

Social Transformation and the Transition from Vocational Education to Work in Hungary: A Differences-in-differences Approach

Clemens Noeke^{1,*} and Daniel Horn^{1,2}

Abstract: The 'dual system' combining school-based vocational education with employer-provided training is often praised for effectively integrating young people into the labour market and recommended as a model for countries struggling with high youth unemployment. However, without an institutional framework supporting employer involvement, it has proven difficult to elicit or maintain what is essentially voluntary provision of training places by employers. Whenever employers are unwilling to train, school-provided training represents a viable alternative, but to date we know little about the relative effectiveness of school- vs. employer-provided training. This study exploits a rapid shift of training provision from employers to vocational schools that occurred during the Hungarian transformation from socialism to capitalism to analyse how these different ways of organizing training affect the labour market entry of vocational graduates. Our expectation is that the substitution of employer- with school-provided training has resulted in higher unemployment and lower job quality, particularly on leaving school. Results from differences-in-differences analyses indicate that the shift in training provision from employers to schools between 1994 and 2000 has increased male vocational school graduates' unemployment rate by 10 percentage points within the first 2 years after graduation. We find no effects of training organization on class position.

Introduction

This study examines how the partial withdrawal of employers from Hungarian vocational education and training (VET) has affected VET graduates' transition from school to work. Past research suggests that employer participation is important for VET to effectively integrate young people into the labour market (Müller and Shavit, 1998; Shavit and Müller, 2000; Gangl, 2001; Ryan, 2001; Breen, 2005; Scherer, 2005; Iannelli and Raffe, 2007; Wolbers, 2007). In particular, the provision of on-the-job training appears to be crucial because it provides vocational students with an opportunity to obtain up-to-date specific skills and secure a foothold in employment before schooling is completed. While employer involvement in VET is highly institutionalized in 'coordinated market economies' (Hall and Soskice, 2001) like Germany or Austria, this is generally not the case for post-socialist European countries or

'liberal market economies' like the United States. Even though VET programmes still enrol a sizeable percentage of young people in several post-socialist Central and Eastern European countries, VET students' access to on-the-job training has diminished considerably (Kogan, 2008).

Similar to the German dual system, Hungarian VET has traditionally combined classroom-based vocational education and employer-provided on-the-job training. However, in the course of transformation from socialism to capitalism, employers withdrew in large numbers from training VET students, and the importance of public vocational schools as training providers has increased. We exploit this institutional variation to analyse whether the substitution of employer- with school-provided training has caused VET graduates' early labour market outcomes to deteriorate.

Our study contributes to several active research fields in sociology. First, there has been a growing number of

¹Center for Population and Development Studies, Harvard University, 9 Bow Street, Cambridge, MA 02138, USA;

²Institute of Economics of the Hungarian Academy of Sciences, and Department of Economics, Eötvös University Budapest, Budaörsi Street 45, Budapest 1112, Hungary. *Corresponding author. Email: cnoeke@hsph.harvard.edu

sociological studies trying to understand how socialist past and diverse transformation experiences have contributed to variation in school-to-work transitions and youth labour market performance in post-socialist countries (for example, Solga and Konietzka, 1999; Konietzka, 2001; Gerber, 2003; Diewald, Goedicke and Mayer, 2006; Kogan, Noelke and Gebel, 2011; Kogan, 2012; Noelke, Gebel and Kogan, 2012). While prior work has analysed the transition from school to work in Hungary (Audas, Berde and Dolton, 2005; Kogan and Unt, 2005; Bukodi, 2006; Bukodi and Robert, 2011), existing studies neither focus in detail on the changing situation of VET graduates nor try to directly measure the role of a specific institutional mechanism, causing the outcomes of VET graduates to change.

Second, our study also contributes evidence on the effectiveness of employer- vs. school-provided training. For example, the German VET system offers both dual apprenticeship-type programmes and fully school-based programmes. To date, we still know little about the causal effects of these different modes of organizing VET. Given the difficulty of eliciting and maintaining employer cooperation in dual system VET, school-based training provision has been tried and may represent a viable alternative. If employers refuse to provide training, public schools may simply step in, as it happened not only in Hungary but also in East Germany, where a decline in the apprenticeship places has been in part compensated by establishing public training centres (Culpepper and Thelen, 2007).

Third, our analysis addresses methodological problems of previous studies on the transition from vocational education to work. Prior research has either compared the outcomes of individuals who enrolled in different VET programmes within a given country (for example, Parey, 2009; Baranowska, 2011; Matkovic, 2011) or the outcomes of VET graduates across countries with different organizations of VET training (for example, Müller and Shavit, 1998). Causal inference based on these comparisons is problematic because of unobserved heterogeneity at the level of individuals and countries. The research design and differences-in-differences (DD) estimator we implement (for a recent applications in sociology, see Mooi-Reci and Mills, 2012) try to address these issues.

