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ABSTRACT

Do Vocational High School Graduates Have Better Employment Outcomes than General High School Graduates?*

This paper estimates the causal effect of vocational high school (VHS) education on employment likeli-hood relative to general high school (GHS) education in Turkey using census data. To address non-random selection into high school types, we collect construction dates of the VHSs at the town-level and use VHS availability in the town by age 13 as an instrumental variable. The first-stage estimates suggest that the availability of VHS does not affect the overall high school graduation rates, but gener-ates a substitution from GHS to VHS. The OLS estimates yield the result that the individuals with a VHS degree are around 5 percentage points more likely to be employed compared to those with a GHS de-gree. When we use the availability of VHS as an instrumental variable, we still find positive and statisti-cally significant effect of VHS degree on employment likelihood relative to GHS degree. However, once we include town-specific socio-economic variables to control for education, employment, and business activity levels in the town, the IV estimates get much smaller and become statistically insignificant. We conclude that although the VHS construction generates a substitution from GHS to VHS education, this substitution is not transformed into increased employment rates in a statistically significant way. We also argue that location-specific controls improve the reliability of the school construction/proximity instruments.

JEL Classification: C26, I21, J21, J24

Keywords: vocational education, employment, school construction, instrumental variables

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1 Introduction

There is an inconclusive debate on the differences between the labor market outcomes of the vocational versus general high school graduates. Although expanding access to vocational high school (VHS) education is often proposed—especially in underdeveloped and developing countries—as a remedy to improve the labor market outcomes of young adults, existing empirical evidence on the relative returns to VHS education is mixed.[1] The mixed nature of empirical evidence generates doubts among academics and policymakers about the true value of VHS education. At the end, the following key question remains mostly unanswered. How would a general high school graduate perform in the labor market had s/he received vocational rather than general education in the high school?

The counterfactual nature of the question posed above is also partly responsible for the mixed and inconclusive results reported in the literature. To be precise, there are two related but distinct problems associated with the search for an answer to this question. First, data availability is a serious concern—especially for the developing countries—reducing the information content of the existing estimates. Second, there is a serious selection problem in the sense that those who choose to receive VHS education are non-randomly different from those who choose to go to a general high school (GHS). The underlying unobserved variable confounds the estimates of the relative returns to VHS education. The data availability problem amplifies this selectivity problem in the sense that it significantly reduces the chances for finding suitable instruments and/or setting up counterfactual worlds to address the selectivity issues. The existing literature has put a fair amount of effort in minimizing the noise generated by these problems; but, there is still ample room for developing additional empirical perspectives and refining the existing results.

In this paper, we use 2000 census data from Turkey to perform a comparison between the *ex post* labor market outcomes of VHS and GHS graduates. Our outcome variable is "being employed as of age 26–35" for whom the terminal educational degree is high school. To tackle with the selection problem, we use an instrumental variable (IV) strategy, which exploits the

[1] See Section 2 for a detailed review of the related literature.

differences across regions in VHS availability—measured in terms of the number and timing of VHS constructions in Turkey. Specifically, we use two different instruments: (1) a dummy variable indicating the existence of a VHS in a given town at the time the individual is 13 years old and (2) the number of VHSs in a given town at the time the individual is 13 years old. This IV framework captures a significant amount of variation across individuals in terms of VHS availability by age 13. Note that we restrict our attention only to men throughout the paper due to the fact that most vocational high school curricula are designed for male-dominant occupations [see Section 3 for the details of data and institutional setting]. Although we argue that the institutional setting in Turkey supports the validity of our identification strategy, the independence of the school construction decision from the local economic conditions which also affect the labor market outcomes is often questioned in the literature. To address this additional concern, we control for a large set of town-level characteristics including population, average educational attainment and employment rates of the previous cohort, the number of establishments, and the number of employed workers. We argue that the inclusion of these regional socio-economic characteristics significantly alters the nature of the IV estimates.

Our first-stage regressions suggest that the existence of a VHS in one's town of birth by age 13 strongly increases the probability of VHS attendance and reduces the probability of GHS attendance, which points out a substitution story. We document that for men the existence of VHS in a given town by age 13 increases the probability of receiving a VHS degree by 0.7 percentage points and reduces the probability of receiving a GHS degree by 0.4 percentage points. However, the availability of VHS in a town does not significantly affect the overall education level of individuals, i.e., does not lead to an educational upgrading. Once we focus on the towns that already had at least one VHS, we find that the increase in the number of VHS in one's town does not have a significant effect on any schooling category. To put it differently, the effect of VHS availability on schooling outcomes operates along the extensive margin rather than the intensive margin.

At the second stage, we investigate the effect of VHS degree on employment likelihood of men in comparison to GHS degree. We start with an OLS estimation and find that men with

a VHS degree are 4.9 percentage points more likely to be employed compared to men with a GHS degree. The IV–2SLS estimates document a larger and statistically significant effect when we include a relatively narrow set of control variables. However, once we include town-specific variables that control for the average education level, average employment rate, and the total number of establishments, the IV estimates become smaller in magnitude and lose their statistical significance. These results suggest that, although the VHS construction generates a substitution from GHS to VHS, this substitution is not transformed into increased employment rates, at least in a statistically significant way. This result is in line with the findings of the recent studies documenting the importance of location-specific controls in estimating returns to education. See Card (2001) and Kitagawa (2015) for an analogous argument.

It should be noted, once again, that our focus is on the individuals for whom the terminal educational degree is high school. Therefore, our estimates should be interpreted as "the employment returns to vocational education among high school graduates." In other words, we seek an answer to the question: "For an individual who gets a high school degree and does not pursue college education, does a VHS degree increase the employment probability relative to a GHS degree?" This is a quite sensible question with strong policy implications. Around 26 percent of all individuals in the age interval 30–34 in Turkey have high school as their terminal educational degree by year 2015.[2] Another important institutional detail for the Turkish case is that the VHS education in Turkey is designed to provide specific vocational skills that allow young individuals to enter the labor force and develop a stable career path without an essential need for further school education. Thus, performing a comparison among high school graduates may even provide a better sense in terms of the employment returns of VHS. This may also be more relevant for policy, because the discussions on the value of VHS degree versus GHS degree mostly target the labor market outcomes of the unskilled with a special emphasis on the potential of VHS education in providing additional incentives for labor market attachment. Our results suggest that, for an individual with a terminal high school degree, whether he receives a general or vocational high school education does not affect his employment probability in a statistically meaningful way.

[2]These statistics are produced by the Turkish Statistical Institute.

