The Impact of Work-Based Education on Personality Skills

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Abstract

A growing literature establishes that personality skills affect life outcomes substantially. However, little is known about the impact of education on personality skills. Hence, this paper analyzes how work-based upper secondary education affects personality skills compared to school-based upper secondary education. We employ three identification strategies to account for selection into education. The first analyzes growth of personality skills. The second approach instruments education choice by regional differences in the relative weight of school- and work-based education across Switzerland, set historically by the regional governments. The third strategy instruments education choice by the fact that students born in countries where work-based education is less prevalent are less likely to select into work-based education. Our results suggest that work-based secondary education permanently increases emotional stability and agreeableness while decreasing openness. Results regarding conscientiousness and extraversion on the other hand are ambiguous. Heterogeneous treatment effects are found for girls and boys.

1. Introduction

"The most promising adolescent programs integrate aspects of work into traditional education. […] In earlier times, adolescents took apprenticeships and jobs where they were supervised and mentored by adults. Mentoring involved teaching valuable character skills – showing up for work, cooperating with others, and persevering on tasks" (Heckman and Kautz 2013:35).

The relationship between personality skills[1] and success in life has been widely demonstrated, as such skills have been found to be strong predictors of academic performance and life outcomes (see, e.g., Almlund et al. 2011; Borghans et al. 2008; Boyce, Wood, and Powdthavee 2013; Brunello and Schlotter 2011; Falch, Nyhus, and Strøm 2014; Fletcher 2013; Heckman and Kautz 2012; Lindqvist and Vestman 2011). Adolescence is shown to be a time during which personality skills are still fluid compared to adulthood. Though they may change as a result of educational experience, there is surprisingly little evidence on the effect of education on personality skills (Büttner, Thiel, and Thomsen 2011; Dahmann and Anger 2014; Hanushek et al. 2011; Heckman, Stixrud, and Urzua 2006; Meghir, Palme, and Simeonova 2013), and none of the studies focuses on work-based education. Previous evidence has shown that work experience has effects on a wide variety of personality skills (for an overview see Roberts, Caspi, and Moffitt 2003). Hence, breaking down the rigid separation between school and work, work-based education may affect personality skills differently than full-time school-based education. Therefore, this paper aims to provide first evidence on the causal effect of work-based upper secondary education on personality skills related to the Big Five (Costa and MacCrae 1992; McCrae and Costa 1987).[2]

We exploit a dataset that follows the participants of the 2000 Swiss Program for International Student Assessment (PISA) examination at grade 9 up to the age of 25. Descriptive statistics suggest that the selection of students into the treatment group of work-based education and the control group of school-based vocational education is quite similar in terms of PISA scores and socio-economic background of the parents, though the data suggests that the personality skills of students might affect the selection of the educational track. Hence, to address these concerns regarding endogeneity due to selection and unobserved heterogeneity, we apply three different strategies. First, we make use of the panel structure of our data set to analyze changes over time. Second, we apply an Instrumental-Variable Approach that exploits re-

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[1] Other terms used for similar concepts in the literature include soft skills, character skills, psychological skills, personality traits, character, personality factors or socio-emotional skills (Borghans et al. 2008; Heckman and Kautz 2013; Heckman, Pinto, and Savelyev 2013).

[2] This paper forms interpretable aggregates of facets of personality skills through factor analysis. This method summarizes the covariablity among different personality measures using low-dimensional latent variables. The latent factors variables are the factors.

gional differences in the relevance of general secondary education across Switzerland. The regional differences in the shares of general secondary education, which varies between 10 and 32 percent, are based on historical decisions made by the government and remained stable over the last 20 to 30 years and we therefore argue that these historical differences produce exogenous variation. We address potential unobserved heterogeneity across regions correlated to both personality skills and general secondary education share, such as cultural variation, by controlling for the level of personality skills in each region, comparing regions within relatively homogenous areas and controlling for a broad set of control variables on the individual and regional level. Third, we apply a second instrument based on the relevance of work-based education in the students' country of origin.

Findings show that work-based education increases emotional stability (i.e. the positive pole of neuroticism), potentially increases agreeableness and decreases openness compared to school-based vocational education. The evidence regarding conscientiousness and extraversion indicates an increasing effect that is unstable across methodologies though. The effect sizes are economically significant. The results suggest that the impact on emotional stability and agreeableness represents a permanent shift, while the potential difference in conscientiousness disappears over time. Analyzing the heterogeneity of the effects between females and males reveals that work-based education compared to school-based vocational education increases emotional stability for females more than for males. The decreasing effect on openness seems to be driven through males. The significance of the effect on agreeableness is more stable for females, though the effect size is similar.

The remainder of this paper is organized as follows. Section 2 reviews the existing evidence on the effects of education on personality skills and discusses how work-based education may affect personality skills. Section 3 reveals the data, and section 4 presents the estimation strategy. Section 5 reports our results of the impact of work-based education on personality skills, and section 6 presents our paper's conclusions.