VET in Hungary

On completion of lower secondary education, students may enrol in vocational schools (*szakmunkásképző* or *szakiskola*) that offer dual system VET. Alternatively, students can continue in either upper secondary general school (*Gimnázium*) or upper secondary vocational

school (*Teknikum* or *Szakközépiskola*), both of which qualify for admission to higher education.¹ VET students typically obtain school-based vocational and academic education during the first 2 years and receive (either school-based or employer-provided) training in the last 2 years. Vocational schools mainly prepare for blue-collar occupations, typically semi-skilled and skilled occupations in industry and agriculture, but also some semi-skilled service sector occupations. Completion of vocational school does not qualify for access to higher education. Therefore, most graduates enter the labour market directly after completion, usually at 17–18 years of age.

Vocational schools were tightly linked to enterprises under socialism. Students received training in enterprise-based workshops or directly at workplaces. Under capitalism, employer-provided training is either organized by students themselves or arranged for by their school. Those who do not (or do not want to) find a training place with an employer are trained within facilities run by the school, such as workshops or, for example, a school canteen. The distribution of training places across industries does not differ much by training sites (schools, employers) and, for the cohorts that we have data for (1997–2000), changes little over time (see Supplementary Figures A1 and A2, Supplementary Appendix). For the 1997 cohort of VET graduates, 54 per cent of school-based training places were in industry, compared with 64 per cent among employers. The largest discrepancy concerns training places in agriculture, which comprise 17 per cent of training places within schools and only 3.8 per cent of the employer-provided training places.

In the course of transformation, vocational schools have lost the support of different stakeholders. Young people themselves increasingly chose upper secondary tracks granting access to higher education instead of vocational schools. While 49 per cent of young people aged 17–22 years had obtained a vocational school degree in 1992, this number dropped to 25 per cent in 2000 and stabilized at ~20 per cent in the early 2000s (Hungarian Labour Force Survey [LFS], own calculations). The economic transformation crisis peaking in the early 1990s reduced employer training provision, both because firms were shedding rather than creating jobs and presumably also because increased job turnover shortened employment spells and therefore incentives to invest into specific skills (Becker, 1994).

While demographic and macroeconomic factors have certainly been influential, institutions have also been critical for the transformation of dual system VET. The socialist state has crowded out institutions that could maintain voluntary employer training provision under

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capitalism, especially independent bodies of collective worker and employer representation (Ost, 2000). The emergent neo-liberal policy regime emphasized market-based decentralized solutions in key areas of educational and labour market policy (Bukodi and Robert, 2008; Horn, 2010). The socialist past and the transformation process have therefore created an environment that is hostile to the maintenance of institutionalized employer coordination in the provision of VET.

While dual systems in 'coordinated market economies' have largely survived economic crises and adapted to the changing skill requirements, the relative absence of institutionalized commitment to maintain VET has left the Hungarian VET sector vulnerable to the transformation crisis. On-the-job training provision for VET students diminished considerably starting in the 1990s. Figure 1 shows that the number of employer-provided training places available to VET students declined rapidly, while the number of places available in schools shows no clear trend. In consequence, the ratio of school- to employer-provided training places more than doubled from ~0.9:1 to ~2.1:1.

Theory and Hypotheses

This study draws on the canonical work of Allmendinger (1989), Kerckhoff (2001) and Müller and Shavit (1998), who emphasize the importance of the education system for structuring the transition from school to work, and research in political economy that focuses on the determinants of employer involvement in VET provision (for example, Culpepper and Thelen, 2007). Following Shavit and Müller (2000) and others, we consider as dependent variables, unemployment as a measure of the difficulty of finding a job and class position as a measure of employment in routine vs. non-routine jobs.

From a human capital perspective (Becker, 1994), by moving training sites out of workplaces into schools, young people are at risk of acquiring obsolete vocational skills, particularly in a rapidly restructuring economy (Blossfeld, 1992; Gebel and Noelke, 2011). Industry-, occupation-, and firm-specific skills derive their economic values from being up-to-date. If school-based vocational curricula were speedily updated to reflect shifts in labour demand, there should be few differences in the skill content of on-the-job and school-based training. However, because of rapid economic restructuring and a lacking institutional infrastructure to achieve employer vocational school coordination, we expect that the shift of training from employers to schools should increase the risk of skill obsolescence. With the value of their vocational skills eroding, young vocational graduates are expected to suffer from

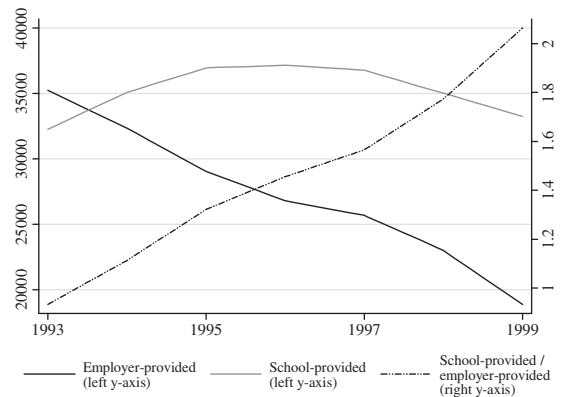


Figure 1 The changing provision of training places. Source: Hungarian School Survey (own calculations)

increased unemployment risks after leaving vocational school, and as obsolete vocational skills have no productive value to the employers, young people should be more likely to work in an unskilled routine occupation.