The plan of the paper is as follows. Section 2 reviews the relevant literature and compares our estimates to the estimates presented therein. Section 3 provides data description along with the institutional details. Section 4 explains our empirical strategy. Section 5 presents and discusses the results. Section 6 concludes.

2 Related Literature

The impact of secondary vocational education on subsequent labor market outcomes has been vastly debated and the current state of the literature is far from offering a conclusive picture on the benefits of VHS education over GHS education. This is worrisome, because promoting vocational education especially in less developed countries (for the purpose of reducing the employment gap in technical jobs) has been one of the major goals of international policy organizations, such as the World Bank, and huge amounts of public and international funds have been allocated on a variety of vocational education programs in those countries. The mixed nature of results sometimes discourages policy efforts and generates further debates along the GHS versus VHS education margin. One major difficulty in estimating the returns to vocational secondary education relative to the returns to general education is to obtain estimates that can be labeled as causal [Ryan (2001)].

Our main goal in this paper is to compare the employment performances between VHS versus GHS graduates of age 26–35. We focus on this relatively mature age range, rather than the immediate school-to-work transition range (which is 18–25 most of the time), for the purpose of measuring the employability of VHS graduates relative to GHS graduates among individuals for whom long-term attachment to the labor market has been mostly decided. To attribute causal interpretations to our estimates, we employ an instrumental variables strategy motivated by the school proximity idea implemented by Card (1993), Kane and Rouse (1995), and Duflo (2001). Our strategy is more similar to Duflo (2001) in the sense that we rely on the variation generated by the regional differences in the timing of town-level VHS construction in Turkey.

We find that, although the sign of the estimated coefficient is consistently positive across alternative specifications, the VHS education does not provide statistically significant employment gains relative to GHS education. Our first-stage estimates suggest that the availability of VHS in the town of birth generates a substitution from GHS toward VHS enrollment, while there is no impact on the overall probability of high school graduation. The interpretation of this result is that space is an important constraint affecting educational preferences at the secondary-school level. Next we find that the coefficient of interest is positive and statistically significant for IV–2SLS estimation outcomes when no explanatory variables are included to control for the impact of time-varying town-level characteristics, while the coefficient turns insignificant after incorporating those variables.

There is an important divide in the literature on the usefulness of VHS education over GHS education in terms of the labor market returns.[3] In a recent paper, Hanushek, Schwerdt, Woessmann, and Zhang (2016) argue that early gains in employment through vocational education could be offset by diminished employment over the life cycle due to less adaptability to changing technology needs. Other papers finding small or no impact of VHS education on labor market outcomes include Altonji (1995), Horowitz and Schenzler (1999), Dearden, McIntosh, Myck, and Vignoles (2002), Meer (2007), Malamud and Pop-Eleches (2010), Newhouse and Suryadarma (2011), and Loyalka et al. (2016). Oosterbeek and Webbink (2007) document that having an additional year of vocational education does not significantly change the earnings. There is another set of papers emphasizing substantial labor market gains that can be obtained through vocational secondary education [see, e.g., Neuman and Ziderman (1991, 1999), Arum and Shavit (1995), Mane (1999), Moenjak and Worswick (2003), Bishop and Mane (2004), and Pugatch (2014)].[4]

[3] See Bennell (1996) for an early review of the literature with a specific emphasis on developing countries. See also Eichhorst, Rodriguez-Planas, Schmidl, and Zimmermann (2015) for an overview.

[4] A firm-side analysis of general versus vocational education is presented in Becker (1993) and Acemoglu and Pischke (1998, 1999). See Bertocchi and Spagat (2004) and Krueger and Kumar (2004) for a macroeconomic perspective on the returns to vocational versus general education. There is also a "specific training" perspective, which mostly focuses on general versus vocational training on the job or through programs out of school for the unemployed. Papers in this literature include Ashenfelter (1978), Andren and Gustafsson (2004), Attanasio, Kugler, and Meghir (2011), Card, Ibarraran, Regalia, Rosas-Shady, and Soares (2011), Flores, Flores-Lagunes, Gonzalez, and Neumann (2012), Picchio and van Ours (2013), Biewen, Fitzenberger, Osikominu, and Paul (2014), Stenberg and Westerlund (2015), and Hirshleifer, McKenzie, Almeida, and Ridao-Cano (2016). Hotchkiss (1993) and Pema and Mehay (2012) find that better labor market outcomes are reached not through vocational education alone, but through the quality of the match between education type and occupational choice. Kahyarara and Teal (2008) emphasize heterogeneity in labor market returns to vocational education.

This paper falls into the first category as we do not find any significant employment gains for attaining a VHS degree versus GHS degree. Our data set forces us to focus only on employment outcomes and disregard wages. In this sense, we have a relatively modest objective. In turn, we are able to augment school construction variables into our data set, which can be used as convincing instruments; thus, we are pushing the interpretation of our estimates towards causality rather than rough correlations. Our paper is one of the very few papers attempting to obtain causal estimates in the literature comparing the returns to vocational versus general education. It is the first paper in this literature using the school proximity and construction timing variables as an instrument.[5]

Hanushek, Schwerdt, Woessmann, and Zhang (2016) use cross-country data with rich information on vocational school attendance of working-age (16–65) individuals and assess the labor market impact of vocational education. They find that vocational education may induce early employment advantages, but these advantages are likely eroded by technological change; since general education equips individuals with flexible tools that will lead them to adapt changing technical needs in the labor market, while vocational education provides skills less adaptable to technological progress. It is worth mentioning the main differences between Hanushek, Schwerdt, Woessmann, and Zhang (2016) and our work. First, Hanushek, Schwerdt, Woessmann, and Zhang (2016) focus on individuals of age 16–65, while our focus is on individuals of age 26–35. Second, we concentrate on those whose terminal degree is high school due to data limitations, while their sample includes individuals who also have attended college. Finally, the definition of vocational education in their paper is a mix of secondary or post-secondary levels, while we restrict our attention to secondary vocational education. Within this framework, the difference between our results and theirs suggests that the life-cycle implications potentially stem from post-secondary vocational education and/or from those who have attended college after vocational secondary education. We find that, among high school graduates, there is no statistically significant early employment gains. Overall, our results support the general policy perspective on vocational education provided in Hanushek, Schwerdt, Woessmann, and Zhang (2016).

[5]See Tansel (1998) for an earlier work on vocational education in Turkey.

