agents and often restricted by political and administrative frictions. Fleige et al. (2019) note that, in general, German institutions operating in the field of adult education do not have a standardized process for creating new course programs. Instead, the authors emphasize local actors' leeway for decision-making and the necessity to balance out conflicting demands and requirements. It can therefore be stated that courses expanded in a decentralized and quasi-random manner. Consequently, we consider courses to be orthogonal to our outcome variable, the share of unemployed.

## 2.2 The East German Labor Market During Transition

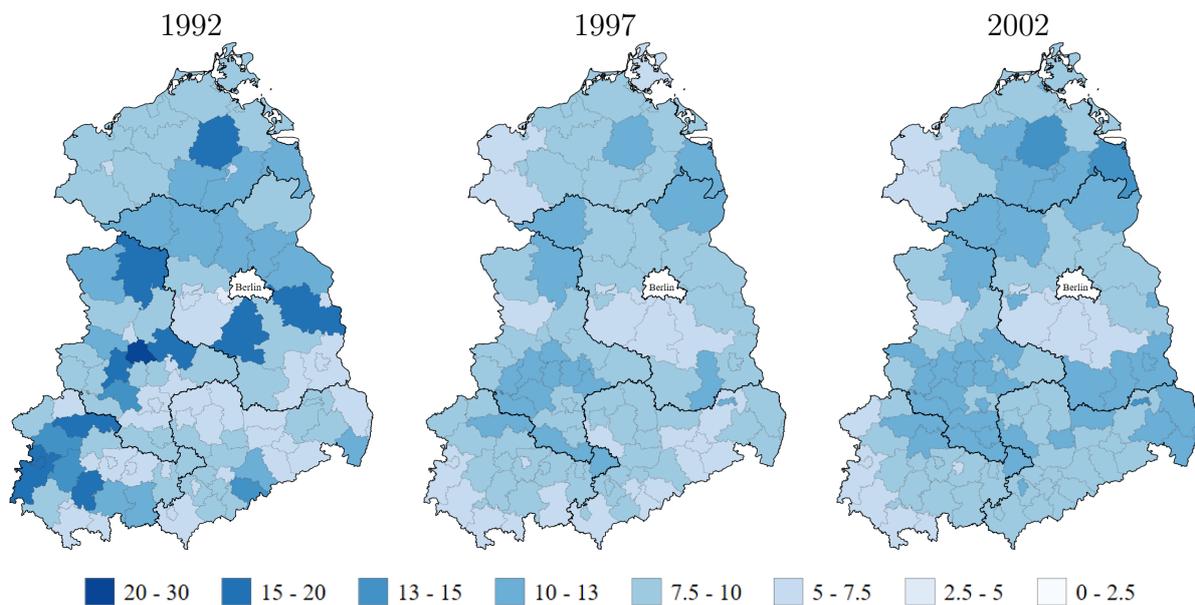
The GDR's labor market was typical for the Command Economies of Eastern Europe of that time. Article 24 of the GDR's constitution gave every citizen the right to as well as the duty to work, such that open unemployment did not exist as such (Dahms and Wahse, 1996). In principle, workers were free to 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 formally joined West Germany, West German institutions were transferred to East Germany, including the legal system 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 enterprises 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, Bird et al. (1994) find 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 (Hunt, 2008). This was motivated mainly by political reasons, irrespective of productivity developments. Hence, wages were found to be above 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 sank 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). However, this rate veils the true extent of underemployment, as workers on short-time work or in ALMP measures were not considered as unemployed. While the massive use of those policies cushioned the reunification's economic effects, the share of unemployed in the population was still above 15 % in about 10 % of all East German counties in 1992 (see Figure 3).

Figure 3: Share of Unemployed in County Population in East Germany



Data Sources: FEA, BBSR, © GeoBasis-DE/BKG 2023.

Notes: County boundaries as of late 2005.

But the turbulence of transformation went beyond unemployment: 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 sinking female labor force participation. In addition, migration to West Germany contributed strongly to the reduction of the East German workforce. Of less importance was the repatriation of guest workers, given their small number.<sup>3</sup>

In 1994, the East German labor market entered a period of stabilization, as employment started to increase again (Thomsen, 2007).<sup>4</sup> The smaller number of persons in labor market programs indicated a temporary relaxation of the tense labor market situation. East-West-migration dropped significantly, meaning that the East German labor force potential changed only slightly in this period. Moreover, there were also fewer employment changes

<sup>3</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>4</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.

between firms, which hints towards of consolidation of the East German firm structure (Bielenski et al., 1997).

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 (Bielenski 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.

## 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. Table 1 presents the summary statistics. Since East and West Berlin are not differentiated in our data sources, we exclude Berlin from our analysis. This is also warranted by the special situation of the Berlin labor market.

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 quickly available and reliable 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 allowed us to extend the temporal coverage of our panel. The resulting panel gives the total number of persons registered as unemployed

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</u> (all per 1,000 inhabitants)					
VHS courses	2.53	1.45	0.00	10.34	1,226
leisure-related 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
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
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.

per county as of June 30 for the years 1992 to 2002.<sup>5</sup>

Unfortunately, the digital dataset 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 fill the missings for Eisenach.

To measure local educational activities, we use the VHS statistic, an administrative dataset that is provided on annual basis by the German Institute for Adult Education (DIE, 2018). This dataset provides detailed information about courses and organizational features of each VHS. Data on East German VHS were first available in 1991. Some 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 A.1). We assume these missings to be as good as random. The number of counties without any VHS report 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>6</sup> We also have this information by course areas, which allows us to distinguish between the yearly number of work-related courses and leisure-related courses. Work-related courses address topics like languages, work & occupation, and basic education. Leisure-related 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>7</sup>, the share of females among participants or the share of participants older than 50 years.

Further regional controls proxy county-level economic activity following Lehnert et al. (2023): Daytime-satellite data provide information on the type of surface that any geographic areas 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>8</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 our dataset.

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<sup>5</sup>Unemployment data by gender is only available from 1996 onwards, which prevents a gender-specific evaluation.

<sup>6</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>7</sup>This variable considers school-leaving degrees gained at VHS, examinations by Chambers of Commerce and Industry, Chambers of Craft and other professional associations but excludes VHS certificates.

<sup>8</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.

Since the predicted value would have been used as independent variable, 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.

For enabling 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.

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 therefore decided to use the county borders as of December 31, 2005. In order to capture regional differences, we furthermore manually created dummies indicating whether a county neighbors the former inner-German border based on maps.

### 3.2 Identification Strategy

For identifying a 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 large temporal and spatial variation in VHS’ educational activities in the context of their course expansion by comparing observations with many courses to those with few. 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:

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

where  $y_{ct}$  denotes the share of unemployed in county  $c$ ’s population in year  $t$ .  $D_c$  are county fixed effects, which account for time-invariant heterogeneity between counties.  $D_t$  denotes year-specific fixed effects, capturing year-specific shocks common for all counties. 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 our outcome and

our 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 controls on course characteristics ensure that potential effects do not arise because of changes in the organizational aspects of courses. 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.

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 unproportionally strongly affected by unemployment (Bielenski et al., 1997). Unfortunately, providing such information to the VHS statistics was not mandatory (Huntemann et al., 2021), leading to a slightly smaller number of observations in the specifications that control for participants' characteristics.

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, leisure-related courses only, and work-related courses only. Leisure-related 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>9</sup>, basic education, courses leading to school degrees, and language courses.

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. Not being able to track individual participation in VHS courses also implies that our parameter of interest  $\beta$  captures the average treatment effect at the county level. Furthermore, it is the average treatment effect on the treated (ATT) that we capture, given the observational nature of this evaluation and given that all units receive the treatment in varying intensity.

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<sup>9</sup>Courses in the realm of work & occupation taught for example how to apply for jobs, accounting or typewriting.

### 3.3 Validation of the Identification Strategy

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 by Section 2.1. Unfortunately, time-varying local covariates are rarely available and pre-treatment data, especially on unemployment, do not exist. This renders many of the commonly used falsification exercises unfeasible. The following empirical analyses investigate the validity of our empirical strategy as thoroughly as possible.