2. Literature and Theoretical Framework

Recent literature finds that non-cognitive skills, such as personality skills – especially those related to conscientiousness, neuroticism and openness – have a significant impact on a wide range of outcomes (Almlund et al. 2011; Borghans et al. 2008; Brunello and Schlotter 2011; Fletcher 2013; Gensowski 2013; Heckman and Kautz 2012; Lindqvist and Vestman 2011). For example, recent evidence shows that 30 to 40 percent of the explained variance in achievement test scores across student is due to personality skills and not IQ (Heckman, Pinto, and Savelyev 2013).

Substantial evidence exists that these personality skills are not permanently entrenched at birth (Boyce et al. 2013; Hanushek et al. 2011; Heckman et al. 2013). While the literature claims that genetic factors are responsible for the stability of personality skills, environmental factors are responsible for changes in personality skills (Blonigen et al. 2006; Borghans et al. 2008; Lykken et al. 1993). Late adolescence and early adulthood seem to be critical and sensitive periods, i.e., a time when personality skills are still very fluid compared to adulthood (Cobb-Clark and Schurer 2012; Dahl 2004; Roberts and Mroczek 2008; Roberts, Walton, and Viechtbauer 2006). As the predominant environment during adolescence and early adulthood is the educational environment, it may influence personality skills. Therefore, it is important to understand how personality skills can change, in particular, to what extent education influences the development of personality skills.

The Impact of Education on Personality Skills

Only a few empirical studies have examined the causal relationship between education and personality skills. Heckman, Stixrud and Urzua (2006) formulate a theoretical model for the effect of school years on cognitive skills and personality skills. Importantly, the model reveals the possibility of reverse causality, i.e. selection of students into education according to cognitive and non-cognitive skills. They find evidence that the number of years of schooling affects personality skills. Concretely, an additional year of either high school or college increases self-esteem, while the locus of control is primarily affected by high school, but not college attendance. Both personality measures are associated with neuroticism[3]. Büttner et al. (2011), in contrast, using a natural experiment in Germany induced by an educational policy reform, where the last year of higher secondary schooling was abolished, find no effect of learning intensity on personality skills. However, Dahmann and Anger (2014), analyzing the same educational reform for the whole country, show a decreasing impact on emotional stability with substantial heterogeneity in the effects. Meghir et al. (2013) analyze an increase of schooling years in Sweden, suggesting that non-cognitive skills are improved, though only for students with high socio-economic background. In addition, Lüdtke et al. (2011) present evidence for Germany that a life experience, i.e. failing an important exam is associated with a change in personality skills, in this case an increase in neuroticism. Jackson (2011) analyzes the impact of educational experience on personality skills and suggests that educational contexts are important for the development of personality skills. In this study experiences outside the classroom were also related to changes in personality skills, e.g. spending time working for pay was associated with increases in extraversion, but not with changes in any other personality skills. However, this study does not identify causal effects.

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[3] Self-esteem refers to an individual's subjective sense of his own worth (De Wals and Meszaros 2011). Locus of control refers to an individual's belief about whether the determinants of one's life are determined internally or externally (Rotter 1966).

The Impact of Interventions Before or During School on Personality Skills

Some studies have analyzed the impact of different interventions[4] before or during school on personality skills. Studies based on the randomized Perry Preschool and STAR projects find that home visits, better peers and smaller classes[5] positively impact personality skills (Dee and West 2011; Heckman, Pinto, and Savelyev 2012; Heckman et al. 2013). Heckman et al. (2013) analyze the channels through which these persistent changes in personality skills may occur: The reduction in externalizing behavior, i.e. aggressive, antisocial and rule-breaking behaviors, is especially strong. Thus, factors other than cognitive skills, such as personality skills, are potentially influenced by experiences within the educational system (Jackson 2011). While these two projects are not designed to affect personality skills, there are programs that do. For example, a randomized 3-year socio-emotional learning program, the Promoting Alternative Thinking Strategies (PATHS) curriculum, is associated with an increase in authority acceptance, concentration and social competence (Bierman et al. 2010). Other interventions are more short-term and designed to isolate a particular effect. In a randomized experiment in Switzerland (Behncke 2009), the treatment group received positive affirmation intervention before taking a math test. The test scores for the treatment group were significantly raised, which the author attributes to a change in non-cognitive abilities, such as an increase in student motivation and self-confidence and a decrease in test anxiety. Accordingly, the learning environment, e.g., teacher practices, seems to be crucial for the development of personality skills.[6]

The Impact of Work on Personality Skills

The question whether work-based education causes a change in personality skills is addressed in this paper. Good-quality workplace learning provides students with valuable labor market experience before graduation by enabling apprentices to develop technical skills and gain real world experiences (OECD 2013). Based on the neo-socioanalytic model (Roberts and Wood 2006) change in personality skills is a result from the transaction between people and their environments, e.g. a person's participation in social norms and the social interactions. In general, these new structures prompt people to become more agreeable and conscientious and less neurotic (Roberts and Wood 2006). Given the high

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[4] For an overview, see Almlund et al. (2011), Brunello and Schlotter (2011) or Heckman and Kautz (2013).