Our paper is also related to the literature investigating the validity of the school-proximity IV. In particular, Card (1993, 2001), Conneely and Uusitalo (1997), Kling (2001), and Kitagawa (2015) document that including variables representing regional or local characteristics into the analysis tends to improve the validity of the school-proximity instrument. The main explanation is that regional or local characteristics tend to affect the link between education and labor market outcomes. Our findings also confirm this perspective, as the coefficient describing the employment gains for VHS degree relative to GHS degree turns statistically insignificant after incorporating town-level characteristics in an IV–2SLS setting. In some sense, this result also implies that the usage of school-construction IV alone, without controlling for local socio-economic characteristics, tends to reflect the OLS estimates which are potentially upward biased. Inclusion of those local characteristics improves the economic validity of the school proximity IV and tends to remove the bias.

3 Data and Institutional Details

We examine whether attending a VHS instead of a GHS increases an individual's labor market outcomes; in particular, the employment probability. A simple comparison of the graduates of two types of high school would yield biased estimates of the VHS employment premium because of non-random selection into school types. We use the variation across years and towns in VHS construction to tackle with the endogeneity of high school type.

In order to obtain town-level variation in VHS construction, one needs data containing information on individual-level characteristics, labor market outcomes, and knowledge of town in which the individuals were born. The 2000 Census sample is one of the rare micro-data sets in Turkey containing this information.[6] The size of the census sample is quite large, and it is representative of the population. It includes approximately 5 percent of the population containing around 3.5 million observations coming from 81 provinces and 923 cities. Among many other characteristics, we can observe the gender, employment status, highest degree of

[6] 2000 Census was the last census in Turkey that is conducted in person across the country. No census was done in 2010. Samples from previous censuses can also be used for the same purpose. Yet, the most recent one has more updated questions and better information content.

schooling attained, marital status, and age of individuals. Also, we can observe the town of birth, town of residence, and town of survey for all individuals.

The data set contains the knowledge of the final educational degree. If an individual is a high school graduate we can also observe the type of the high school. The drawback of the data is that we cannot observe the type of high school for an individual who further continued college education. For those who pursued higher education, the data allow us to see whether an individual is a two-year college graduate or a four-year college graduate. In the data, we can only observe whether the individual is employed or not. We cannot observe whether the non-employed individual is unemployed or out of the labor force. As a consequence, our main outcome variable is the employment-to-population ratio within the relevant population.

Apparently, the census data do not contain information on VHS construction. We collect data on the construction year of the VHSs at the town level from the official web sites of the current VHSs and merge the data with the census using the town identifiers. We may be missing the VHSs that existed before and do not exist anymore. Yet, it should not be a big concern as closing of an existing high school rarely happens in Turkey. There are a number of VHS types including commerce, medical, industrial, and textiles.[7] A small cautionary note is that, since several curricula can be taught in the same building, it is sometimes difficult to identify the type of VHS education. Also, we should note that most of these curricula appeal to men rather than women. Therefore, in this paper we investigate the effect of VHS education on employment outcomes of men. Regarding the terminal degree of schooling, we generate the following schooling categories: those with middle school degree or less, those with general high school degree, those with vocational high school degree, those with two-year college degree, and those with at least four-year college education.

To control for overall educational characteristics of towns, we generate the following variables. First, we control for 2000 population of towns-of-birth. This variable controls for the overall size of the town that an individuals was born. Next, using the 2000 census sample, we calculate the average years of education, general high school graduation ratio, vocational high school

[7] We exclude the religious VHSs and did not collect the construction data for those schools.

graduation ratio, 2–year college graduation ratio and college graduation ratio for the previous cohort, among men and women between 36 and 48 for all towns in the country. By doing that we aim to control for town characteristics that may affect the education decisions of individuals besides the vocational high school construction. We also calculate the employment ratio of the previous cohort, individuals aged 36–48, born in each town. Finally, we control for town specific economic activity level. We receive establishment count data from TURKSTAT that gives the number of establishments and employment level in 2002 for each town. The number of establishment in a town controls for town specific opportunities of employment.

In order to focus on individuals with the highest degree of labor market attachment, we restrict the sample to men of age 26–35 at the time of census, 2000. Although the sample covers all of the 81 provinces and 923 towns in Turkey. A number of large towns in metropolitan areas constitute a single market for education and labor employment. The absence of a vocational high school in a town in a metropolitan area may not prevent individuals from pursuing a VHS education as long as the neighboring town has one. This is the case especially for Istanbul. Thus, we drop observations for individuals who were born in Istanbul. This leaves us with 503,816 individuals of age 26–35 from 882 towns in Turkey, 262,282 of whom are men.

The instrumental variable constructed here is the existence or the number of vocational high school in the town of birth when an individual is 13 years old. Note that we do not observe which town the individual actually lives when he is 13 years old. For simplicity, we assume that at age 13 (and below) the individual probably lives in his town of birth. So we construct the VHS availability variables based on this assumption. The choice of age 13 basically captures the opportunities when an individual or his family is about to decide on the type of high school.[8] First, we construct a dummy variable D taking 1 if there exists a vocational high school in a given town when an individual is 13 and 0 otherwise. This variable captures the extensive margin. It is also possible to capture the intensive margin. So, as the second instrument, we construct a variable N describing the number of vocational high schools in a

[8]Although a student can start a vocational school after finishing the primary school, he or she can also switch to a vocational high school after finishing the middle school. Therefore we chose the age 13 as the benchmark age. The results are not sensitive to the choice of age as long as it ranges between 9 and 13.

given town when an individual is 13.

35 year-old individuals were 13 in 1978, and 26 year-old individuals were 13 in 1987. 226 of the 892 towns in the sample had at least one vocational high school in 1978, and the number increased to 292 in 1987. There is a variation in the existence of a vocational high school across towns and across time. After controlling for other province and town characteristics, and individual control variables, this variation allows us to identify the effect of vocational high school education on employment likelihood. See Tables (1) and (2) for the summary statistics pertaining to our sample.

4 Empirical Strategy

Our main goal is to answer the question whether the employment likelihood of the GHS graduates would increase had they received a VHS degree instead. This is a relevant question in terms of economic policy, because the ones who have a GHS degree as their terminal educational certification (especially the younger and less experienced ones among them) are often regarded as vulnerable to labor market shocks for two reasons. First, they are less-skilled than the college graduates. Second, they are only exposed to a broad curricula in high school, which may pose difficulties in locating a stable career path early in the labor market. Therefore, receiving "specific education" in high school and, therefore, receiving a VHS degree instead of GHS degree might increase the employment likelihood and job stability among the young high school graduates. Based on this reasoning, extending the VHS education capacity in a country is often regarded as a viable policy alternative to improve the employability of high school graduates especially in developing countries.