Firstly, we take a closer look at the comparison we do. As our methodological approach relies on comparing counties with many courses to those with few, we create balance tables contrasting observations with an above-median number of courses versus a below-median number of courses. Table 2 shows that observations with above-median and below-median course numbers are equiprobable of being located next to Berlin. In contrast, counties bordering West Germany are significantly more likely to have an above-median course number than inland counties. We also see that observations with above-median course numbers stem from significantly smaller and less densely populated counties. As all of these characteristics do not or only barely change over time, the included county fixed effects will account for these differences. In consequence, these differences do not pose a threat to our identification strategy but should be kept in mind for contextualizing the later results.

Turning to the internal aspects of VHS, we find no differences in the sourcing of funds between observations with many and those with few courses. Yet, above-median observations have significantly more local branch offices and offer more events besides courses. Interestingly, we find that courses in counties with an above-median course number are on average shorter, end less often with an exam, and have more female and older participants. This underlines the heterogeneity of VHS and calls for using these variables as control variables.

To understand how county-year observations with extremely many courses differ from those with extremely few, we additionally contrast the top quartile of the distribution with the bottom quartile. Table A.2 shows the corresponding results in a second balance table. We find the same pattern in differences. Not surprisingly, the differences between counties with many and those with few courses became larger by looking at the more extreme cases.

Secondly, we test the empirical relevance of reversed causality and dynamic treatment effects. Such dynamic treatment effects would violate the common trend assumption required for a causal interpretation of our results (see for example De Chaisemartin and D’Haultfœuille (2020)). Reversed causality implies that the outcome variable impacts the treatment variable, which would also bias our estimates. We therefore regress our outcome

Table 2: Balancing Table

	(1)	(2)	(3)
	below median	above median	difference
bordering Berlin	0.09 (0.29)	0.07 (0.25)	-0.02 (0.02)
bordering West Germany	0.15 (0.36)	0.20 (0.40)	0.05** (0.02)
area in square km	1,042.85 (688.05)	885.37 (758.89)	-157.48*** (41.37)
population per square km	131,871.61 (62,293.55)	120,822.36 (72,452.83)	-11,049.25*** (3,859.25)
log of surface share with builtup	0.16 (0.08)	0.16 (0.08)	0.00 (0.00)
log of surface share with crops	0.32 (0.11)	0.29 (0.11)	-0.03*** (0.01)
log of surface share with forest	0.16 (0.10)	0.19 (0.11)	0.02*** (0.01)
log of surface share with grass	0.16 (0.05)	0.16 (0.05)	0.01** (0.00)
log of surface share without vegetation	0.03 (0.03)	0.03 (0.03)	-0.00 (0.00)
log of surface share with water	0.05 (0.03)	0.04 (0.04)	-0.00 (0.00)
share of revenues from public funds	0.62 (0.17)	0.62 (0.15)	-0.00 (0.01)
share of revenues from fees	0.34 (0.16)	0.35 (0.14)	0.00 (0.01)
number of local branch offices	2.38 (2.78)	2.94 (3.86)	0.56*** (0.19)
sum of events and lecture series at VHS	21.75 (35.67)	57.13 (140.37)	35.38*** (5.85)
number of one-day study trips and excursions	1.73 (3.91)	3.02 (5.30)	1.29*** (0.27)
number of study trips over several days	1.14 (2.21)	1.87 (3.20)	0.73*** (0.16)
mean hours per course	49.98 (21.71)	36.62 (12.09)	-13.36*** (1.00)
exams per course	0.68 (0.99)	0.29 (0.48)	-0.39*** (0.04)
share of females among participants	0.71 (0.12)	0.72 (0.10)	0.01* (0.01)
share of participants > 50 years	0.16 (0.09)	0.23 (0.09)	0.07*** (0.01)
Observations	613	613	1,226

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

*Notes:* Sample split at the median value for VHS courses per 1,000 inhabitants. Standard errors are given in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

variable on future, contemporaneous and past values of the treatment variable:

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

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. Figure A.6 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 A.3-A.5 for the corresponding regression estimates). This eliminates potential concerns about reversed causality: There is no evidence for cross-country variation in curricula induced by local labor market developments. Furthermore, as both the first and the second lag are insignificantly different from zero, we find no evidence on effects fading out nor on lock-in effects. Both findings strengthen the plausibility of our identification strategy.

## 4 Empirical Results

### 4.1 Main results

Table 3 presents our main results corresponding to Equation 1. Panel A looks at the effects of all VHS courses on subsequent unemployment rates. All specifications show results that are close to zero and insignificant. In Column 1, where population is held constant, we find that an additional VHS course per 1,000 inhabitants decreases the subsequent unemployment rate by 0.01 percentage points. Additionally controlling for GDP renders the effect slightly positive. In Column 2, an additional course per 1,000 inhabitants increases subsequent unemployment insignificantly by 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 further 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 and insignificant. In this last specification, an additional course per 1,000 inhabitants leads to a 0.01 percentage point reduction in the unemployment share.

VHS offer courses on a broad range of topics, which are expected to affect individual employment chances differently. For this reason, we distinguish between leisure-related and work-related courses and estimate their effects separately. Panel B presents the results for leisure-related courses. Here, an additional course decreases unemployment by 0.13 percentage points (see Column 1). This effect is insignificantly different from zero. Also the alternative specifications in Columns 2-4 find effects with varying signs

Table 3: Main Effects

	Dependent Variable: Share Unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All Courses</u>				
Courses per 1,000 inhabitants	-0.01 (0.16)	0.03 (0.15)	0.01 (0.16)	-0.01 (0.17)
N	1226	1226	1226	1138
$R^2$	0.480	0.495	0.496	0.505
Adjusted $R^2$	0.422	0.436	0.436	0.439
<u>Panel B: Leisure Courses</u>				
Courses per 1,000 inhabitants	-0.13 (0.21)	-0.07 (0.19)	-0.04 (0.19)	0.02 (0.21)
N	1226	1226	1226	1138
$R^2$	0.481	0.495	0.499	0.506
Adjusted $R^2$	0.423	0.436	0.439	0.441
<u>Panel C: Work-Related Courses</u>				
Courses per 1,000 inhabitants	0.10 (0.31)	0.13 (0.29)	0.07 (0.30)	-0.04 (0.30)
N	1226	1226	1226	1138
$R^2$	0.481	0.495	0.498	0.507
Adjusted $R^2$	0.423	0.436	0.438	0.442
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓

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

*Notes:* All specifications control for county population. We proxy GDP following Lehnert et al. (2023) by adding county shares of different surface groups to the set of control variables. Additional controls on course characteristics entail the mean number of exams per course and the mean course length as measured in hours. Participants' characteristics refer to the share of females and of participants older than 50 years among participants. Standard errors are clustered at county level and given in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

that are close to zero and insignificant. Turning to work-related courses in Panel C, we find that an additional course increases subsequent unemployment by 0.1 percentage points. This effect is again insignificant. Also the alternative specifications in Columns 2-4 find insignificant effects. Neither work- nor leisure-related courses significantly affect subsequent unemployment.