[5] For Sweden, Fredriksson et al. (2013) apply a regression discontinuity approach to show that a unit reduction in class size improves non-cognitive outcomes by 0.026 of a standard deviation.

[6] Others relate systemic features of school systems to personality traits (Falck and Woessmann 2010). Luedemann (2011), for example, finds a small but significantly positive impact on students' personality traits results from the monitoring of teacher lessons by the principal or external inspectors according to assessments used to compare the school to district or national performance standards.

proportion of time many individuals spend each day at the workplace, the workplace may be one of the domains within which personality changes. Several empirical studies have examined the relation between work experiences and personality, showing that work has effects on a wide variety of skills (for an overview see Roberts, Caspi, et al. 2003), consistent with the neo-socioanalytic model. For example for men using a wider variety of skills on the job is related to increases in emotional stability (Brousseau and Bruce 1981). Women's participation in the paid labor force is associated with an increase in conscientiousness (Roberts 1997). Moreover, for both sexes, occupational attainment and work satisfaction are associated with an increase in emotional stability and conscientiousness (Roberts, Caspi, et al. 2003; Roberts and Chapman 2000). Lüdtke et al. (2011) show that positive experiences of beginning regular work were associated with increases in emotional stability. Further, applying a Diffs-in-Diffs Approach, they find that entering work or vocational education after general secondary education at age 19 (in this research we analyze the transition from compulsory education to secondary education at age 15) compared to starting college is associated with an increase in conscientiousness and a decrease in agreeableness (Lüdtke et al. 2011). However, a common trend is assumed.

Channels Through which Work-Based Education Might Affect Personality Skills

On the basis of this previous research, we identify four channels, i.e. mechanisms that have the potential to be related to a different causal effect to change in personality skills for work-based education compared to full-time school-based vocational secondary education. Recent evidence shows, that there is nearly no correlation between the effect of teachers on students' test scores and on students' non-cognitive outcomes (Jackson 2012). Therefore teachers and schools face a trade-off between investments in cognitive skills and personality skills, which we label the *Trade-off channel*. Full-time schools measure student achievement by cognitive tests, as personality skills are difficult to measure. Moreover, general secondary education teachers are not allowed to rate or assess students' personality skills, while firms training apprentices have to follow a prescribed curriculum, including teaching of personality skills. Accordingly, full-time schools do not focus on the development of personality skills. Because apprentices, on the other hand, come into contact with clients, instructors are more inclined and have to invest resources in the development of personality skills.

Individuals are assumed to change personality skills as they learn social norms, most often on the basis of feedback from peers (Roberts, Caspi, et al. 2003; Turner 2013). This *Feedback Channel* may affect apprentices different compared to students because apprentices are supervised and mentored by professionals in the training firm and most have contact with clients. Therefore, education in the workplace may involve the teaching of different personality skills (Heckman and Kautz 2013; Lerman 2013). For example, apprentices must report for work on time (punctuality), and they do not have the option of 'skipping' the first lesson. They also have to cooperate with others more intensely (team

work) and not only with students of the same age but also with adults and professionals who are older and more experienced (OECD 2013). Therefore, apprentices face a much older and more experienced peer group. By serving as role models, these older peers may affect the personality skills of individuals. Furthermore, peers have the potential to sanction non-conforming social behaviors. Relatedly, as apprentices earn wages, the training firms also have the possibility to sanction non-conforming behaviors. Persevering on tasks (work discipline) and reliability represent examples of skills that apprentices must acquire to be successful in their workplace environment. Following a more disciplined schedule with structured expectations increases conscientiousness, which is shown for students entering vocational training or work after general secondary education compared to students entering college (Lüdtke et al. 2011).

Two other domains of work-related socialization are power, e.g. having the ability to get things done and the feeling that one is gaining financial security (Roberts, Caspi, et al. 2003). Through experiences of fulfilling task and obligations individuals develop responsibility (Roberts, Wood, and Smith 2005). We use the term *Responsibility Channel* for this socialization process which may affect apprentices different compared to students because apprentices face more responsibility. First, they interact directly with clients. Second, they are responsible for valuable equipment, and third they serve as role models for the younger apprentices. Hence, during their education, they assume a supervisory and parental role for younger apprentices. Taking on a new role or obligations is described as the first step in the youth's cycle of developing responsibility (Salusky et al. in press). Fourth, apprentices earn for the first time some money and therefore "feel that they have "made" the transition to adulthood or maturity" (Roberts, Caspi, et al. 2003:584) which is associated with skills such as emotional stability, agreeableness, and conscientiousness (Roberts, Robins, et al. 2003). Accordingly, acting responsibly and feeling responsible is important and may lead to increased self-confidence and reliable behavior. Hence, we hypothesize that these three channels would be related to increases in conscientiousness and emotional stability. However, we remain agnostic regarding the expected relationship to agreeableness, because the above effects might be offset by the more serious nature of work-based education attenuating agreeableness (Lüdtke et al. 2011). The effect on agreeableness is unclear.