As we describe in Section 3, we have a cross-sectional census data for a single year, 2000. To focus on those who have completed their schooling choices and, at the same time, those with the potentially highest degree of labor market attachment, we restrict our attention to high-school graduate men of age 26–35 in Turkey. Section 3 describes the details of our sample choice. We perform our regressions using a sample for those who have high school education

as their terminal degree and, then, compare the employment probabilities across VHS versus GHS graduates.

Ignoring the fundamental self-selection problem, the easiest regression equation can be formulated as follows:

$$E_{i,p,t} = \alpha + \beta V_{i,p,t} + \boldsymbol{\theta}' \boldsymbol{X}_{i,p,t} + \epsilon_{i,p,t}, \tag{4.1}$$

where i, p, and t are individual, province, and town indices, respectively, E is a dummy variable taking 1 if the individual is employed at the time of observation and 0 if non-employed, V is a dummy variable taking 1 if the individual is graduated from a vocational high school and 0 if s/he is graduated from a general high school, $\boldsymbol{X}$ is a vector of covariates, and ϵ is a usual error term. The vector of covariates $\boldsymbol{X}$ includes a full set of age dummies, town-level characteristics, province-of-birth fixed effects, and the urban/rural indicator. The age fixed effects capture characteristics such as life/work experience that are invariant across individuals. Similarly, the province-of-birth fixed effects control for the province-level characteristics that are common across individuals. The town-of-birth-specific characteristics—which include town population along with the average years of education, employment-to-population ratio, GHS graduation ratio, VHS graduation ratio, 2–year college graduation ratio, and 4–year college (and above) graduation ratio for the previous cohort in the town as well as the number of establishments and employed workers in the town—represent the town-level socio-economic environment also common across individuals. Our main parameter of interest is β, which describes whether the VHS graduates are more likely to be employed than the GHS graduates. Clearly, Equation (4.1) is plagued with the classical endogeneity problem, since the individuals who choose to receive a VHS degree as their final educational attainment are likely to be systematically different from the individuals who have GHS education as their terminal degree. Technically speaking, it is quite likely the case that $\mathbb{E}[\epsilon|V, \boldsymbol{X}] \neq 0$. To address this problem, one would ideally have access to the following counterfactual world. Suppose that we have a large sample of middle-school graduates, who are about to choose a high school type. We randomly pick a sub-sample of these individuals, force them to get GHS degree, and force the rest of them to

get a VHS degree. Then we could use Equation (4.1) and estimate the relative employment returns to VHS education. But we have non-experimental data and an appropriate empirical design is needed to eliminate this selection bias.

We attack the selectivity problem by adopting an instrumental variable (IV) strategy. We have access to town-level administrative information about the year of VHS construction in Turkey. For each town, we know the construction dates of VHSs that currently exist. Some towns do not have any VHS, while others have at least one. We exploit this information in our IV strategy. In particular, we construct two different instruments. First, we create a dummy variable D taking 1 if there exists a VHS in a given town and 0 otherwise. This variable captures the extensive margin. It is also possible to design an alternative instrument capturing the intensive margin. So, as the second instrument, we construct a variable N describing the number of VHSs in a given town. One key issue in defining the instruments D and N is the timing. D and N should be defined so that they should describe the environment and opportunities before the student (or his/her family) chooses whether to go to a VHS or GHS. To reflect this key point, we define D and N for each individual in our data set in such a way that they describe VHS availability at age 13—right after they finish the primary school. In other words, D takes 1 if there is any VHS in the town when the individual is 13 and 0 otherwise; while, N denotes the number of VHSs in the town when the individual is 13.[9]

Based on this definition, the first and second stages of our IV estimation can be described by the following set of equations:

$$V_{i,p,t} = \gamma + \delta D_{i,p,t} + \boldsymbol{\theta'} \boldsymbol{X_{i,p,t}} + \nu_{i,p,t}, \tag{4.2}$$

$$E_{i,p,t} = \alpha + \beta \hat{V}_{i,p,t} + \boldsymbol{\theta'} \boldsymbol{X_{i,p,t}} + \epsilon_{i,p,t}, \tag{4.3}$$

where all the variable definitions are same as above except that $\nu_{i,p,t}$ is the error term for the first-stage equation and $\hat{V}$ is the estimated V that comes from Equation (4.2). For the

[9] We relax this assumption and try other age thresholds, namely 9 and 11, to test the sensitivity of our results to the VHS availability age.

alternative IV specification, the first-stage equation becomes

$$V_{i,p,t} = \gamma + \delta N_{i,p,t} + \boldsymbol{\theta}' \boldsymbol{X}_{\boldsymbol{i,p,t}} + \nu_{i,p,t}. \tag{4.4}$$

This IV strategy says that the variables (D and N) describing the VHS availability in an individual's town of birth at age 13 can affect the employment outcomes of the same individual at age range 26–35 only through whether the individual has a VHS versus GHS education. To put it differently, the variables D and N are correlated with V (i.e., preferences on school type), while they should be uncorrelated with E (i.e., the employment outcome). This is the main identifying assumption and it is adopted by several papers in the literature. A criticism often raised in the literature is that such an assumption may not hold if the timing of VHS construction (or, more generally, the availability of VHS) is correlated with employment opportunities in the town. To remove this concern, one should introduce a rich set of town-level socio-economic characteristics into the analysis [Card (2001) and Kitagawa (2015)]. Accordingly, the town-level characteristics listed above are included into the analysis to control for any remaining location-specific social and economic factors that can potentially violate this identifying assumption. In other words, they are included to address the possibility that the existence and number of VHS in one's town of birth might depend on location-specific attributes that can affect the schooling choices.

5 Results and Discussion

In the previous sections, we explained the potential endogeneity concerns in the OLS estimates of VHS employment premium and we described the main identification strategy. Those who choose to receive VHS education are non-randomly different from those who choose to receive a GHS degree. To deal with this endogeneity issue, we exploit the variation in the VHS construction across time and space in Turkey. In this section, we first estimate the effect of VHS availability in a given town on the school preferences and education levels of individuals. We use two different explanatory variables: (1) the existence of at least one VHS in a town at the time the individual is 13 years old and (2) the number of VHSs in a town at the time

the individual is 13 years old. We find that the VHS availability in an individual's town of birth at age 13 increases the likelihood of VHS attendance and reduces the probability of GHS attendance. Using an IV strategy with a narrow set of controls, we estimate that the VHS graduates have better likelihood of employment than the GHS graduates in Turkey. However, once we control for town-specific socio-economic characteristics, we find that the substitution from GHS to VHS is not transformed into increased employment rates, at least in a statistically significant way. In this section, we describe in detail our first- and second-stage results followed by a series of robustness checks to confirm the validity of our specifications and estimates.