## 4.2 Effect Heterogeneity

### 4.2.1 Time-Heterogeneous Effects

Following the reunification, the East German labor market underwent different periods of adjustment (as described in Section 2.2). 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:

$$y_{c,t+1} = \alpha + D_c + D_t + \beta \times courses_{ct} + \theta(D_t \times courses_{ct}) + \gamma X_{ct} + \epsilon_{ct} \quad (3)$$

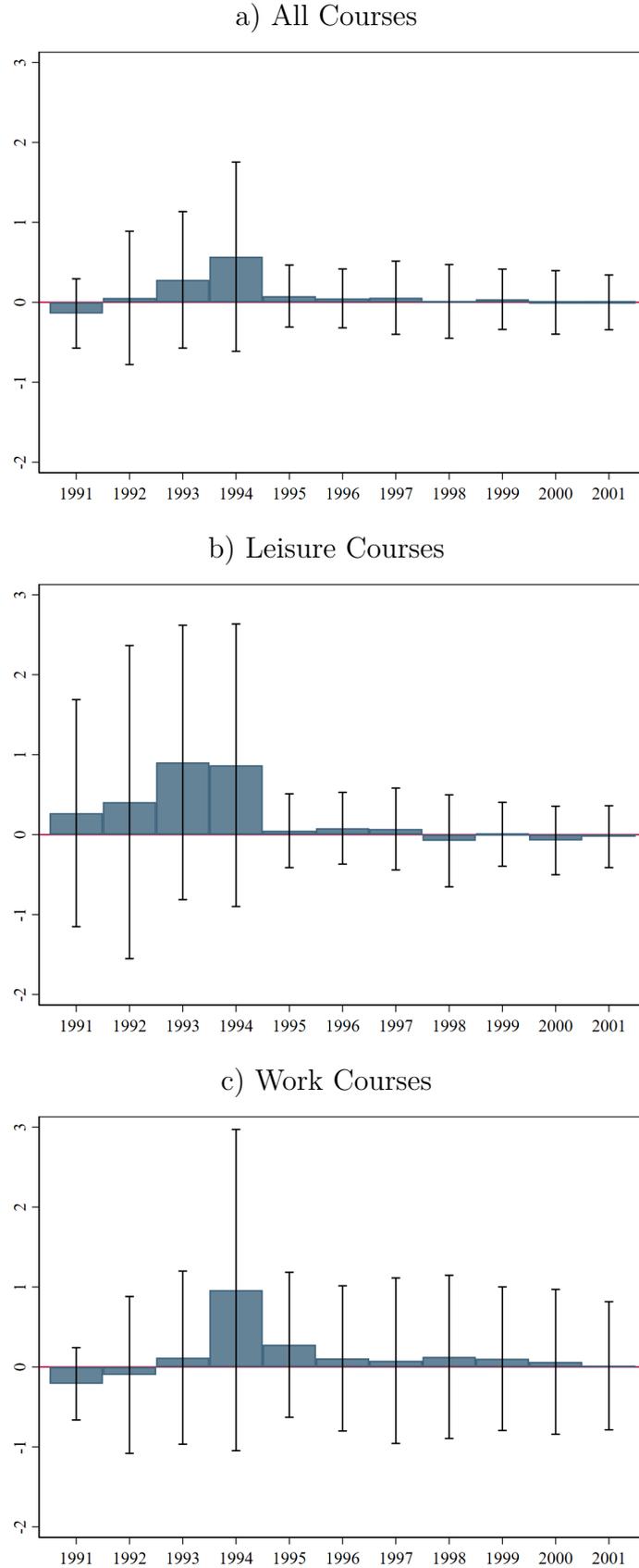
$courses_{ct}$  acts again as a placeholder for varying types of courses, that are considered in different model specifications. If effects changed over time, this would imply significant estimates for  $\theta$ . Yet, this coefficient does not exactly represent what we are looking for: We are interested 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

$$\hat{\sigma}_{\delta y_{c,t+1}/\delta courses_{c,t}} = \sqrt{var(\hat{\beta}) + D_t^2 var(\hat{\theta}) + 2D_t cov(\hat{\beta}, \hat{\theta})}. \quad (4)$$

Figure 4 shows the marginal effect of an additional course in any year and the corresponding confidence interval at the 95 % level. Neither courses overall, nor leisure- or work-related courses significantly affect subsequent unemployment in any year. Effect directions may change but all estimates are close to zero. Table A.6 presents the corresponding results.

Given the small number of county-level observations per year, this analysis may have trouble finding significant effects. We therefore repeat this analysis on a more aggregate level and estimate period-specific effects. The definition of periods follows Section 2.2: 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, the observation period is split into four periods of equal length. This regression model now interacts courses with period dummies instead of year dummies. In

Figure 4: Year-Specific Effect of an Additional VHS Course on the Share Unemployed



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

*Notes:* Specification includes the full set of control variables. Confidence intervals are shown at the 95 % level. Standard errors are clustered at the county level.

addition, previous year fixed effects were replaced by period fixed effect, denoted by  $D_p$ . The rest is analogous to the previous analysis:

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

If effects changed over periods, this would imply significant estimates for  $\theta$ . The marginal effect of an additional course in period  $p$  equals  $\beta + \theta D_p$ . Again, corresponding standard errors have to be calculated. Figure A.5 in the appendix shows that also when looking at aggregated periods, there is no effect of VHS courses on subsequent unemployment. This finding holds for courses overall, leisure- and work-related courses. While effect directions may change over time, all estimates remain close to zero and insignificantly different from zero. Table A.7 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>10</sup> That the composition of labor demand matters can be seen using 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 the 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).

In consequence, also the realization of labor market effects of VHS education may depend on the overall level and the composition of labor demand. Given that the available unemployment data do not distinguish by employment sector, we are not able to consider the labor demand composition. For investigating whether the overall demand level matters for the realization of education effects, we contrast spatially distinct labor markets: As the production factor 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, as commuting to nearby jobs in West Germany was easily feasible. After the German Unification, West Germany saw an increase in employment in all sectors, except the primary one, after the German Unification (Thomsen, 2007). Throughout the 1990s, unemployment rates in West Germany were only half of those in East Germany.

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<sup>10</sup>They find that programs in recessionary periods have larger average impacts, especially if the downturn is relatively short-lived.

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

$$y_{c,t+1} = \alpha + D_c + D_t + \beta \times courses_{ct} + \theta_{border}(courses_{ct} \times border_c) + \gamma X_{ct} + \epsilon_{ct} \quad (6)$$

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  $\beta + \theta = 0$ .

Table 4 shows the results. Panel A presents the results for courses overall. As the p-value of the Wald test shows, courses significantly decrease subsequent unemployment in counties adjoining the inner-German border. This effect is robust across all specifications and significant at the 1 or 5 % level. In our preferred specification (see Column 4), an additional VHS course per 1,000 inhabitants decreases the share of unemployed in the following year by 0.73 percentage points in border counties. For the inland counties, we find that in two out of four specifications, courses increase the share of unemployed significantly at the 10 % level. This effect becomes insignificant when adding more controls.

Panel B shows the results for leisure-related courses. While leisure courses in the rest of East Germany remain ineffective, courses in counties flanking the former inner-German border significantly decreased the share of unemployed in the following year. The interaction term is significantly negative in all specification. The total effect in these border counties is robust in all specifications except the last one. The total effect also becomes a bit smaller when adding more controls. In our preferred specification (Column 4), an additional leisure course in a county bordering West Germany leads to a 0.77 percentage points lower unemployment share. For these counties, the effects of leisure-related courses appear to be larger than the effects of courses overall. However, the precision of the estimates is also lower.

Panel C presents the results for work-related courses. Again, courses are found to be ineffective in inland counties. Only the specification with the smallest set of control variables finds a positive effect, that is significant at the 10% level (see Column 1). This effect vanishes when adding more control variables. In counties bordering West Germany, work-related courses decrease the share of unemployed in the following year. This effect is robust across all specifications and highly significant at the 1% level. In our preferred specification, an additional work-related course in a county bordering West Germany reduces the unemployment share by 1.39 percentage points (Column 4). Compared to the previous panels, the effects for work-related courses are largest in size.