Students starting work-based education move earlier from the freedom of adolescence to the responsibilities of adulthood (process of social investment) than students moving to full-time school-based secondary education. This so-called social investment process (Lodi-Smith and Roberts 2007)[7] in the workplace is associated with personality skill change (Hudson and Brent 2012). We therefore label this channel the *Freedom Channel* that arises because students in school-

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[7] The social investment process is shown for the example of young adults who entered for the first time a long-term romantic relationship and experienced a simultaneous increase in emotional stability (Lehnart, Neyer, and Eccles 2010).

based education profit from a higher degree of freedom and more leisure time. This includes both freedom regarding the way students learn and the amount of leisure time they have each week. Furthermore, school-based education offers more than twice as much vacation time for students compared to apprentices, which typically have 5 to 6 weeks of vacation per year. The lower degree of freedom might foster extrinsic over intrinsic motivation and decrease openness to new experiences as suggested by the self-determination theory (Deci and Ryan 1985; Ryan and Deci 2000). Komarraju et al. (2009) support this hypothesis by showing that openness is related to intrinsic motivation of college students. Komarraju et al. (2009) further show that extrinsic motivation is positively related to extraversion. In the light of the freedom channel, this suggests that work-based education increases extraversion. This is supported by the finding that extraversion is positively associated with earning money (Viinikainen et al. 2010).

3. Data

In this research, we use the Transition to Education and Employment survey (TREE) [8]. The TREE is a longitudinal follow-up panel study to the PISA 2000 that was conducted in Switzerland. The TREE survey is administered each year between 2001 and 2007 and in 2010. The sample is representative of both the country as a whole and its three main language regions (German, French, and Italian). This unique database combines the variables in the standard PISA survey, such as parental background, PISA test scores and living conditions with information on personality factors and employment/education status. Table 1 summarizes the dependent variables used in this analysis. Furthermore, appendix A1 shows a description of the variables in Table A1.2 and the corresponding descriptive statistics of the balanced panel in Table A1.3.

Swiss Education System

After completing the Swiss compulsory school (9th grade), adolescents can choose among several possibilities. Almost half of the students (43%) enter apprenticeship training programs. Apprenticeships are a core element of the vocational education and training (VET) in Switzerland and typically last three or four years. They combine on-the-job training at the training firm with one to two days of classroom learning in a vocational school per week. Of the students finishing

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lower secondary education, 30% begin a general upper secondary educational program (high school), i.e., a full-time school-based education that allows entry to universities upon successful completion, 9% choose a vocationally oriented, full-time school-based upper secondary educational program (HMS, DMS, FMS), which prepare for direct labor market entrance (in this paper, we use the term "school-based vocational secondary education"), 16% follow an alternative education path, 1% enter the workforce and 1% do nothing. However, these percentages differ substantially among the various Swiss cantons (member states), and these differences have been highly persistent for the last 20 years (SKBF 2011).

Measures of Personality Skills

The choice of the five dependent variables employed in this study follows the psychological concept of the Big Five personality traits (Costa and MacCrae 1992; McCrae and Costa 1987). Each of the five dimensions openness, conscientiousness, extraversion, agreeableness, and neuroticism incorporates a large number of distinct, more specific personality facets. . "[T]hese broad dimensions are key determinants of behavior, and the aggregation of information resulting from a person's placement on these dimensions gives a reasonably good snapshot of what a person is like" (Carver and Connor-Smith 2010:681). Unfortunately, the Big Five inventory is not included in the TREE data. We therefore use a number of self-reported measures[9] of personality skills, as summarized in Table 1, where their correspondence to some of the facets (bold) with the Big Five personality traits is noted.[10]

Table 1: Dependent Variables

Big Five Item	Big Five Facets	American Psychology Association Dictionary	Approximation	Questionnaire Items in the TREE Data	Likert Scale
Openness	Fantasy, Aesthetics, Feelings, Actions, Ideas, **Values**	The tendency to be open to new aesthetic, cultural, or intellectual experiences	**Purpose of Working**	Thinking about the future, how important is it to have a job, where I have a lot of contact with other people. Thinking about the future,	1=totally subordinate; 2=rather subordinate; 3=rather important; 4=very important 1=totally subordinate;

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[9] Measurement of latent factors with self-reports may be false when false responses are made because of impression management or due to self-deception (Paulhus and Reid 1991; Paulhus 1984).