5.1 The Link between VHS Availability and High School Preference

This subsection presents evidence on the link between the VHS availability on school choices and educational attainment. This roughly resembles the first stage of our IV-2SLS regressions presented in the next subsection. Table (3) shows the estimated effect of VHS availability—described with a dummy variable indicating the existence of a VHS in one's town of birth at age 13—on educational attainment. Each cell in the table reports the result of a separate estimation. We divide the educational attainment into five mutually exclusive and collectively exhaustive categories. Individuals have one of the following terminal degrees: middle school and below, general high school, vocational high school, 2–year college, and 4–year college and above. In each column, the dependent variable is a binary indicator for having the corresponding degree. The last column specifies educational attainment by the total years of completed education.[10] Each panel includes a different set of control variables. The first panel controls for age fixed effects, province-of-birth fixed effects, town population at the survey year, urban/rural status. The second panel also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. The third panel also controls for the town-specific number of establishments and employed workers. The third panel includes the largest set of control variables and is our "preferred specification." In each regression, we allow standard errors to be correlated within the same town of birth. The

[10]The years of education variable is not directly observed. What we observe is the completed educational degrees at the survey year. Since we focus on individuals of age 26–35, we can roughly assume that the reported educational degrees are the terminal degrees. The years of education is obtained by summing the years spent in each completed education level. Grade repetitions or years spent in school without receiving the corresponding degree are disregarded due to data limitations.

sample includes men of age 26–35 at the time of survey.

The first panel suggests that the existence of a VHS in a town decreases one's probability of having a middle school degree (and below) at most by 3.5 percentage points, while increasing the probability of VHS degree attainment by 1.6 percentage points, 2–year college degree attainment by 0.5 percentage points, and 4–year college degree (and above) attainment by 0.9 percentage points. Moreover, the last cell of the first panel suggests that the existence of a VHS in a given town increases the total years of education by 0.28 years, on average. The first panel suggests that the existence of VHS even affects 2–year and 4–year college degree attainment. As almost each and every town already had a GHS at the time, we would not expect educational upgrading due to VHS existence. Rather we expect a substitution across high school types, which means that the VHS availability affects educational preferences. When we include a larger set of control variables in the second and the third panels, we find that the existence of a VHS in a town decreases the probability of GHS degree attainment by 0.4 percentage points and increases probability of VHS degree attainment by 0.7 percentage points. Considering the mean values, this corresponds to a 2.5 percent decrease in the probability of GHS degree attainment and an 11 percent increase in the VHS degree attainment.

Table (4) restricts the sample to towns that had at least one VHS and repeats the same exercise using the number of VHS in a town as the explanatory variable. In other words, Table (4) reports the results on the intensive margin. We find that once a town already has a VHS, an extra VHS in the town does not have a statistically significant effect on school choice. Overall, these results suggest that the VHS availability operates along the extensive margin and has no effect on educational preferences along the intensive margin. The construction of the first VHS in the town generates a statistically significant switch from GHS to VHS, while inclusion of additional VHSs does not induce further substitution. So, if the VHS degree induces labor market benefits over the GHS degree, then the first-pass is achieved in the sense that individuals tend to choose VHS over GHS once the option becomes available. Whether there is actually a statistically significant labor market benefit or not associated with a VHS degree will be tested in the next subsection, where we present our IV estimates.

5.2 The Effect of VHS Degree on Employment Likelihood – IV Estimates

The previous subsection shows that the availability of a VHS in one's town of birth by age 13 increases the probability of VHS attendance, while reducing the probability of GHS attendance, without affecting the probability of obtaining a higher degree. The punchline is that the VHS availability generates a substitution from GHS to VHS attendance, without an educational upgrading. We are particularly interested in the relative employment returns to VHS education versus GHS education among high school graduates only. As we discuss above, VHS construction is used as an IV in our regressions. We report the results of our IV estimations in several steps [see Tables (5)–(9)]. The first column reports the basic OLS estimates. The second column reports the IV-2SLS estimates including only a narrow set of controls—age fixed effects, province-of-birth fixed effects, town population at the survey year, and the urban/rural status. The third column also controls for the town-specific education levels and employment rates of the previous cohort, i.e., individuals of age 36–48. The fourth column also controls for the town-specific number of establishments and employed workers. The fifth column has all controls in the fourth column and also includes the number of VHS as an additional IV. This ordering aims to demonstrate that (*i*) the OLS estimates are biased, (*ii*) using the school construction/proximity IV with a narrow set of controls yields potentially misleading results, and (*iii*) including town-specific controls washes out the statistical significance. The main idea behind the school construction/proximity IV is that the VHS construction is likely random across time and space. One potential criticism is that school construction may be correlated with location-specific socio-economic characteristics which may also affect the high school preferences of individuals. To address this concern, we embed a rich set of town-specific socio-economic characteristics into our IV-2SLS setting. Note that columns 4 and 5 are our preferred regression settings.

Although our data set is quite large and detailed, it has certain limitations. As we mention at various places in the text, we only observe the individuals' terminal degree. To be concrete, we cannot identify a college graduate individual's high school type. For that reason, we estimate the effect of VHS under three different specifications. In our *first specification*, which is our

baseline specification, we focus on the individuals who have high school education as their terminal degree and compare the VHS graduates with GHS graduates. In Tables (3)–(4), we already showed that the VHS availability does not increase 2–year or 4–year college education, which signals that it is not likely to have a selection problem due to omitting college graduates from the analysis. Moreover, the last column in both tables shows that the VHS availability does not increase the years of completed education. In other words, the VHS availability only changes the composition of high school graduates; it does not trigger further success in college education. Estimating the employment returns to VHS education relative to GHS education by focusing on individuals with a terminal high school degree is an interesting research objective on its own. High school graduate workers are often regarded as "low-skill" workers; so, it is important in terms of policy to understand whether an individual with a VHS education as a terminal degree would perform better in the labor market than an observationally-equivalent individual with a GHS education as a terminal degree.

However, given the data limitations forcing us to focus on the ones with a high school degree only, it is still possible to perform additional exercises for the purpose of having a hint of what would happen if we also had access to information on vocational education of college graduates. To push this agenda further, we construct two counterfactual worlds. In the *second specification*, we include 2–year college graduates in the sample and consider them as a part of the VHS graduates. Thus, the treatment group consists of VHS graduates and 2–year college graduates, while the control group only includes the GHS graduates. This specification treats all 2–year college graduates as VHS graduates. The reason is that the majority of 2–year colleges have technical and vocational curricula and the VHS graduates are granted easier access to 2–year colleges in comparison to the GHS graduates. Finally, in the *third specification*, we include the 4–year college (or above) degree holders in the sample. This setup treats all 2–year college graduates as VHS graduates and all 4–year college graduates as GHS degree holders. The main motivation is that (i) 2–year college education mostly has a vocational curricula and (ii) most of the 4–year college programs in Turkey offers curricula consistent with the general education provided in the high school. In other words, VHS

education followed by a 2-year college degree is the natural path for vocational education, while a GHS education followed by a 4–year degree is the natural path for general education. These two counterfactual exercises aim to roughly answer the question "What is the potential bias due to ignoring college-educated individuals?"