On-the-job training also matches young people to prospective employers, reducing information problems, search costs, and unproductive turnover (Acemoglu and Pischke, 1998; Breen, 2005). On-the-job training provides an opportunity for employers to screen potential future employees, while students have the opportunity to assess whether a specific employer would be a good fit for them. Moving the site of training provisions from companies to schools implies that young people lack a bridge into employment. Young people (as well as employers) increasingly face search costs that prolong job search and increase the incidence and duration of search-related unemployment spells (Breen, 2005; Wolbers, 2007). The increase in search costs due to the substitution of training places should therefore increase unemployment risks on graduation, and may also force young vocational graduates to accept unskilled rather than skilled jobs.

Whether through human capital or matching mechanisms, training substitution should have the strongest impact on VET graduates immediately on leaving school because firm-provided training may lead to continuous employment after graduation in skilled occupations in the training firm. In contrast, school-trained VET graduates, unless they have found a job before graduation, will become unemployed when they graduate and search for jobs. With time spent on the labour market, the chance of a high-quality match between employers' and individuals' preferences and skills should increase, and young people also acquire experience from the jobs

they obtain. Therefore, time spent on the labour market should become an increasingly important determinant of early career unemployment risks and job quality. We expect experience-unemployment profiles to steepen, as recent graduates suffer increasing disadvantages for their lack of experience. However, as they acquire experience, their unemployment risk diminishes. Similarly, the risk of working in an unskilled job should become more strongly dependent on labour force experience, with risks increasing immediately on graduation.

Review of Previous Research

Prior research has identified the effect of VET training provision by comparing VET graduates who received employer-provided training to ‘similar’ VET graduates who enrolled in fully school-based VET programmes. Studies on Western European countries suggest that employer-provided training lowers unemployment risks on graduation, but find no effects on earnings (for example, [Parey, 2009](#)). Studies on Croatia ([Matkovic, 2011](#)) and Poland ([Baranowska, 2011](#)) find little or no evidence that employer-provided training leads to faster labour market entries or better job quality. Evidence from cross-nationally comparative studies are based on comparing differences in outcomes between VET graduates and other secondary school graduates across countries with different VET systems, and yield less conclusive results (see [Supplementary Appendix](#), for further details).

Causal inference in either type of study hinges on the assumption that conditional on measured covariates, sorting into different VET programmes (or secondary school types) is as good as random. This assumption is most likely violated, as at least some individual characteristics that are predictors of both training choice and labour market outcomes are typically unobserved or poorly measured. The comparative studies, in addition, have to assume equivalence of educational degrees across countries ([Schneider, 2010](#)) and rule out unobserved confounders at the country level.

Data and Methods

This study exploits the rapid substitution of employer-with school-provided training places that occurred in post-socialist Hungary during the 1990s. The rapid change obviates the need for cross-country comparison to obtain institutional variation in VET provision. By comparing vocational school graduation cohorts over time, we do not have to compare graduates from different secondary school types. The DD estimator

([Angrist and Pischke, 2009](#)) allows us to control non-parametrically for unobserved time-constant and time-varying confounders.

Data

From official school reports (KIR-Stat database [Közoktatási Információs Iroda]) collected by the Hungarian Ministry of Education in October around the beginning of the school year, we obtain information on the number of training places available at schools or employers at the county level for the period from 1993 to 1999. We calculate three indicators measuring training opportunities: the ratio of school- to employer-provided training places, the ratio of school-provided training places to total training places, and the ratio of employer-provided training places to total training places. While we cannot use data after 1999 because of changes in survey design, we still capture the most dynamic period in terms of the restructuring of training provision.

Data on labour market outcomes are obtained from the Hungarian LFS, provided by the Hungarian Statistical Office and available since 1992. We restrict the sample to male vocational school graduates and define labour market entrant cohorts by the year of obtaining the vocational school degree. From individual information on graduation years, we can identify individuals belonging to the same cohort across surveys, thereby generating a pseudo panel ([Deaton, 1985](#)) of labour market entrant cohorts. Using information on graduation years and counties in the LFS data, we merge the LFS with the training data, assigning each respondent county-by-cohort averages on the training indicator variables.

For the multivariate analysis, we restrict the sample to respondents who obtained their vocational school degree between 1994 and 2000. To capture graduates early in their labour market career, we restrict the analytical sample to those who obtained a degree within 1–24 months before the month of survey and report not to be enrolled in education at the time of survey. We further restrict the sample to students aged 17 and 22 years (dropping 2.6 per cent of the sample) to focus only on those young people who make the typical transition after completing vocational school in regular time. [Supplementary Table A1 \(Supplementary Appendix\)](#) contains descriptive information for the observations used in the unemployment analyses. Individual respondents are nested within 20 counties, 7 (annual school-leaver) cohorts, and 8 years (periods).