[10] As a robustness check for the correlation between the personality skill measures used in this research and the Big Five personality traits, Table A1.1 shows correlations between the cantonal average of the measures employed in this paper and the cantonal average of the Big Five Inventory-Ten (Rammstedt and John 2007) as reported in the Swiss Household Panel (http://forscenter.ch/en/our-surveys/swiss-household-panel/). All correlations exceed .5, except for openness, which might be explained by the fact that the Big Five Inventory-Ten focuses on the facet of fantasy and aesthetics. Furthermore, Section A3 in the appendix provides further discussion regarding the relationship of our personality skill measures and the conceptual framework of the Big Five personality traits.

				how important is it to have a job, where I can help other people.	2=rather subordinate; 3=rather important; 4=very important
				Thinking about the future, how important is it to have a job, which gives me the feeling of doing something sensible.	1=totally subordinate; 2=rather subordinate; 3=rather important; 4=very important
Conscientiousness	Competence, Order, Dutifulness, Achievement, **Self-discipline**, **Deliberation**	The tendency to be organized, responsible, and hardworking	**Task-centered coping**	When I am stressed or find myself in a difficult situation, I focus on the problem and see how I can solve it.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical
				When I am stressed or find myself in a difficult situation, I think about the event and learn from my mistakes.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical
Extraversion	Warmth, **Gregariousness**, Assertiveness, **Active**, Excitement seeking, Positive emotions	An orientation of one's interest and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability	**Leisure time valuation**	How important is it to have a job, where I have a lot of leisure?	1=totally subordinate; 2=rather subordinate; 3=rather important; 4=very important
				How important is it to have a job, where I have a lot of time for myself?	1=totally subordinate; 2=rather subordinate; 3=rather important; 4=very important
				How important is it to have a job, where I have a lot of time for my friends?	1=totally subordinate; 2=rather subordinate; 3=rather important; 4=very important
Agreeableness	**Trust**, Straightforwardness, Altruism, Compliance, Modesty, Tendermindedness	The tendency to act in a cooperative, unselfish manner	**Contact-centered coping**	When I am stressed or find myself in a difficult situation, I try to be with other people.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical
				When I am stressed or find myself in a difficult situation, I visit a friend.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical
Neuroticism (the inverse of	Anxiety, Anger, Depression, Self-consciousness, **Impulsiveness,** Vulner-	Neuroticism is "a chronic level of emotional instability and proneness to psycho-	**Emotion-centered coping**	When I am stressed or find myself in a difficult situation, I get angry.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical

Emo-tional Stabil-ity)	ability	logical distress". Emotional stability is "Predictability and consistency in emotional reactions, with absence of rapid mood changes."	When I am stressed or find myself in a difficult situation, I feel anxious about not being able to cope.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical
			When I am stressed or find myself in a difficult situation, I blame myself for not knowing what to do.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical
			When I am stressed or find myself in a difficult situation, I wish I could change what has happened.	1=very atypical; 2=rather atypical; 3=so, so; 4=rather typical; 5=very typical

Source: Rows two and three adapted from Costa and MacCrae (1992) and Heckman and Kautz (2013), respectively. Bold facets refer to facets explained in this research.

There are many ways to summarize the available psychological measures in TREE. The approach used in this paper is exploratory factor analysis. Factor analysis is the standard approach for defining constructs in personality psychology (Borghans et al. 2008) and is applied by Heckman et al. (2013) when summarizing Perry Preschool psychological measures in order to interpret them in terms of the Big Five personality traits. Using the within-cluster correlations of the measures, we isolate a latent factor for each of the personality skills, thereby create a low dimensional and interpretable aggregate of the employed psychological measures. The rotated factor loadings of the principal component factor analysis displayed in Table A1.1 confirm that the employed proxies represent independent dimensions. The table further shows that the measures aggregated in each dimension are internally consistent, i.e. load into the same factor with sufficient strength. Table A1.3 shows summary statistics for the factor scores divided by the educational path.

We therefore provide evidence on specific facets of the Big Five personality traits[11]. Conscientiousness, emotional stability and agreeableness are based on questions regarding coping strategies with stress and difficult situations, i.e. efforts to prevent or diminish threat, harm, and loss. Given exposure to such stressors, personality can influence coping in several ways. Personality may affect coping directly by facilitating the use of specific strategies or indirectly by influencing the severity of stressors experience (Bolger and Zuckerman 1995; Connor-Smith and Flachsbart 2007). Studies found strong correlations between personality and different coping strategies (for an overview see Connor-Smith and Flachsbart 2007; Fleishman 1984)[12].

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[11] Different facets in the domain of the personality skills may change differently. Jackson et al. (2009) show that some facets of conscientiousness such as impulse control increase with age, but orderliness does not.

[12] However, two meta-analyses (Connor-Smith and Flachsbart 2007; Solberg Nes and Segerstrom 2006) suggest that the relation between personality and coping is modest, but Carver and Connor-Smith (2010) highlight, that this does not mean that the impact of personality on

Concretely (see Table 1), our measure of conscientiousness (CONSC) refers to structured and determined coping strategies, hence captures the facets self-discipline and deliberation. The measure for neuroticism or emotional stability (STAB) refers to emotional coping strategies, suggesting that it corresponds to the facet impulsiveness. Turning to other people when facing difficult situations is related to the trust facet of agreeableness (AGREE). Openness to experience (OPEN) is modeled as intrinsic work motivation, thus capturing the value facet. Extraversion (EXTRA) is captured by the relevance of leisure time, hence corresponds to the gregariousness facet.