Table (5) shows the IV–2SLS estimates of the effect of VHS education (versus GHS education) on employment likelihood for the entire sample using the *baseline specification*. The OLS estimate suggests a large employment premium—in the order of 4.9 percentage points—in favor of VHS degree. The IV-2SLS estimate controlling for only a limited set of variables (excluding town-specific socio-economic characteristics) says that the coefficient is still positive and statistically significant. After controlling for a large set of town-specific socio-economic characteristics, however, the estimates turn statistically insignificant and the null hypothesis that the VHS education does not pose any additional employment gains over the GHS education cannot be rejected. There are two main lessons. First, we find that the observed employment advantage in favor of VHS education disappears after implementing an appropriate identification strategy. Second, school construction is potentially correlated with town-specific socio-economic conditions; thus, the school construction/proximity IV should be used together with a rich set of location-specific variables capturing the economic, demographic, and social environment—which supports Card (2001) and Kitagawa (2015).

Although our data set offers only a snapshot, it is still possible to look at basic life-cycle implications to test the compatibility of our results with the ones reported by Hanushek, Schwerdt, Woessmann, and Zhang (2016). Specifically, we divide our sample into two—men of age 26-30 and men of age 31–35—and we perform separate regressions for these two groups using our baseline specification. Tables (6) and (7) report the results. The OLS estimates weakly support the Hanushek, Schwerdt, Woessmann, and Zhang (2016) results. To be concrete, the VHS employment premium is larger for the younger cohort (5.3 percentage points) than the older one (4.2 percentage points) based on the OLS estimates. However, once we implement our IV-2SLS analysis this basic difference gets eroded and, for both cohorts, the VHS employment gain becomes statistically indistinguishable from zero. Although the coefficients of the

younger cohort tend to be larger than those for the older cohort for all estimations, they are statistically insignificant in our preferred regressions (which are columns 4 and 5) and, thus, we conclude that there are not early employment advantages for the VHS graduates.

Next we present the results from the second and third specifications described above. Table (8) repeats the same exercise for the entire sample with specification 2. The nature of the results are almost unaltered, which suggests that treating 2–year college graduates as VHS graduates does not affect the qualitative structure of the estimates. Table (9) reports the results from the entire sample under the third specification. Again, the IV-2SLS results of our preferred regressions do not yield any statistically significant estimates. Thus, the VHS education does not pose any employment advantages or disadvantages over GHS graduates even after treating all 4–year college graduates as GHS-educated individuals. The OLS estimate in Table (9), as expected, is much smaller than those reported in Tables (5) and (8). The main reason is that the ability bias is less pronounced under the third specification due to inclusion of the 4–year college graduates into the GHS sample. Overall, these findings demonstrate that although we only focus on men with only (and only) high school degree, the qualitative nature of our results would likely remain unchanged if we had access to information on high school types of college graduates.

We test the robustness of the age cutoff, which is 13 in our baseline analyses. To make the timing of VHS availability an *ex ante* event, our instruments are constructed to represent VHS availability in one's town of birth at age 13—under the assumption that the individual was still living in his town of birth by age 13. We choose the age cutoff 13 based on the consideration that age 13 roughly corresponds to the last year before high school attendance and it is a reasonable age to form high school preferences. However, these criteria may still sound arbitrary. To test the sensitivity of the results to the age cutoff, we use the baseline specification and change the age cutoff as 11 and 9. This is a relevant exercise, because early revelation of high school availability information may generate a different sorting outcome relative to the case in which the information is revealed later. Tables (10) and (11) report the estimates in which we construct our instrument as VHS availability by age 11 and 9,

respectively, rather than 13. We clearly document that the results are qualitatively identical to the presented in Table (5). We notice that the coefficients of the IV-2SLS regressions tend to increase monotonically as the age cutoff declines, although the coefficients are all statistically insignificant.

Finally, we perform a simple additional analysis to test instrument validity from a different perspective. For the VHS availability to be a good instrument, it should be correlated with VHS attendance after controlling for the observed covariates. Second, it should not be correlated with the employment likelihood through mechanisms other than VHS education. The first condition is satisfied without much doubt as shown in Tables (3) and (4). We carry out two additional estimations to demonstrate that the second condition holds. The VHS availability is not supposed to affect the employment outcomes of middle-school graduates or college graduates. For this purpose, Table (12) presents the reduced form estimates on the employment likelihood of middle-school graduates and college graduates. Column 1 shows that VHS availability in a town by age 13 does not significantly affect the employment likelihood of individuals with middle-school degree or less. Column 2 looks at the same effect in the sample of college-graduate men. Again, we do not find any significant effect of the VHS availability. These two tables suggest that the VHS availability does not affect the employment outcomes through mechanisms other than VHS education—controlling for a rich set of individual- and town-level covariates.

The bottom line of the paper can be summarized as four main points:

1. Our first-stage estimates suggest that VHS availability generates a statistically significant substitution from GHS to VHS education, while there is no evidence of educational upgrading.

2. Based on simple OLS analysis, the VHS graduates have 4–5 percentage points higher employment probabilities than the GHS graduates, where the employment probabilities are defined as the employment-to-population ratios in a sample of high school graduate men of age 26–35 in Turkey. We seek an answer to the question: "Does this suggest that

VHS education offers better employment opportunities than GHS education for those who choose high school education as a terminal degree?" The fundamental selectivity problem suggesting that the choice of high school type is likely endogenous prevents us from attributing causal meanings to the OLS estimates.

3. Using administrative data on time and regional variation in VHS construction in Turkey, we implement an econometric identification strategy based on instrumental variables techniques. We provide robust evidence that VHS education does not pose any statistically significant employment gains over GHS education.

4. However, if VHS educated people earn higher wages or work in jobs with higher quality, then the VHS availability would be welfare enhancing. Our analysis only says that VHS education does not provide statistically significant advantages over GHS education in terms of employment likelihood. Other outcomes are not investigated.