Table 4: Heterogenous Effects: Border

	Dependent Variable: Share Unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All Courses</u>				
Courses per 1,000 Inhabitants	0.26*	0.25*	0.23	0.23
	(0.14)	(0.14)	(0.14)	(0.16)
Courses # Border	-1.05***	-0.92***	-0.93***	-0.96***
	(0.27)	(0.27)	(0.27)	(0.29)
p-value for $\beta + \theta = 0$	0.003	0.014	0.011	0.013
N	1226	1226	1226	1138
$R^2$	0.510	0.516	0.518	0.526
Adjusted $R^2$	0.455	0.459	0.460	0.463
<u>Panel B: Leisure Courses</u>				
Courses per 1,000 Inhabitants	0.26	0.24	0.26	0.33
	(0.24)	(0.23)	(0.23)	(0.24)
Courses # Border	-1.34**	-1.11**	-1.08**	-1.10**
	(0.52)	(0.49)	(0.47)	(0.50)
p-value for $\beta + \theta = 0$	0.035	0.067	0.072	0.121
N	1226	1226	1226	1138
$R^2$	0.500	0.507	0.510	0.518
Adjusted $R^2$	0.443	0.449	0.451	0.453
<u>Panel C: Work-Related Courses</u>				
Courses per 1,000 Inhabitants	0.53*	0.51	0.44	0.37
	(0.32)	(0.31)	(0.32)	(0.34)
Courses # Border	-1.86***	-1.65***	-1.72***	-1.76***
	(0.45)	(0.45)	(0.43)	(0.43)
p-value for $\beta + \theta = 0$	0.001	0.006	0.001	0.000
N	1226	1226	1226	1138
$R^2$	0.507	0.516	0.520	0.528
Adjusted $R^2$	0.451	0.458	0.462	0.465
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 share of unemployed. 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 county population. Additional controls on course characteristics entail the mean number of exams per course and the mean courses length as measured in hours. Participants' characteristics refer to the share of females and of participants older than 50 years among participants. We proxy economic activity following Lehnert et al. (2023) by adding county shares of different surface groups to the set of control variables. Standard errors are clustered at county level and given in parentheses.

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

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. Yet, these unemployment reductions do not necessarily imply additional employment. Participants may have succeeded in finding employment in their county of residence, commuted to West Germany, transitioned into retirement or withdrew from the labor market (e.g. by becoming a stay-at-home parent). Proximity to West Germany should not affect the propensity to retire or withdraw from the labor market. We consequently suspect the opportunity to commute or better employment prospects to be the main driver of effect in border counties.

The positive effect of leisure-related courses on labor market integration in border counties cannot be explained with this skill-adjustment argument. The skills conveyed in courses on society & politics, culture & arts, and health may have indirectly affected labor market integration at the most. Again, these courses were only effective in the counties bordering West Germany. We therefore suspect that here, the mechanism is based on changes in social networks. Leisure-related courses may have provided an opportunity to build new social ties between East and West Germans and fostered the exchange of information, for example about job opportunities. This mechanism may have been at play in work-related courses.

To inspect potential heterogeneities in VHS education, Table A.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 leisure-related 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 hours 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. 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. 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.

### 4.3 Robustness Checks

We conduct several additional analyses to test the robustness of our findings. First, we alternate the definition of our treatment variable by using the number of participations in VHS courses instead the number of courses itself. 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 A.9 presents the results, which are similar to our main results: Again, all estimates are close to zero and insignificant. It is reassuring that our previous results do not change with this alternative treatment definition.

A second robustness test looks into the classification of language courses. In our main analysis, we consider language courses to be work-related. Yet, language courses might 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 A.10 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 also estimate the effects of courses of each specific area individually. Table A.11 presents the corresponding regression estimates from this third robustness test. 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 test 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 A.7 shows the linear prediction of the share of unemployed at different levels of VHS courses. All plots are based on estimates from the model with the full set of control variables (see Column 4 in Table A.12). Panel A shows that unemployment is a slightly concave function of VHS courses. When there are only few courses per 1,000 inhabitants, an 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 A.12 shows that the squared treatment and its regular term are significant in all specifications except the last one.

For leisure-related courses, on the other hand, we find no effect at all. Panel B in Figure A.7 shows that the predicted average share of unemployed remains relatively stable

between 8 and 9 percent regardless of how many leisure-related courses take place. The regression results endorse this graphic analysis as both leisure courses and their square term have no significant effect on subsequent unemployment.

Panel C shows the predicted average 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 C in Table A.12 shows that in all specifications, the coefficient of work-related courses is positive and significant, whereas its square term is negative and significant.

This shows that the effects of work-related courses and potentially courses overall are non-linear. Non-linearity may arise with if VHS courses gain signal strength with increasing with stronger prevalence. Alternatively, knowledge spillovers to non-participants or network effects may explain the non-linear effects.

Since many 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 trend assumption. Table A.13 shows the regression results: Even when allowing for state-specific linear time trends, there are no significant effects of VHS courses on subsequent employment. An 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, regardless of the type of course and the set of control variables.

A sixth and last robustness check (see Table A.14) deals with potentially different time trends in the counties bordering West Germany. Note here, that already the previous analysis controlled for local GDP. To further strengthen the validity of our results, we redid the analysis on spatial differences, now allowing for border-specific linear trends. Most notably, the effects of leisure-related courses are now (mostly) insignificantly different from zero in border counties, too. Work-related courses remain to significantly reduce unemployment. The effect of courses overall remains slightly positive and of a similar size compared to the previous analysis. Yet, it gains in statistical significance. The interaction term remains significantly negative, but the total effect of an additional course in a border county is now insignificantly different from zero.

## 4.4 Discussion

Since earlier studies focused on FEA programs alone, they provide an interesting point of comparison for our evaluation. While we find that VHS did not reduce unemployment

(besides the special case of the former border regions), this was also found to be true for most ALMP measures at the time. By and large, both VHS courses and ALMP measures failed at bringing people into jobs. On the other hand, some of the ALMP measures were found to increase unemployment, often only in the short term. We do not find such lock-in effects for VHS courses. This matches with the typically lower number of course hours in VHS courses. One reason why both ALMP and VHS education did not succeed at reducing unemployment may have been the weak development of the East German economy. The results from our heterogeneity analysis support this notion as they found VHS courses to reduce unemployment only in counties neighboring West Germany, where labor demand was arguably stronger.

The analysis of the border regions hints us towards multiple mechanisms, how voluntary adult education may affect unemployment. Education may improve labor market prospects via upskilling. But the effects of leisure-related courses show that social networks matter, too. Based on the freedom of choice for participation in general and for specific courses, it may be the case that VHS have a comparative advantage over ALMP in attracting and building social capital.

However, it should also 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, transitioned into retirement or withdrew from the labor market (e.g. by becoming a stay-at-home parent). With the data at hand, we cannot further explore this. Yet, proximity to West Germany should not affect the propensity to retire or withdraw from the labor market. We consequently suspect the opportunity to commute and the better employment prospects to be the main effect driver in border counties.

At this point, we also want to discuss some shortcomings 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. Participants were and still are not considered as unemployed (based on §16 Abs. 2 SGB III). 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 exists 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 data limitation also prevents an empirical investigation of potential interaction effects between ALMP and VHS education. Thirdly, data limitations also prevent the 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, which in turn posed tremendous challenges on the East German workforce. For individual workers, training and education played a major role for adjusting to the new labor market situation. Several studies have investigated the effectiveness of the FEA's trainings to this aim. We extend this literature by evaluating the labor market effects of voluntary adult education. For doing so, we focus on the role of VHS in post-unification East Germany.

VHS provide courses on a wide range of topics. We categorize courses on culture & arts, society & politics, and health as leisure-related courses. Courses dealing with topics in the realm of work & occupation, languages, and basic education are considered as work-related courses instead. We expect these courses to affect labor market outcomes differently: Only work-related courses directly target human capital adjustments relevant for labor market integration. Leisure-related courses on other hand are expected to affect labor market outcomes indirectly at the most, for example via social capital effects, improved health or soft skill training.

The results of our analysis do not support these hypotheses. The effect of VHS courses on the share of unemployed in the following year is close to zero and statistically insignificant. We find the same results when looking at courses on work-related topics or leisure-related courses. These results are very robust. Although the East German labor market underwent different phases after reunification, this null-result holds also for year- and period-specific effect. We find no time heterogeneities at all.

That education did not reduce unemployment may have been caused by the weak development of the East German labor market. 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. We suspect the same to be true for further forms of adult education such as VHS courses.

Accordingly, we find that courses in counties bordering the former inner German border significantly decreased unemployment. For these counties, we find that both work- and leisure-related courses led to lower unemployment rates. While the effects of work-related courses can be explained with skill adjustments relevant to labor market integration, the effects of leisure-related courses cannot be explained via the usual skill-adjustment argument. Instead, we presume changes in social networks to be the mechanism. As we find this effect only in the border region, VHS courses may have fostered new social ties between East and West Germans.