4. Estimation Strategy

To assess the impact of work-based education on personality skills compared to full-time school-based vocational education, we start by estimating an OLS equation of the following form:

$$P_{it} = \alpha + \alpha_t + \beta_1 A_i + \beta_2 B_{it} + \varepsilon_{it}, \hspace{3cm} [1]$$

where A is a dummy variable indicating work-based education (apprenticeship) and P represents the personality skills of student i at time t. B is a set of control variables, e.g. gender, age, PISA reading scores, socioeconomic background of mother and father, family structure, urban living. Tables A1.2 and A1.3 contain a description of all control variables included in the estimations as well as descriptive statistics. ε is a random error with mean 0, clustered at the individual level.

We construct our treatment group from individuals who start work-based education in 2001 and remain apprentices until 2003, and we compare the outcomes to a control group[13] that participates in full-time vocational schooling (see description of Swiss education system in section 2). This control group starts school-based vocational secondary education in 2001 and remains enrolled in the program until 2003. We restrict the sample to observations of individuals who have responded in all employed variables between 2001 and 2003, i.e. create a balanced sample for this period. However, the measures used to construct personality skills are not available for all years. In order to enable an analysis of differences across time, we linearly interpolate openness and extraversion for the year 2002 and linearly interpolate the values of conscientiousness, agreeableness and emotional stability in 2003.

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coping is negligible, but that specific coping strategies should be tested rather than only broad coping types. However, coping literature reveals more than 100 coping categorization schemes, which complicates meta statements (Skinner et al. 2003).

[13] Using observations of individuals in the respective track in 2001, 2002, 2003 and 2004 yields qualitatively similar results.

Ability-based selection into control and treatment group is similar, because both programs are vocational and allows direct entrance in the labor market. This is confirmed by the similar values of the two groups for the PISA reading scores, number of books at home, ISEI of the father and education of the mother displayed in Table A1.3.[14] However, table A1.3 reveals substantial differences between control and treatment group in terms of personality skills, highlighting the possibility of selection into education track according to personality skills (Hanushek et al. 2011; Heckman et al. 2006). Hence, OLS estimates may suffer from an endogeneity bias due to selection. For example, low emotional stability might lead the student to choose a vocational school-based education rather than work-based secondary education. Because we can never observe the same student under different secondary education treatments, the credibility of an empirical analysis depends on the plausibility of the identification strategy. Our first approach to tackle selection is to exploit the longitudinal structure of the data base. Including the lagged dependent variable P_{it-1} on the right hand side accounts for selection in terms of the personality skill level (LDV):

$$P_{it} = \alpha + \alpha_t + \beta_1 A_i + \beta_2 B_{it} + \beta_3 P_{it-1} + \varepsilon_{it.} \qquad [2]$$

While this approach represents a first step towards a causal interpretation, we still assume a common trend, i.e. that personality skill trends would be the same for both groups of students in the absence of the treatment. Since we observe personality skills in 2001 for the first time, we cannot test this assumption. Furthermore, the first observation of personality skills takes place a few months after the secondary education has started. Hence, this approach disregards any effect that arises during the first months after the start of the education.[15]

Due to these issues with the estimation of [2], we additionally report the results of an instrumental variable (IV) approach (Angrist, Imbens, and Rubin 1996) in which case A_i in formula (1) represents predicted values based on the following first-stage model:[16]

$$A_i = \delta + \delta_t + \delta_1 B_{it} + \theta_1 z_{1j} + u_{it}, \qquad [3]$$

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[14] As an extension concerning the comparison between treatment and control group, we compare students enrolled in work-based education to students' enrolled in general secondary education (high school). This has the advantage that the sample size increases substantially. However, Table A1.3 reveals that the students selecting work-based education differ in terms of both ability and personality from students selecting into general secondary education. Hence we treat this control group as a robustness check and report the corresponding results in section A2 of the Appendix. Our results are confirmed and the larger sample size increases estimation precision substantially.

[15] Section A4 of the appendix addresses this issue by displaying and discussing the results of our estimation for late starters, i.e. for individuals who were neither working nor in an apprenticeship in 2001 and who were enrolled in the control or treatment group continuously between 2002 and 2004. The results suggest that our results hold for this small group of individuals, but also that a large portion of the treatment effect occurs in the beginning of the treatment period.

[16] Due to the binary character of the endogenous variable, we estimate the model with the treatreg command of Stata12 and use the ivreg2 command of Stata 12 as a robustness check and to provide statistical tests for weak instruments and overidentification.

where z denotes our instrumental variables and u is a random error term. Subscript j refers to the level of the instrument.

We use two different instruments as described in Table A1.2 and summarized in Table A1.5 in Appendix A1. Thereby, we provide evidence that the instrumental variable approach holds for two different types of arguably exogenous variation. Furthermore, using both instruments simultaneously allows us to conduct a Sargan test, thereby testing the validity of our instrument formally.