5. We clearly show that including town-specific socio-economic characteristics removes the statistical significance of the IV-2SLS estimates of VHS employment gains. Moreover, after incorporating the town-level socio-economic variables, the results get closer to the range on which a consensus is formed in the related literature. This confirms the Card (2001) and Kitagawa (2015) view that the validity of the school construction/proximity instruments improves after incorporating a relevant set of regional variables.

6 Concluding Remarks

Increasing the degree of labor market attachment for young individuals has been an important goal especially in developing countries. Providing more and higher quality vocational education opportunities are often argued to increase the employment capacity of young individuals. In this paper, we use 2000 census data from Turkey and implement an instrumental variables strategy based on the variation in timing and location of VHS construction in Turkey to estimate the impact of VHS education (relative to GHS education) on the employment likelihood of men of age 26–35 among the ones whose terminal education degree is high school. We find

that the OLS estimates suggest positive employment returns for VHS graduates, while the estimated returns lose statistical significance once we employ IV-2SLS regressions and include town-specific socio-economic characteristics. In the overall, our findings suggest that VHS availability at age 13 in one's town of birth generates a substitution from GHS enrollment to VHS enrollment, but this substitution is not translated into employment gains in favor of VHS graduates. We conclude that VHS education does not pose a statistically significant employment advantage relative to GHS education. We also report that the relevance of the school construction/proximity IV improves once location-specific socio-economic characteristics are controlled for. This is the first paper in the literature to estimate the labor market returns to vocational education relative to general education using an identification strategy based on the school construction/proximity instrument.

It should be noted that, although we find that there is not any statistically significant difference between the employment probabilities of VHS versus GHS graduates in Turkey, our analysis is silent on the job quality dimension due to data limitations. It is likely that the VHS graduates may be facing better non-wage job-specific amenities than the GHS graduates early in the labor market. The GHS graduates receive a standard education and they are mostly called "unskilled" or "less-skilled" workers, especially during the early stages of their labor market experience. The VHS graduates on the other hand are taught specific "technical skills" that would guide them through a less uncertain career path. Although we do not have any concrete evidence confirming or discrediting this hypothesis, it would not be surprising to find a job quality gap in favor of VHS graduates especially for young workers. If this is the case, our first-stage estimates—suggesting that availability of VHS in one's town of birth increases the probability of attending VHS—would gain substantial policy relevance. One should also keep in mind that the lack of employment gains to VHS education over GHS education does not imply in any way that there are no wage returns to VHS education, which is a different question and should be addressed separately.

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Summary statistics (Men 26–35)

Age (mean)	30.41
Middle school and below (share)	0.67
General high school only (share)	0.15
Vocational high school only (share)	0.06
2–year college only (share)	0.04
4–year college and above (share)	0.08
In urban areas (share)	0.67
Employed (share)	0.85
Ever married (share)	0.84
# of Observations	263,282

Table 1: **Summary statistics for our sample:** The sample contains men of age 26–35 from the 2000 Census. Schooling categories are mutually exclusive and collectively exhaustive. The VHS category includes all types of VHSs. The "ever married" category includes those who are currently married, divorced, or widowed.

Towns with VHS across years

Year	VHS does not exist	VHS exists	Total # of VHS
1978	659	226	494
1979	640	243	528
1980	623	260	558
1981	617	266	583
1982	614	269	600
1983	612	271	621
1984	608	275	639
1985	603	280	652
1986	601	282	663
1987	593	292	693

Table 2: **Number of towns with VHS over years.**

First-stage relationship between the existence of VHS and educational attainment

	MS and below	GHS	VHS	2Y–COL	4Y–COL	Y of EDUC
Existence of VHS	-0.035***	0.005	0.016***	0.005***	0.009***	0.282***
[Panel 1]	(0.006)	(0.003)	(0.002)	(0.001)	(0.003)	(0.055)
Existence of VHS	-0.004	-0.005**	0.007***	0.001	0.000	0.024
[Panel 2]	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)	(0.028)
Existence of VHS	-0.005	-0.004*	0.007***	0.001	0.001	0.032
[Panel 3]	(0.004)	(0.002)	(0.002)	(0.001)	(0.002)	(0.028)
Mean of Dependent Var.	0.671	0.152	0.061	0.033	0.081	7.647
# of Observations	263,282					

Table 3: **First-stage estimation:** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. Each column shows a separate estimation and the name of the dependent variable is given at the top of the column. All dependent variables are defined as binary variables. MS, GHS, VHS, and COL refer to middle school, general high school, vocational high school, and college, respectively. The main variable of interest is the existence of VHS in the town of birth at age 13. **The first panel** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, and the urban/rural status. **The second panel** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The third panel** also controls for town-specific number of establishments and employed workers. The sample contains men from 80 provinces of age 26–35.

First-stage relationship between the number of VHS and educational attainment

	MS and below	GHS	VHS	2Y–COL	4Y–COL	Y of EDUC
Number of VHS	-0.005	0.002	0.003**	0.001	-0.001	0.011
[Panel 1]	(0.005)	(0.002)	(0.001)	(0.001)	(0.004)	(0.040)
Number of VHS	0.000	0.000	0.001	-0.001	0.000	-0.022
[Panel 2]	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.017)
Number of VHS	-0.001	0.001	0.001	-0.000	-0.001	-0.015
[Panel 3]	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.019)
Mean of Dependent Var.	0.632	0.157	0.073	0.039	0.099	8.004
# of Observations	126,079					

Table 4: **First-stage estimation:** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. Each column shows a separate estimation and the name of the dependent variable is given at the top of the column. All dependent variables are defined as binary variables. MS, GHS, VHS, and COL refer to middle school, general high school, vocational high school, and college, respectively. The main variable of interest is the number of VHS in the town of birth at age 13. **The first panel** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, and the urban/rural status. **The second panel** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The third panel** also controls for town-specific number of establishments and employed workers. The sample contains men from 80 provinces of age 26–35, from the towns with at least one VHS.

IV estimation: 1st specification (entire sample)

	OLS	**IV–1**	**IV–2**	**IV–3**	**IV–4**
VHS degree	0.049***	0.262***	0.092	0.083	0.076
	(0.003)	(0.092)	(0.149)	(0.154)	(0.155)
Mean of dependent var.	0.845	0.845	0.845	0.845	0.845
# of Observations			56,150		
Instruments					
Existence of VHS at age 13	No	Yes	Yes	Yes	Yes
Number of VHS at age 13	No	No	No	No	Yes

Table 5: **IV estimation – 1st specification (entire sample):** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. **The second column (IV–1)** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status. **The third column (IV–2)** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The fourth column (IV–3)** also controls for town-specific number of establishments and employed workers. **The fifth column (IV–4)** also has full set of controls and uses number of VHS as an instrument as well. The sample contains men from 80 provinces of age 26–35, who have **exactly a high school degree**.