In conclusion, we find that voluntary adult education can reduce unemployment if met by favorable conditions. There are more mechanism at play than just upskilling: We find evidence that VHS courses fostered human capital adjustments but also may have affected social networks. Under beneficial conditions, this can lead to an improved labor market integration. But our analysis also shows that the realization of such education effects depends on macroeconomic conditions. These results underline the importance of non-governmental providers of voluntary adult education, especially in addition to governmental efforts like ALMP.

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# Appendix

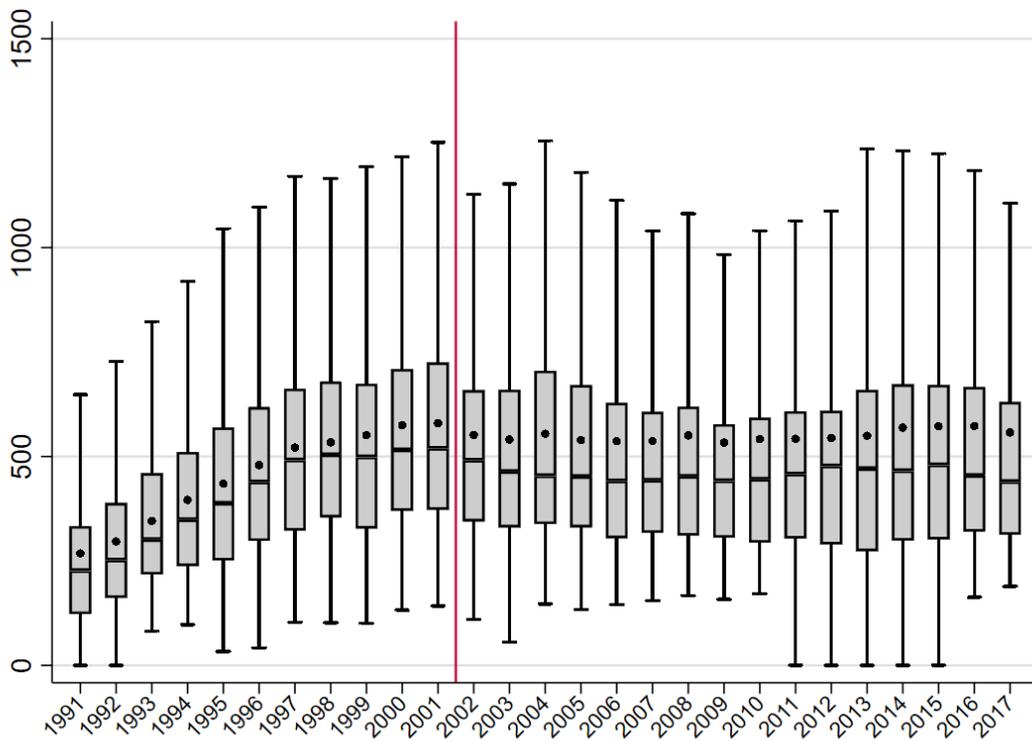
## Figures

Figure A.1: Excerpt from a VHS Program

<b>Maschinenschreiben I - Grundkurs I und II</b>	
Fähigkeit, Schreibmaschinen zu bedienen - Beherrschung der drei Buchstabenreihen 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	
<hr/>	
<b>63 002 B Grundkurs I</b>	
MO., ab 13. 3., 14.30-16.45 Uhr, 10 Wo., 30 Ustd.	125,00 DM
Volkshochschule	Monika Proksch
<hr/>	
<b>63 004 B Grundkurs I</b>	
MO., ab 6. 3., 17-18.30 Uhr, 13 Wo., 26 Ustd.	115,00 DM
Volkshochschule	Dr. Hans-Peter Flamme
<hr/>	
<b>63 006 B Grundkurs I</b>	
MI., ab 22. 3., 13-15.15 Uhr, 10 Wo., 30 Ustd.	125,00 DM
Volkshochschule	Doris Lahr
<hr/>	
<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.	125,00 DM
Thomas-Müntzer-Schule	Lieselotte Otto
<hr/>	
	61

Source: Volkshochschule Leipzig, 1995.

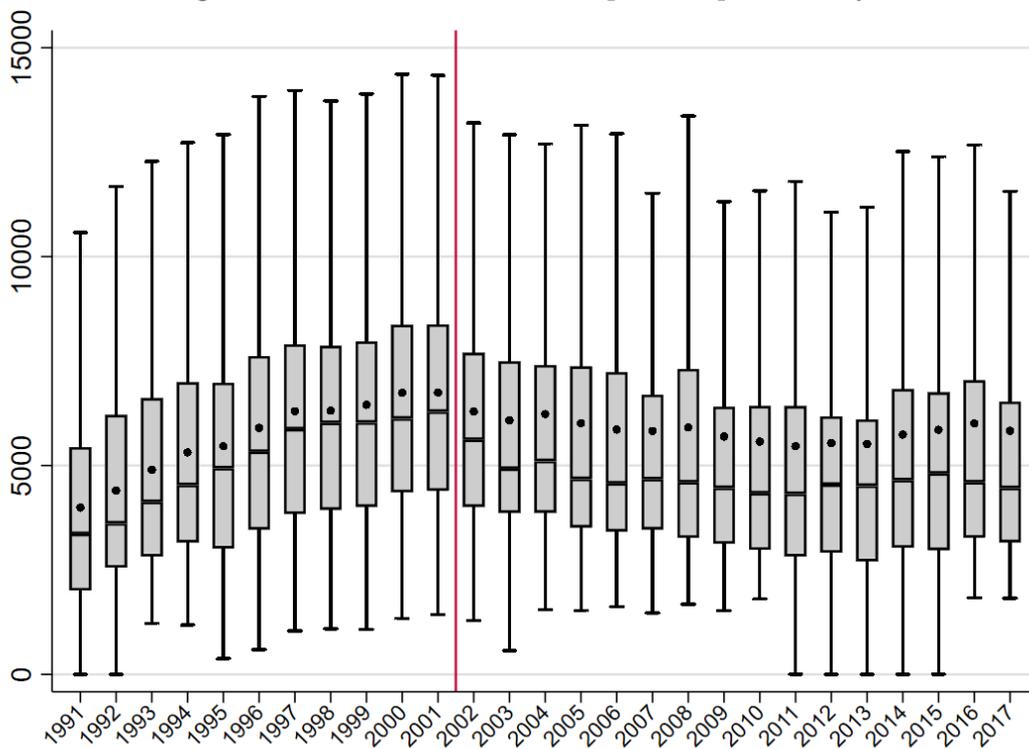
Figure A.2: VHS Courses per County



*Data Sources:* VHS, BBSR.

*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.

Figure A.3: VHS Course Participations per County

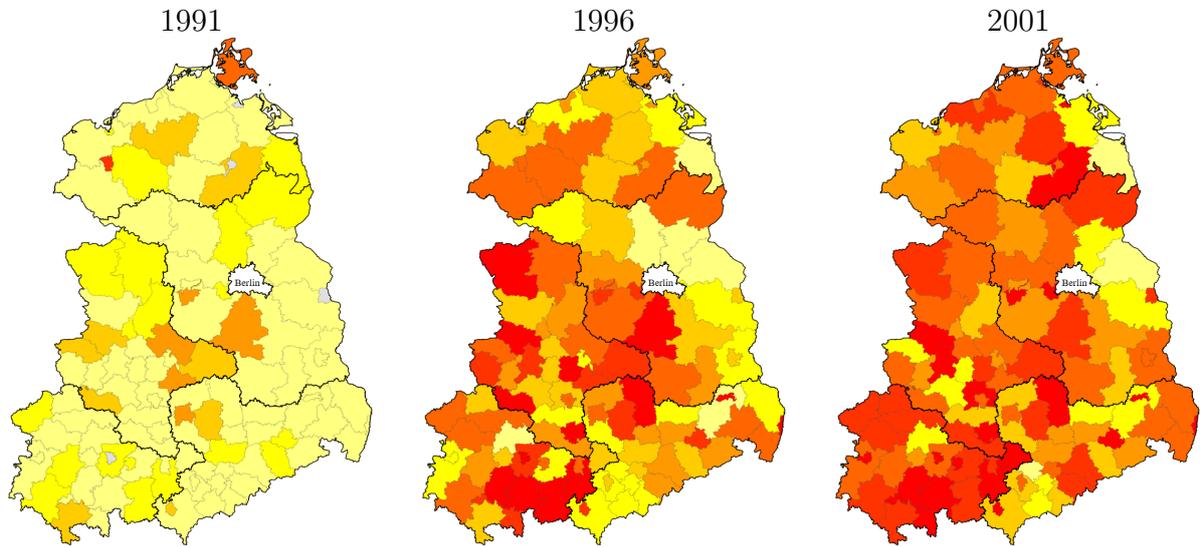


*Data Sources:* VHS, BBSR.