The first instrument refers to the share of general secondary education among cantons in Switzerland in 1998. As Table A1.5 shows, this share varies substantially across Switzerland. The cantonal differences in the share of general secondary education are based on historically set shares by the government and reflect the historical differences in the importance of work-based education in the region. Table A1.5 shows that the differences remained stable over the last 20 to 30 years. Figure 1 displays that the national share of general education in Switzerland is independent of the cohort size of the 16 year old. Figure A1.1 in Appendix 1 shows that this holds for each region. We use this historical pattern as a natural experiment to estimate the causal effect of work-based education on students' personality skills in cross-cantonal student-level analyses.

Figure 1: Cohort Sizes of General Upper Secondary Education (High School) and 16-Year Old in Switzerland

Switzerland
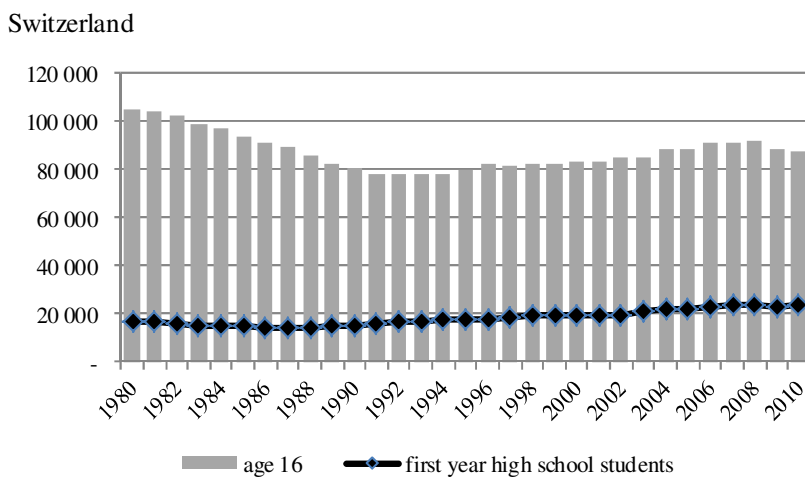
The internal validity of our IV approach relies on the assumption that the cantonal shares of general upper secondary education and personality skills are independent. This assumption, however, may be violated, e.g., because of culture.

Beside of controlling for an extensive vector of control variables, we address this issue in two main ways.[17] First, we include the lagged dependent variable on the right hand side, thereby removing any unobserved heterogeneity in the level of personality skills across cantons. We also report estimates that include the first and second lag of the dependent variable on the right hand side, thereby accounting for differences in both level and trend. Secondly, we add dummies for seven areas in our estimation, implying that we only exploit within-area variation for the identification of the effect and thereby homogenize the variation in terms of, e.g., culture.

Another potential confounder of our estimation arises because personality skills affect occupational choice (Heckman et al. 2006). We address this issue in two ways. First, we include dummy variables for the first job (4-digit ISCO codes). Second, we report estimates that restrict the sample to apprentices in a commercial apprenticeship (KV). Hence, we compare secondary students in a work-based commercial education (KV) with students attending full-time school-based education geared towards office jobs. Hence, both education types allow direct access to the labor market upon successful completion and prepare for the same occupation, but one group is trained in a work-based education and the other in full-time school-based education.

The second instrument exploits the fact that foreigners that are less familiar with the Swiss education system are less likely to choose a work-based education. We approximate familiarity with the principle of work-based education by the share of work-based education in the country of origin, based on the OECD indicator "Students enrolled by type of institution" available at http://stats.oecd.org/.

5. Results

This section starts by presenting the results that address selection by exploiting the longitudinal dimension of the data set to analyze the impact of work-based education compared to vocational schooling on personality skills.[18] Concretely, Figure 2 represents the approach graphically. Table 2 displays the corresponding estimation results, which are complemented by Table A1.4 in appendix A1, displaying simple correlations for all explanatory variables.

Figure 2: Graphical Representation of Personality Skills Change by Education Track

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[17] Further robustness checks reported in Table A1.7 in the appendix include using general secondary education shares in 1980 as instrument, using a 2SLS estimation, excluding the vector of control variables and estimating a reduced form estimation.