IV estimation: 1st specification (younger men, age 26–30)

	OLS	**IV–1**	**IV–2**	**IV–3**	**IV–4**
VHS degree	0.053***	0.311**	0.170	0.163	0.160
	(0.004)	(0.126)	(0.225)	(0.231)	(0.231)
Mean of dependent var.	0.828	0.828	0.828	0.828	0.828
# of Observations			32,611		
Instruments					
Existence of VHS at age 13	No	Yes	Yes	Yes	Yes
Number of VHS at age 13	No	No	No	No	Yes

Table 6: **IV estimation – 1st specification (younger men):** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. **The second column (IV–1)** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status. **The third column (IV–2)** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The fourth column (IV–3)** also controls for town-specific number of establishments and employed workers. **The fifth column (IV–4)** also has full set of controls and uses number of VHS as an instrument as well. The sample contains men from 80 provinces of age 26–30, who have **exactly a high school degree**.

IV estimation: 1st specification (older men, age 31–35)

	OLS	**IV–1**	**IV–2**	**IV–3**	**IV–4**
VHS degree	0.042***	0.181*	-0.006	-0.019	-0.018
	(0.005)	(0.099)	(0.150)	(0.155)	(0.154)
Mean of dependent var.	0.881	0.881	0.881	0.881	0.881
# of Observations			23,539		
Instruments					
Existence of VHS at age 13	No	Yes	Yes	Yes	Yes
Number of VHS at age 13	No	No	No	No	Yes

Table 7: **IV estimation – 1st specification (older men):** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. **The second column (IV–1)** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status. **The third column (IV–2)** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The fourth column (IV–3)** also controls for town-specific number of establishments and employed workers. **The fifth column (IV–4)** also has full set of controls and uses number of VHS as an instrument as well. The sample contains men from 80 provinces of age 31–35, who have **exactly a high school degree**.

IV estimation: 2nd specification

	OLS	**IV–1**	**IV–2**	**IV–3**	**IV–4**
VHS degree	0.045***	0.235***	0.084	0.072	0.081
	(0.003)	(0.085)	(0.139)	(0.146)	(0.145)
Mean of dependent var.	0.854	0.854	0.854	0.854	0.854
# of Observations			65,035		
Instruments					
Existence of VHS at age 13	No	Yes	Yes	Yes	Yes
Number of VHS at age 13	No	No	No	No	Yes

Table 8: **IV estimation – 2nd specification:** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. **The second column (IV–1)** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status. **The third column (IV–2)** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The fourth column (IV–3)** also controls for town-specific number of establishments and employed workers. **The fifth column (IV–4)** also has full set of controls and uses number of VHS as an instrument as well. The sample contains men from 80 provinces of age 26–35, who have **a high school degree** or a **2–year college degree**. VHS and 2–year college graduates are grouped together.

IV estimation: 3rd specification

	OLS	**IV–1**	**IV–2**	**IV–3**	**IV–4**
VHS degree	0.019***	0.281***	0.114	0.098	0.077
	(0.003)	(0.099)	(0.155)	(0.156)	(0.157)
Mean of dependent var.	0.871	0.871	0.871	0.871	0.871
# of Observations			86,587		
Instruments					
Existence of VHS at age 13	No	Yes	Yes	Yes	Yes
Number of VHS at age 13	No	No	No	No	Yes

Table 9: **IV estimation – 3rd specification** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. **The second column (IV–1)** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status. **The third column (IV–2)** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The fourth column (IV–3)** also controls for town-specific number of establishments and employed workers. **The fifth column (IV–4)** also has full set of controls and uses number of VHS as an instrument as well. The sample contains men from 80 provinces of age 26–35, who have **at least a high school degree**. VHS and 2–year college graduates are grouped together, and GHS and 4–year college graduates are grouped together.

IV estimation: Using VHS availability at age 11 as the instrument

	OLS	**IV–1**	**IV–2**	**IV–3**	**IV–4**
VHS degree	0.049***	0.313***	0.189	0.182	0.202
	(0.003)	(0.088)	(0.138)	(0.142)	(0.139)
Mean of dependent var.	0.845	0.845	0.845	0.845	0.845
# of Observations			56,150		
Instruments					
Existence of VHS at age 11	No	Yes	Yes	Yes	Yes
Number of VHS at age 11	No	No	No	No	Yes

Table 10: **IV estimation (VHS availability at age 11):** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. **The second column (IV–1)** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status. **The third column (IV–2)** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The fourth column (IV–3)** also controls for town-specific number of establishments and employed workers. **The fifth column (IV–4)** also has full set of controls and uses number of VHS as an instrument as well. The sample contains men from 80 provinces of age 26–35, who have **exactly a high school degree**.

IV estimation: Using VHS availability at age 9 as the instrument

	OLS	**IV–1**	**IV–2**	**IV–3**	**IV–4**
VHS degree	0.049***	0.375***	0.255	0.247	0.256
	(0.003)	(0.097)	(0.172)	(0.179)	(0.173)
Mean of dependent var.	0.845	0.845	0.845	0.845	0.845
# of Observations			56,150		
Instruments					
Existence of VHS at age 9	No	Yes	Yes	Yes	Yes
Number of VHS at age 9	No	No	No	No	Yes

Table 11: **IV estimation (VHS availability at age 9):** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. **The second column (IV–1)** controls for age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status. **The third column (IV–2)** also controls for variables indicating the town-level education levels and employment ratios of the previous cohort. **The fourth column (IV–3)** also controls for town-specific number of establishments and employed workers. **The fifth column (IV–4)** also has full set of controls and uses number of VHS as an instrument as well. The sample contains men from 80 provinces of age 26–35, who have **exactly a high school degree**.

Reduced-form estimation for middle-school degree holders or college graduates

	Middle-school degree at most	**At least 2–year college degree**
Exist. of VHS at age 13	-0.001	-0.001
	(0.003)	(0.004)
Mean of dependent var.	0.841	0.910
# of Observations	176,695	30,437

Table 12: **Additional robustness checks:** ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Standard errors are clustered at the town level. These are all linear probability model estimations where the dependent variable is an indicator for being employed. VHS refers to vocational high school. Controls include age fixed effects, province-of-birth fixed effects, town-of-birth population at the survey year, urban/rural status, variables indicating town-level education/employment levels of the previous cohort, and the town-specific number of establishments and employed workers. The first column contains men from 80 provinces of age 26–35, who have **at most a middle-school degree** and the second column contains those who have **at least a 2–year college degree**.