Our dependent variables are a dummy variable for unemployment (1 = unemployed, 0 = employed) and, as

a measure of job quality and skill requirements, a dummy variable for employment in a routine occupation (1 = employed in routine occupation, 0 = employed in other occupation). Routine occupations are those belonging to class 9 in the European Socio-economic Classification (Harrison and Rose, 2006), a class schema derived from the Erikson–Goldthorpe–Portocarero scheme (Goldthorpe, 2007). Class 9 comprises routine occupations that do not require extensive skills and can be monitored easily. Typical occupations include cleaners, labourers, assemblers, porters, and messengers. We used three-digit ISCO-88 codes to derive the class schema. Unfortunately, information on respondents' occupation was available only from 1995, which is why we drop the 1994 cohort in the respective analyses. Data on respondents' wages were unavailable.

All models control for the natural log of respondents' age. Moreover, as 95 per cent of the respondents in the analytical sample are identified as children on the survey household roster, we can identify their parents within households and thereby control for respondents' social background (parental education and employment status, number of siblings) to control compositional differences across counties and cohorts. Further details on the construction of variables and descriptive statistics are included in the [Supplementary Appendix](#).

Identification and Estimation

We estimate variants of the following linear DD model:

$$Y_{icjt} = \beta_0 + \beta_1 TSG_i + \delta TRAIN_{cj} + \gamma_t + \delta_c + \mu_j + \varepsilon_{icjt} \quad (1)$$

where Y_{icjt} is an outcome variable measured at the level of individuals i , nested in j counties, c cohorts, and t years. $TRAIN_{cj}$ is the indicator of training opportunities varying at cohort and county level (e.g. the ratio of school- to employer-provided training places for each cohort and county) and TSG_i is 'time since graduation', a measure of potential labour force experience. γ_t is a vector of year fixed effects (year-specific dummy variables), with $t = 1, \dots, 8$, δ_c are cohort fixed effects, with $c = 1, \dots, 7$, and μ_j are county fixed effects with $j = 1, \dots, 20$. β_0 is a constant, and ε_{icjt} is an idiosyncratic error term. We use the natural log transformation of time since graduation and training indicators in all models. To assess whether the effect of training provision causes the outcome variable to be more strongly dependent on time since graduation (potential labour force experience), we add an interaction between $TRAIN_{cj}$ and TSG_i . The [Supplementary Appendix](#) provides additional background information and discusses

differences between [equation 1](#) and canonical examples of DD models.

δ estimates the effect of changing the opportunities for training provision for all VET graduates no matter what type of training they received, picking up the individual level returns to different types of training, general equilibrium effects, for example, due to job competition on the labour market (Imbens and Wooldridge, 2009; Gangl, 2010), and time-varying effects, such as exit from the labour force of discouraged workers.² δ does not estimate by how much individual i 's unemployment probability would be reduced if he or she participated in firm- rather than school-based training.³ Instead, we obtain an estimate of the total effect of changing the structure of training provision on all the individuals exposed to that change.⁴

Our key identifying assumption is that differences in training opportunities, i.e. in $TRAIN_{cj}$, across cohorts are as good as random, i.e. independent of unobserved factors specific to cohorts and counties that predict both training opportunities and labour market outcomes.⁵ Because we compare cohorts with different training opportunities within counties, we make use of fixed effects in our baseline specification ([equation 1](#)) to control for unobserved factors specific to cohorts, counties, and calendar years that may be confounded with variable training opportunities across cohorts and counties. This is a powerful strategy to deal with the endogeneity of $TRAIN_{cj}$ due to unobserved confounders or selection on unobservables, i.e. factors associated with both training choice and labour market outcomes, which are a key threat to causal inference (Imbens and Wooldridge, 2009; Gangl, 2010).⁶

Because of the county, period, and cohort fixed effects included in [equation 1](#), we need not worry about unobserved time-constant confounders specific to counties and time-varying confounders such as the national business cycle affecting all counties/cohorts equally, changes in economic restructuring that proceed in the same manner across counties/cohorts, reforms of vocational schools that change the organization of schools for different cohorts in the same way, and change in the composition of VET graduates that affects all counties equally. However, biases may result from unobserved changes that occur at different speeds across cohorts or counties (or affect only certain cohorts or counties), which may induce a non-causal association between $TRAIN_{cj}$ and Y_{icjt} . For example, if labour demand declines in some counties but not others, this would cause both a reduction in firm-based training and increased unemployment among vocational graduates in these counties. To address these and other biases, we perform three specification checks.

First, we control for county-specific linear trends in the outcome variable (Angrist and Pischke, 2009). To the extent that time-varying unobserved confounders, such as gradual changes in the composition of vocational graduates or training firms, evolve smoothly with the county-specific linear trends, these trends account for such confounding. Rather than identifying the effect of changes in training provision around county-specific means (equation 1), the resulting model identifies the effect from non-linear changes in training provisions around county-specific linear trends.⁷

Second, as individuals observed in the same county and calendar year can belong to two different cohorts, we can adopt a more flexible specification for county and period shocks by replacing the γ_t and μ_j in equation 1 with 160 county-by-year dummies. With this DD specification, we control for whatever shocks have occurred that equally impacted members of two cohorts we observe within each county-by-year cell. This specification should be powerful in removing non-linear county-specific trends in labour demand and other county- and year-specific confounders.