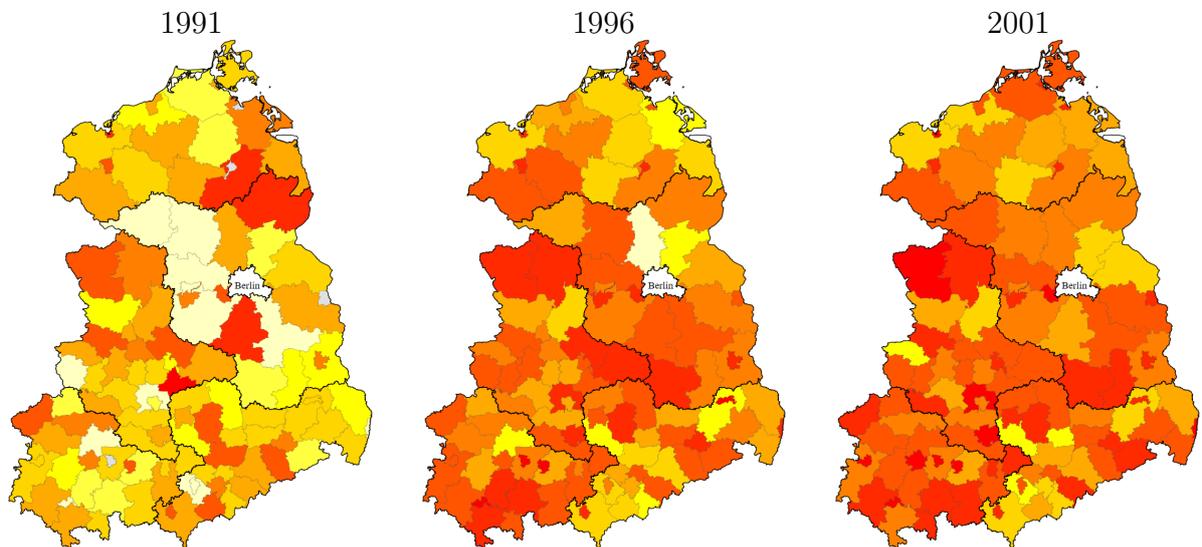
*Notes:* Yearly boxplots show the evolution of participations in freely accessible VHS courses in East Germany over time. Courses are summarized at the county level, given the boundaries at the end of 2020. Outlier values are blinded out.

Figure A.4: VHS Courses per 1,000 Inhabitants by Topic

*Panel A: Leisure Courses*



*Panel B: Work Courses*

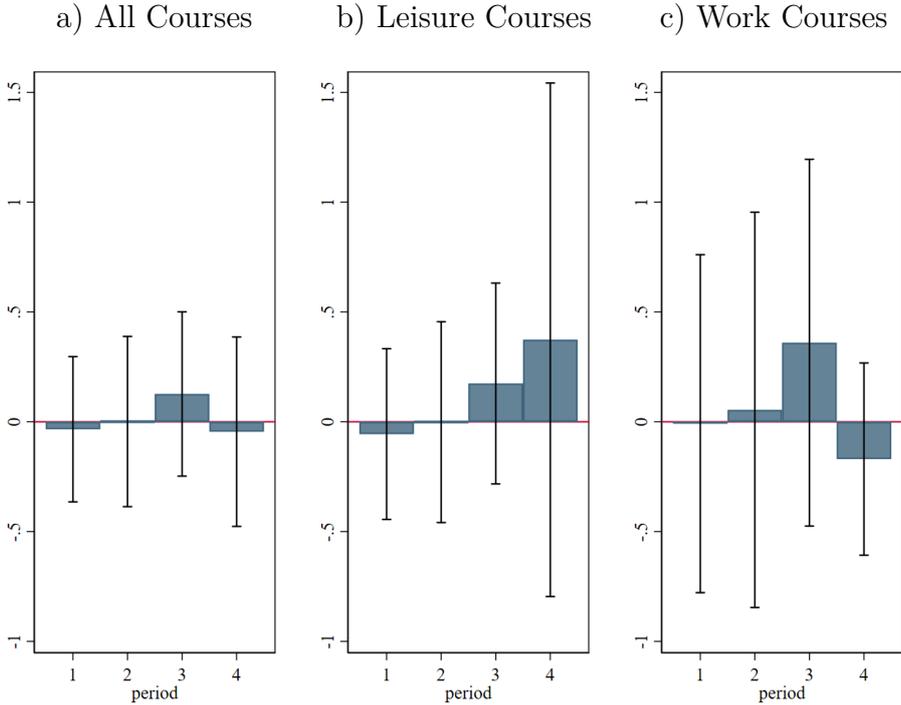


0 - .25
  .25 - .5
  .5 - .75
  .75 - 1
  1 - 1.25
  1.25 - 1.5
  1.5 - 2
  2 - 9.5
  No data

*Data Sources:* VHS, BBSR, © GeoBasis-DE/BKG 2023

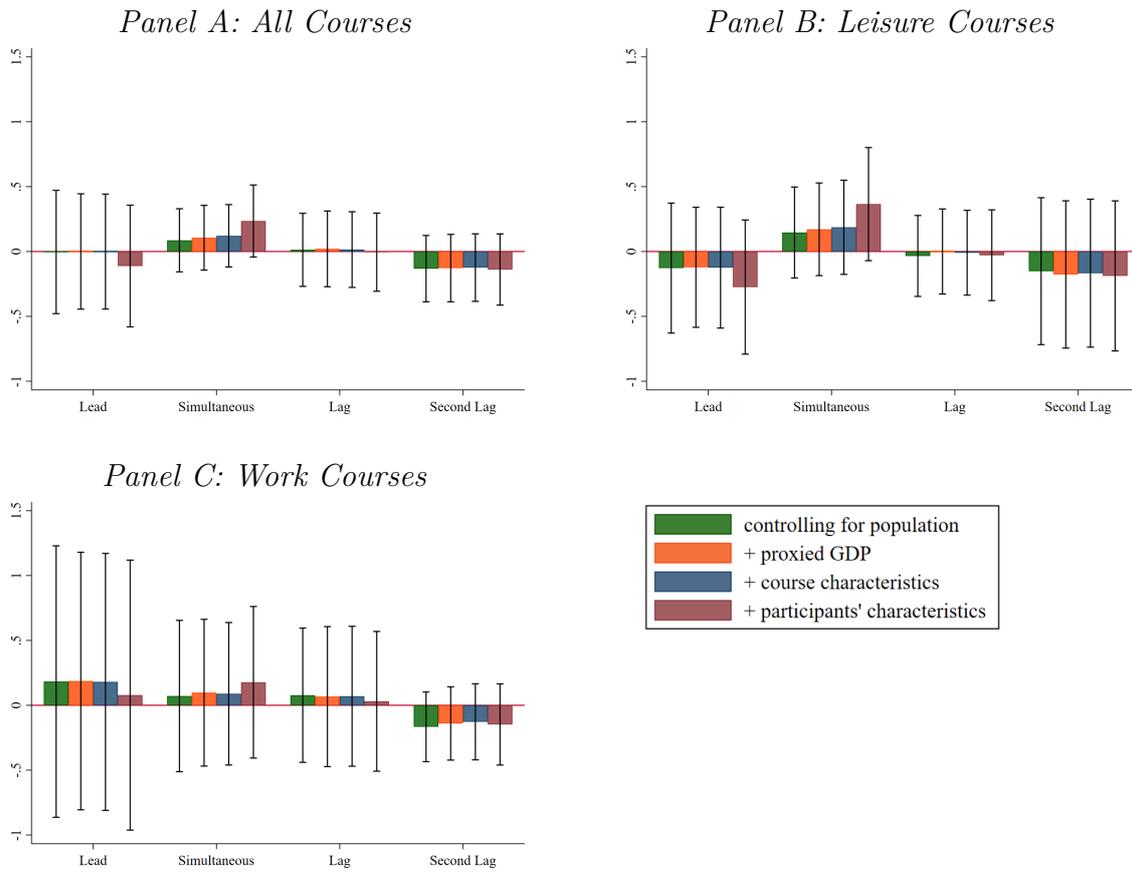
*Notes:* Leisure-related courses encompass those on society & politics, culture & arts, and health. Work-related courses encompass those on work & occupation, basic education and language courses. County boundaries as of late 2005.