Third, to test whether cohorts observed within the same county and year differ, we replace the cohort fixed effects δ_c and county fixed effects μ_j in equation 1 with 140 county-by-cohort dummies. Because the cohort-by-county dummy variables are perfectly collinear with the main effect of the training indicator variable, this effect is no longer identified. However, we can still estimate the interaction term between training provision and time since graduation. In this case, we identify the effect of reform by comparing outcomes of individuals within the same cohort with different levels of labour force experience.

All analyses are performed separately by gender. To be able to compare coefficient estimates across different model specifications and interpret interaction effects in an intuitive manner, we report estimates from Ordinary Least Squares (OLS) linear probability models (Mood, 2010). We also graph simulated probabilities from logistic regressions using the CLARIFY ado (King, Tomz and Wittenberg, 2000; Tomz, Wittenberg and King 2003). Both approaches yield consistent results. Standard errors are adjusted for clustering within the 140 county-by-cohort cells.

Results

Figure 2 shows trends in the main outcome variables over cohorts calculated from the respective analysis samples. Here and in the following, we focus on male vocational school graduates, who were more strongly affected by training substitution compared with women.

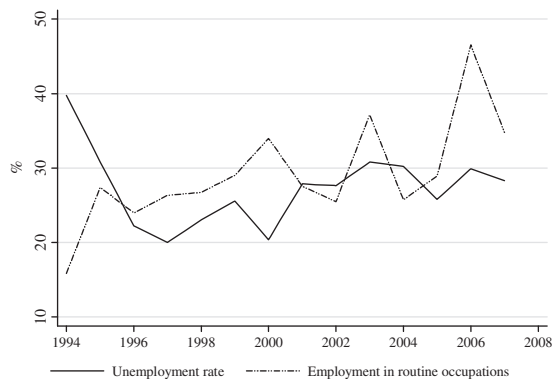


Figure 2 Cohort-specific percentages unemployed and employed in routine occupations (among employed). Note: male VET graduates aged 17–22 years, observed 1–24 months after graduation. The multivariate analysis only uses data for the 1994–2000 cohorts. Source: Hungarian LFS (own calculations)

This is consistent with prior research indicating that apprenticeship programmes tend to be particularly effective for non-college bound young men (Lynch, 1992; Ryan, 2001; Bonnal, Mendes and Sofer, 2002). Moreover, in the Hungarian context, men are over-represented in Hungarian VET by a factor of 2:1 and disproportionately enrol in programmes where employer-provided training has been especially prevalent, such as crafts and manufacturing.

Our observation period is marked by a recovery on the youth labour market. From peak levels observed in the early 1990s in the midst of transformation crisis, male vocational school graduates' unemployment rates decline until 1997. Macroeconomic recovery in the second half of the 1990s could certainly be strong enough to mask a weakening of vocational graduates' labour market outcomes due to the substitution of employer with school-provided training places. The goal of the multivariate analyses is to account for such macroeconomic and other time-varying factors to partial out the independent effect of training substitution. We also observe a steady increase of the percentage used in the lowest occupational category, which points to a weakening of vocational graduates' employment opportunities despite macroeconomic recovery.

Table 1 reports the results from linear probability OLS regression models where the dependent variables are unemployment (upper panel) and employment in a routine occupation (lower panel). The baseline specification M1 (equation 1) shows that the substitution of employer- with school-provided training provision has had a positive effect on vocational graduates' unemployment risk significant at the 5 per cent level ($P=0.016$).

Table 1 OLS estimates ('cluster robust' standard errors) of the effect of the ratio of school- to employer-provided training places and time since graduation on male VET graduates' labour market outcomes 1–24 months after graduation, 1994–2000 graduation cohorts

	M1	M2	M3	M1i	M2i	M3i	M4i
<i>Unemployment probability</i>							
ln(time since graduation)	-0.11*** (0.02)	-0.11*** (0.02)	-0.11*** (0.02)	-0.10*** (0.02)	-0.09*** (0.02)	-0.09*** (0.02)	-0.10*** (0.02)
ln(school-/employer-provided places)	0.11* (0.05)	0.10 (0.09)	0.16 (0.09)	0.28*** (0.07)	0.25*** (0.10)	0.30** (0.10)	0.30** (0.10)
ln(time since graduation)				-0.06** (0.02)	-0.07*** (0.02)	-0.08*** (0.02)	-0.06** (0.02)
N	5,584	5,584	5,584	5,584	5,584	5,584	5,584
R ²	0.12	0.13	0.17	0.12	0.13	0.18	0.18
<i>Probability of employment in routine vs. other occupation</i>							
ln(time since graduation)	0.00 (0.02)	0.01 (0.02)	0.01 (0.02)	0.00 (0.02)	0.00 (0.02)	0.01 (0.02)	0.02 (0.02)
ln(school-/employer-provided places)	0.02 (0.06)	0.15 (0.12)	-0.03 (0.13)	0.02 (0.11)	0.11 (0.13)	-0.02 (0.15)	-0.02 (0.15)
ln(time since graduation)				0.00 (0.03)	0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)
N	4,005	4,005	4,005	4,005	4,005	4,005	4,005
R ²	0.05	0.06	0.14	0.05	0.06	0.14	0.15
<i>Social background</i>							
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	No	Yes	Yes	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	No
County-specific trends	No	Yes	No	Yes	Yes	No	Yes
County-by-year FE	No	No	Yes	No	No	Yes	No
County-by-cohort FE	No	No	No	No	No	No	Yes