Figure A.5: Period-Specific Effect of an Additional VHS Course on the Share Unemployed



*Data Sources:* VHS, FEA, BBSR, Lehnert et al. (2023).  
*Notes:* Specification includes the full set of control variables. Confidence intervals are shown at the 95 % level. Standard errors are clustered at the county level. Period 1 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.

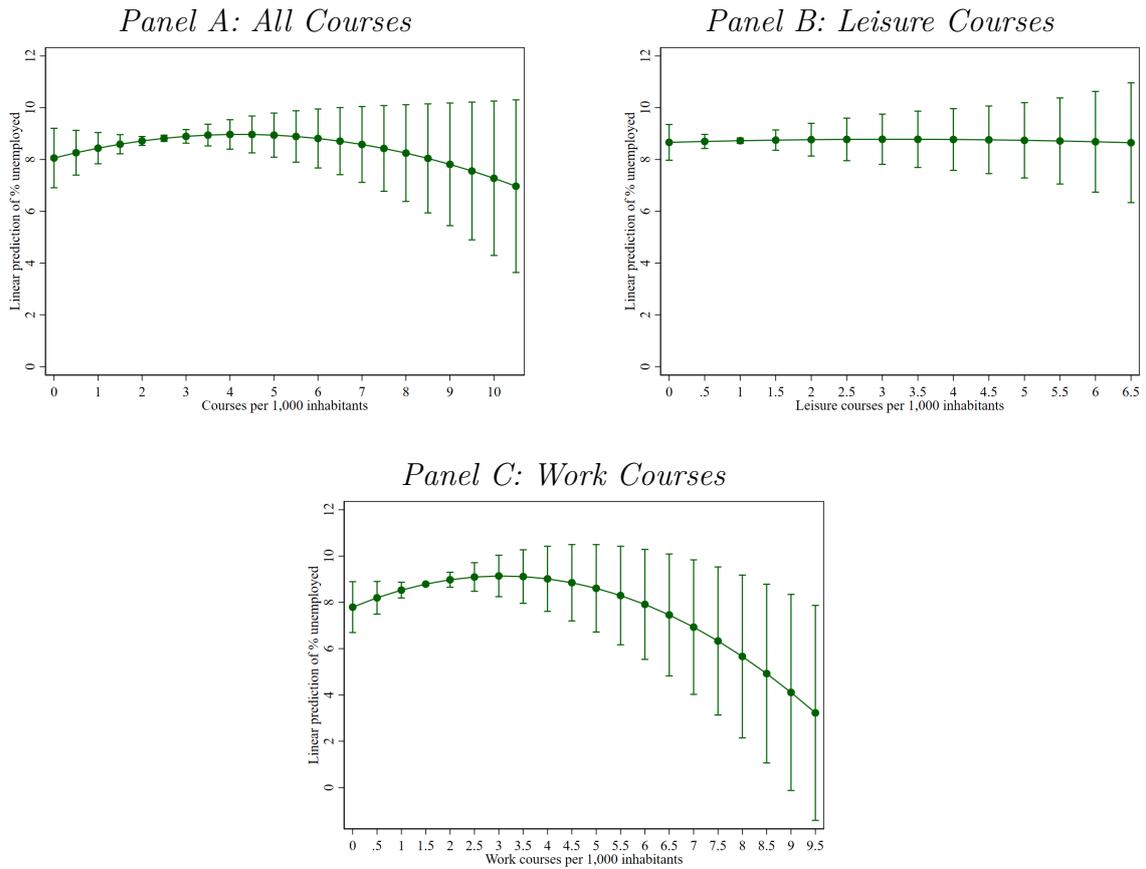
Figure A.6: Dynamic Effects



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

*Notes:* Confidence intervals are reported at the 95% level. Standard errors are clustered at county level. Tables A.3-A.5 present the corresponding regression estimates.

Figure A.7: Non-Linear Effects



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

*Notes:* Based on a model extended by a square term of the treatment, these graphs show the linear prediction of the outcome of interest at different levels of the treatment. All estimates refer to the specification with the full set of control variables. Confidence intervals are reported at the 95% level. Standard errors are clustered at county level.

## Tables

Table A.1: 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 A.2: Balance Table II

	(1)	(2)	(3)
	bottom quartile	top quartile	difference
bordering Berlin	0.12 (0.32)	0.08 (0.27)	-0.04 (0.02)
bordering West Germany	0.14 (0.35)	0.23 (0.42)	0.08*** (0.03)
area in square km	1,050.17 (644.32)	742.58 (693.19)	-307.59*** (54.10)
population per square km	241.82 (341.84)	413.11 (420.46)	171.29*** (30.98)
log of surface share with builtup	0.15 (0.07)	0.16 (0.07)	0.01 (0.01)
log of surface share with crops	0.32 (0.11)	0.27 (0.11)	-0.04*** (0.01)
log of surface share with forest	0.17 (0.10)	0.20 (0.12)	0.04*** (0.01)
log of surface share with grass	0.16 (0.05)	0.16 (0.05)	0.00 (0.00)
log of surface share without vegetation	0.03 (0.03)	0.03 (0.03)	0.00 (0.00)
log of surface share with water	0.05 (0.02)	0.05 (0.05)	0.00 (0.00)
share of revenues from public funds	0.61 (0.16)	0.61 (0.14)	-0.00 (0.01)
share of revenues from fees	0.35 (0.15)	0.35 (0.13)	0.01 (0.01)
number of local branch offices	2.00 (2.26)	3.11 (4.11)	1.11*** (0.27)
sum of events and lecture series at VHS	13.46 (32.90)	73.89 (181.33)	60.43*** (10.54)
number of one-day study trips and excursions	1.13 (3.02)	3.18 (4.92)	2.06*** (0.33)
number of study trips over several days	0.87 (1.99)	2.43 (3.83)	1.56*** (0.25)
mean hours per course	55.26 (24.56)	33.55 (9.82)	-21.72*** (1.51)
exams per course	0.80 (1.09)	0.20 (0.36)	-0.60*** (0.07)
share of females among participants	0.70 (0.13)	0.72 (0.09)	0.02* (0.01)
share of participants > 50 years	0.14 (0.09)	0.23 (0.09)	0.09*** (0.01)
Observations	306	306	1,226

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

*Notes:* This table contrasts observations belonging to the highest quartile of the distribution of VHS courses per 1,000 inhabitants to the observations belonging to the lowest quartile. Standard errors are given in parentheses.