Source: Hungarian LFS and Hungarian School Survey (own calculations).

Note. All models control for respondents' age (ln).

Social background = dummy variables for mother's and father's education and employment status, and number of children living in household.

County FE = county-specific dummy variables; Cohort FE = cohort-specific dummy variables; Year FE = year-specific dummy variables; County-specific trends = county-specific linear trends; County-by-year FE = exhaustive set of county-by-year dummy variables; County-by-cohort FE = exhaustive set of county-by-cohort dummy variables. Full results available on request.

***p < 0.001, **p < 0.01, *p < 0.05.

Controlling for county-level linear trends (M2), the training coefficient drops only marginally in size. Controlling for county-by-year fixed effects (M3), the effect increases in size. Neither county-specific linear trends nor county-by-year-specific shocks reduce the effect size more than marginally compared with the baseline specification (M1), indicating that the training variable is not endogenous to either type of unobserved time-varying confounder. That statistical significance drops is likely caused by restricting the variation in the training indicator that is used to estimate the effect of training substitution.

Allowing for an interaction between training provision and time on the labour market (time since graduation) provides for a more realistic model: the impact of training substitution should be strongest on leaving school and then dissipate, as young VET graduates spend more time on the labour market. Consistent with our expectations, M1i provides strong evidence in support of this interaction. The unemployment-reducing effect of experience is more pronounced if a greater fraction of graduates has received training in schools rather than enterprises. The interaction effect is barely changed by the inclusion of county-specific trends (M2i), county-by-year fixed effects (M3i), and county-by-cohort fixed effects (M4i).

The interaction effect is also not affected by dropping whichever year, cohort, or county and is also unaffected by retaining only respondents for which we have full social background information. If we move the cluster level, over which standard errors are calculated, from the county-by-cohort up to the county level (effectively assuming only 20 independent observations for the purposes of calculating standard errors), standard errors increase but the interaction effects retain significance at the 5 per cent level and also remains statistically significant when dropping any year, cohort, and county from the sample. For women, however, we find no significant effect of the training indicator, or its interaction with experience, on unemployment, or class position (see [Supplementary Appendix, Supplementary Table A2](#)).

As a further test for the endogeneity of the training indicator, the leftmost column of [Table 2](#) reports results from a placebo test. Instead of VET graduates, we use a sample of upper secondary (gymnasium and tehnikum) graduates, specified in the same manner as for VET graduates, and assess whether their unemployment risks have also been affected by training substitution, which theoretically they should not be. However, if the training indicator captures unobserved macroeconomic shocks that have an impact on training provision and the youth labour market and that our control variables were unable

Table 2 OLS estimates ('cluster robust' standard errors) of changing training provision and time since graduation on male unemployment probability 1–24 months after graduation, 1994–2000 graduation cohorts

Sample	Upper secondary graduates		VET graduates		VET graduates	
	School-provided/ employer-provided training places	School-provided/ employer-provided training places	Per cent school-provided training places	Per cent school-provided training places	Per cent employer-provided training places	Per cent employer-provided training places
ln(time since graduation)	-0.12*** (0.02)	-0.12*** (0.02)	-0.11*** (0.02)	-0.20*** (0.03)	-0.11*** (0.02)	-0.02 (0.03)
ln(training indicator)	-0.06 (0.06)	-0.10 (0.09)	0.23* (0.12)	0.60*** (0.17)	-0.18* (0.07)	-0.46*** (0.12)
ln(time since graduation)		0.01 (0.03)		-0.15** (0.05)		0.11** (0.04)
N	2,590	2,590	5,584	5,584	5,584	5,584
R ²	0.13	0.13	0.12	0.12	0.12	0.12

Source: Hungarian LFS and Hungarian School Survey (own calculations).

Note. All models control for respondents' age (ln), respondents social background, county, cohort, and year fixed effects. Full results available on request.

***p < 0.001, **p < 0.01, *p < 0.05.

to account for, we would expect the training indicator to also predict the unemployment rate of upper secondary graduates. Using the baseline specifications (M1, M1i in Table 1), we find no effect of training provision on upper secondary graduates' unemployment probability (see Supplementary Appendix, Supplementary Table A4, for full results).

Figures 3 and 4 illustrate the interaction between training and time since graduation. We have re-estimated the specification M1i in Table 1 using logistic regression and simulate predicted unemployment probabilities for different levels of the training variable and time since graduation. To generate Figure 3, we simulated the mean effect of decreasing the training indicator variable from its average value for the 1994 cohorts to the average value for the 2000 cohort at different values of time since graduation. The effect of training substitution is strongest in the first month after leaving school, where it increases unemployment probability by 21 percentage points (90 per cent confidence interval: 0.10, 0.32), and declines thereafter. Twenty-four months after graduation, the effect is still 6 percentage points (-.002, .130) and no longer statistically significant at the 10 per cent level. Averaging over the entire

24-month period, training substitution increased male VET graduates' unemployment by 10 percentage points (90 per cent confidence interval: 0.03, 0.17).

Figure 4 illustrates that potential labour force experience has become a more important predictor of unemployment. The more VET graduates have received training in schools rather than enterprises, the steeper the slope of the unemployment-experience profile. The negative effect of additional months of labour force experience on unemployment is particularly strong in the months after leaving school. Over time, the unemployment risks of VET graduates trained in schools vs. enterprises become more similar, as VET graduates predominantly trained in schools acquire more relevant skills and better information about available jobs.

To further explore the underlying mechanisms, we use two alternate training indicators: the percentage of school-provided training places (of all training places) and the percentage of employer-provided training places (see Table 2). As we would expect, school-based training raises unemployment and increases the unemployment-reducing effect of time since graduation, as young people's unemployment risks become more dependent on labour force experience. Also conforming to expectations, employer-provided training lowers VET graduates

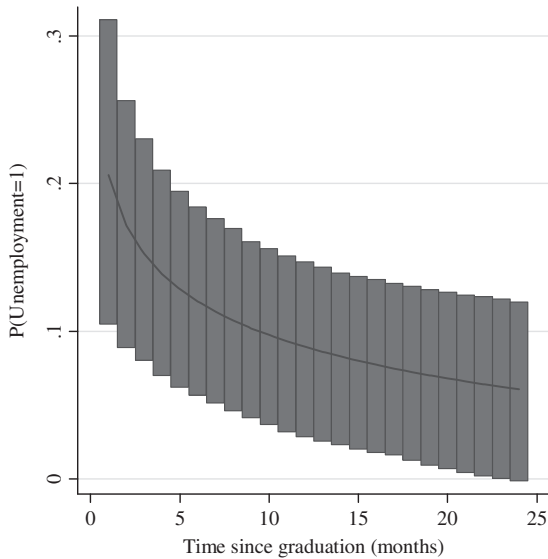


Figure 3 Simulated effect of changing training provision (ratio of employer- to school-provided training places) from 0.93 (average value, 1994 cohort) to 2.06 (average value, 2000 cohort) on unemployment probability, by months since graduation. Note: based on logistic regression with covariate specification as in Table 1, Model M1i. Vertical bars represent 90 per cent confidence intervals. Source: Hungarian LFS and Hungarian School Survey (own calculations)

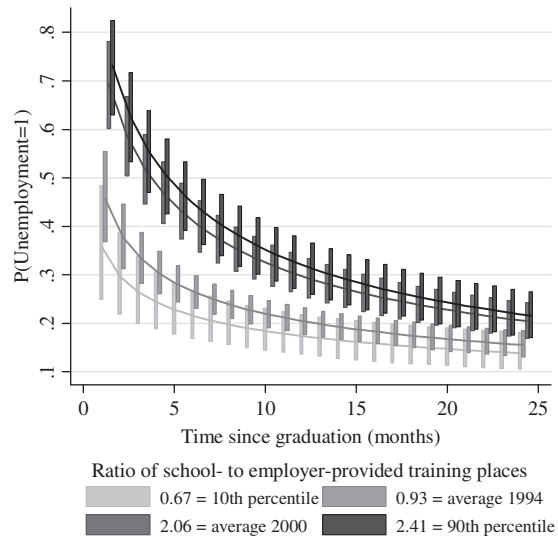


Figure 4 Simulated effect of months since graduation on unemployment probability for different training indicator values. Note: based on logistic regression with covariate specification as in Table 1, Model M1i. Vertical bars represent 90 per cent confidence intervals. Source: Hungarian LFS and Hungarian School Survey (own calculations)

unemployment, and flattens their unemployment-experience profiles.

The [Supplementary Appendix](#) contains additional results for male vocational graduates ([Supplementary Table A3](#)). Repeating the unemployment analyses, but including individuals who report to be enrolled in school yields similar results. Repeating the analyses using employment probability (1 = employed, 0 = not employed) as the dependent variable also produces the expected patterns, essentially mirroring the results for unemployment with respect to the interaction effect.⁸ While the unemployment analyses may suffer from bias due to selective withdrawal of individuals from the labour force, this does not affect the employment analyses. We find no effect of training provision on being neither in education nor employment. We also find no effects on temporary employment status.