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

Table A.3: 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)
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course Characteristics			✓	✓
Participants' Characteristics				✓
N	1002	1002	1002	930
$R^2$	0.481	0.492	0.493	0.499
Adjusted $R^2$	0.407	0.416	0.416	0.415

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

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

Table A.4: Dynamic Effects of Leisure 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)
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓
N	1002	1002	1002	930
$R^2$	0.481	0.492	0.493	0.499
Adjusted $R^2$	0.407	0.416	0.415	0.415

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

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

Table A.5: Dynamic Effects of Work 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)
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course characteristics			✓	✓
Participants' characteristics				✓
N	1002	1002	1002	930
$R^2$	0.481	0.492	0.493	0.499
Adjusted $R^2$	0.408	0.417	0.416	0.414

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

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

Table A.6: Year-Specific Marginal Effects

	Dependent Variable: Share Unemployed		
	(1)	(2)	(3)
	All courses	Leisure courses	Work 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	1138	1138	1138

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

*Notes:* Based on a regression model extended by a year-treatment interaction term and the full set of control variables, this table presents the total marginal effect of an additional course per 1,000 inhabitants on the share of unemployed in the following year. The corresponding standard errors are given in parentheses.

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

Table A.7: Period-Specific Marginal Effects

	Dependent Variable: Share Unemployed		
	(1)	(2)	(3)
	All Courses	Leisure courses	Work 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	1138	1138	1138

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

*Notes:* We estimate the average marginal effect of an additional course per 1,000 inhabitants 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 A.8: Comparison of Border and Inland Counties

	(1)	(2)	(3)
	inland counties	border counties	difference
share unemployed in county population	8.66 (2.51)	8.27 (2.75)	-0.40** (0.20)
VHS courses per 1,000 inhabitants	2.49 (1.45)	2.71 (1.44)	0.22** (0.11)
leisure-related VHS courses per 1,000 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 1,000 inhab.	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)	6.79*** (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)
change in county population to previous year	-1,297.41 (3,207.99)	-894.83 (1,849.25)	402.58* (224.05)
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 A.9: Effects of VHS Participations on the Share Unemployed

	Dependent Variable: Share Unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All Courses</u>				
Participations per 1,000 Inhabitants	-0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
N	1226	1226	1226	1138
$R^2$	0.480	0.495	0.496	0.505
Adjusted $R^2$	0.422	0.436	0.436	0.439
<u>Panel B: Leisure Courses</u>				
Participations per 1,000 Inhabitants	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)
N	1226	1226	1226	1138
$R^2$	0.482	0.495	0.499	0.506
Adjusted $R^2$	0.424	0.436	0.439	0.441
<u>Panel C: Work-Related Courses</u>				
Participations per 1,000 Inhabitants	0.02 (0.03)	0.03 (0.03)	0.02 (0.03)	0.02 (0.03)
N	1226	1226	1226	1138
$R^2$	0.482	0.497	0.500	0.508
Adjusted $R^2$	0.424	0.438	0.440	0.443
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 A.10: Robustness Check - Effect of VHS Courses on Unemployment with Alternative Course Categorization

	Dependent Variable: Share Unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: Leisure Courses</u>				
Courses per 1,000 Inhabitants	-0.05 (0.19)	-0.00 (0.18)	0.04 (0.18)	0.04 (0.19)
N	1226	1226	1226	1138
$R^2$	0.480	0.495	0.497	0.505
Adjusted $R^2$	0.422	0.436	0.437	0.439
<u>Panel B: Work-Related Courses</u>				
Courses per 1,000 Inhabitants	0.15 (0.38)	0.22 (0.37)	0.07 (0.38)	-0.10 (0.37)
N	1226	1226	1226	1138
$R^2$	0.481	0.495	0.499	0.508
Adjusted $R^2$	0.423	0.436	0.439	0.443
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course Characteristics			✓	✓
Participants' Characteristics				✓

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

*Notes:* These alternative definitions categorizes language courses as leisure-related courses. Leisure-related courses consist now 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. Each coefficient is estimated by another specification. Standard errors are clustered at county level and given in parentheses.

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

Table A.11: Robustness: Effects of VHS Courses on Unemployment by Topic Area

	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)
Population	✓	✓	✓	✓
Proxied GDP		✓	✓	✓
Course Characteristics			✓	✓
Participants' Characteristics				✓
N	1226	1226	1054	983
$R^2$	0.483	0.497	0.505	0.515
Adjusted $R^2$	0.423	0.436	0.428	0.432

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

*Notes:* 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 A.12: Non-Linear Effects

	Dependent Variable: Share Unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All Courses</u>				
Courses per 1,000 Inhabitants	0.46*	0.47*	0.45*	0.43
	(0.26)	(0.25)	(0.26)	(0.31)
Square of Courses	-0.06**	-0.05**	-0.05*	-0.05
	(0.03)	(0.03)	(0.03)	(0.03)
N	1226	1226	1226	1138
$R^2$	0.484	0.498	0.499	0.507
Adjusted $R^2$	0.425	0.438	0.438	0.441
<u>Panel B: Leisure Courses</u>				
Courses per 1,000 Inhabitants	-0.05	0.00	0.05	0.08
	(0.44)	(0.41)	(0.41)	(0.46)
Square of Courses	-0.02	-0.02	-0.02	-0.01
	(0.07)	(0.07)	(0.07)	(0.07)
N	1226	1226	1226	1138
$R^2$	0.481	0.495	0.499	0.506
Adjusted $R^2$	0.422	0.435	0.438	0.440
<u>Panel C: Work-Related Courses</u>				
Courses per 1,000 Inhabitants	1.03***	1.07***	0.98***	0.88**
	(0.37)	(0.36)	(0.36)	(0.42)
Square of Courses	-0.15***	-0.15***	-0.15***	-0.14***
	(0.04)	(0.04)	(0.04)	(0.04)
N	1226	1226	1226	1138
$R^2$	0.489	0.503	0.506	0.514
Adjusted $R^2$	0.431	0.444	0.446	0.449
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 A.13: Robustness: State-Specific Linear Time Trends

	Dependent Variable: Share Unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All Courses</u>				
Courses per 1,000 inhabitants	0.14 (0.16)	0.13 (0.15)	0.13 (0.16)	0.13 (0.17)
N	1226	1226	1226	1138
$R^2$	0.532	0.541	0.541	0.551
Adjusted $R^2$	0.460	0.466	0.465	0.470
<u>Panel B: Leisure Courses</u>				
Courses per 1,000 inhabitants	0.14 (0.21)	0.12 (0.20)	0.16 (0.20)	0.28 (0.21)
N	1226	1226	1226	1138
$R^2$	0.532	0.540	0.543	0.555
Adjusted $R^2$	0.459	0.465	0.468	0.474
<u>Panel C: Work Courses</u>				
Courses per 1,000 inhabitants	0.21 (0.30)	0.20 (0.29)	0.16 (0.29)	0.06 (0.29)
N	1226	1226	1226	1138
$R^2$	0.532	0.541	0.541	0.551
Adjusted $R^2$	0.459	0.466	0.466	0.470
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 A.14: Robustness: Effects of VHS Courses on Unemployment With Border-Specific Time Trends

	Dependent Variable: Share Unemployed			
	(1)	(2)	(3)	(4)
<u>Panel A: All Courses</u>				
Courses per 1,000 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	1226	1226	1226	1138
$R^2$	0.546	0.551	0.551	0.561
Adjusted $R^2$	0.475	0.478	0.477	0.481
<u>Panel B: Leisure Courses</u>				
Courses per 1,000 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	1226	1226	1226	1138
$R^2$	0.538	0.544	0.547	0.558
Adjusted $R^2$	0.466	0.470	0.472	0.477
<u>Panel C: Work-Related Courses</u>				
Courses per 1,000 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	1226	1226	1226	1138
$R^2$	0.548	0.553	0.555	0.564
Adjusted $R^2$	0.477	0.480	0.481	0.484
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 share of unemployed. 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 county population and allow for border-specific time trends. We proxy GDP following Lehnert et al. (2023) by adding county shares of different surface groups to the set of control variables. Additional controls on course characteristics entail the mean number of exams per course and the mean course length as measured in hours. Participants' characteristics refer to the share of females and of participants older than 50 years among participants. Standard errors are clustered at county level and given in parentheses.

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