The lower panel of [Table 1](#) reports regression results with employment in routine occupations (=1, employment in other occupation = 0) as a dependent variable. We observe no statistically significant effects. Repeating these analyses with occupational status (measured by the International Socioeconomic Index; [Ganzeboom, De Graaf and Treiman, 1992](#)) as the dependent variable did not yield different conclusions. That we fail to find an effect on job quality might reflect the short post-graduation observation span or the measures of job quality used. However, it also remains a possibility that extant research finding an association ([Arum and Shavit, 1995](#); [Shavit and Müller, 2000](#)) has suffered from bias due to, for example, unobserved demand side factors. The organization of production and demand for the products intensive in VET graduates skills should be a critical determinant of the number, skill content, and quality of jobs available to VET graduates. Therefore, one interpretation of our results is that demand side factors, but not training organization, are critical for the quality of jobs, while training organization matters for unemployment risks and the dynamics of labour market integration.

Discussion

In the course of economic liberalization, employers withdrew in large numbers from providing training places to vocational students in the Hungarian dual system. Our analyses indicate that the resulting substitution of employer- with school-provided training between 1994 and 2000 has increased male VET graduates' unemployment rate by 10 percentage points within the first 2 years after graduation. We found no evidence linking the training shift to changes in class positions. While concerns about time-varying

confounding remain, our results have proven remarkably robust to demanding specification checks for this type of confounding.

These results suggest that economic liberalization in Hungary has made the transition from vocational education to work more difficult by breaking linkages from schools to employers that perform a critical matching function. The growing role of markets has led to more search-related unemployment and turnover due to diminished flow of information between vocational schools and employers. The absence of an effect on quality of employment (skilled vs. unskilled) may be taken as further evidence that it is the matching rather than the skilling function of employer-provided training that makes dual system VET effective ([Acemoglu and Pischke, 1998](#); [Breen, 2005](#)).

This case study also illustrates the contingency and importance of employer involvement in VET at a time where the dual system is, once again, portrayed as a model to emulate for other countries.⁹ The Hungarian case and the experience of post-socialist Central European countries more generally illustrate the challenges in building and maintaining dual system VET ([Culpepper and Thelen, 2007](#)): without historically grown institutions facilitating voluntary employer involvement in VET, employer participation is difficult to elicit, and as the Hungarian case illustrates, employers exit in droves during periods of economic crisis. This suggests that reformers in countries without strong institutional foundations for voluntary employer involvement in VET face tough constraints on their reform options, and might consider innovative strategies that do not rely on employers providing training places for vocational skill formation.

Is school-provided vocational training an alternative? Our and other research clearly indicates that declining employer involvement leads to higher unemployment on graduation. Our results also indicate that after 2 years, more than two-third of the initial adverse effect on unemployment has dissipated. The absence of effects on class position (and temporary contract status) suggests equivalent outcomes of school- and employer-provided training. However, before we can draw definite conclusion on whether or under which conditions employer- and school-provided training yield equivalent or divergent outcomes, more research is clearly in order. In particular, the underlying logics of employer training provisions as well as the effectiveness of on-the-job training may differ considerably across occupations. Future research should also consider other outcomes, including wages, health, and well-being, examine long-term effects, and further explore gender segregation in

VET enrolment and gender differences in VET outcomes (Jacob, Kleinert and Kühhirt, 2009).

unemployment (Frankfurter Allgemeine Zeitung, 2013).

Notes

- 5 1. For a description of the Hungarian education system, see Bukodi and Robert (2008).
2. This effect is likely to cause downward bias in our analyses of unemployment probability.
3. The individual-level training effect would likely be larger because of self-selection into firm-based training.
4. Epidemiologists refer to conceptually similar effect estimates in clinical trials as intent-to-treat effects, which measure the total effect of being exposed to (a certain level of) treatment at baseline irrespective of subsequent changes in treatment status (Hernán and Hernández-Díaz, 2012).
5. Moreover, we need to make an assumption about the functional form of effect of the treatment variable. While we chose the natural log, we obtained substantively similar results using other functional forms (see Supplementary Appendix, for further discussion).
6. If we modelled training choice at the individual level, using individual fixed effects to rule out selection on time-constant unobservables (IQ, personality, etc.) would be practically impossible. Because we are dealing with first-time labour market entrants, by definition, we lack pre-training outcome data to estimate individual fixed effects.
7. We also experimented with flexibly specified control variables measured at the county and year/cohort level (youth unemployment rates, adult male vocational graduate unemployment rate, and cohort size). The results of the latter specification checks were similar to the ones reported here, but they are less attractive because they are based on the inclusion of endogenous covariates.
8. Excluding respondents enrolled in school does not affect the employment results.
9. US President Barack Obama praised the German dual system in his 2013 State of the Union Address (New York Times, 2013), and Italian and Spanish politicians have taken efforts to boost dual system VET to combat disastrous levels of youth

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Supplementary Data

Supplementary Data are available at ESR online.

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