[18] Results for the control group general secondary education are similar and can be found the Appendix A2.
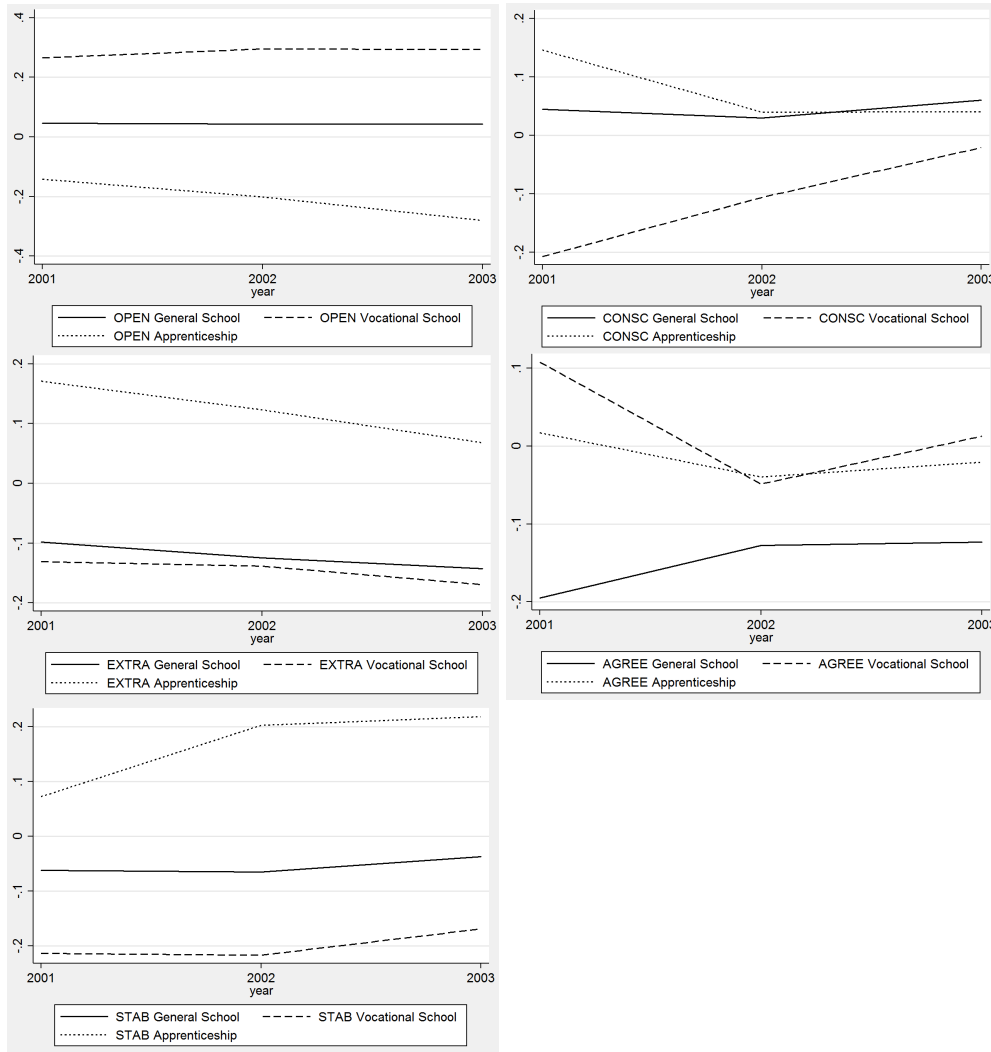
Note: General School refers to students starting general secondary education in 2001, Vocational School refers to students starting full-time school based vocational education, Apprenticeship refers to students starting work-based education in 2001.

Figure 2 and Table 2 suggest that work-based education increases emotional stability but decreases openness. Furthermore, conscientiousness might be decreased. The coefficient estimates are positive but insignificant for extraversion and agreeableness.

Table 2: OLS Estimates Including Lagged Dependent Variable: Work-based Education vs. Vocational School

	OPEN	CONSC	EXTRA	AGREE	STAB

Base POLS (N=2008)					
Apprentice	-0.102*	-0.094*	0.022	0.052	0.099
	(0.052)	(0.052)	(0.043)	(0.042)	(0.067)
Base 2002 (N=1004)					
Apprentice	-0.132***	-0.085	0.046	0.117	0.166**
	(0.037)	(0.074)	(0.038)	(0.071)	(0.068)
Base 2003 (N=1004)					
Apprentice	-0.051	-0.073**	-0.009	-0.025	0.007
	(0.044)	(0.037)	(0.044)	(0.037)	(0.033)

Notes: The table displays OLS coefficients and standard errors clustered at the individual level in parentheses based on the TREE dataset for 2002 and 2003 pooled and separately. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The sample consists of students continuously enrolled in an educational track between 2001 and 2003. All estimates include year dummies and the control variables described in Table A1.2 in addition to the lagged dependent variable.

However, while these estimates control for selection in the level of the dependent variable, we are unable to show that control and treatment group have common trends.[19] Hence, our preferred estimation strategy is based on an instrumental variable approach that exploits the regional variation in the share of general secondary education which was set by government historically. Table 3 displays the baseline results in addition to a number of robustness checks.[20] Apprentice refers to the second-stage coefficients of the endogenized variable indicating work-based education and compares work-based educated students to school-based vocational secondary students. All estimates include covariates that may affect the choice for work-based education, i.e., socio-demographic and socio-economic background, age, gender, language, cantonal religion and particularly important student's competence level measured at the end of compulsory education in the standardized PISA competence measurement.[21] We report Kleibergen-Paap rk Wald F weak instrument statistics, which substantially exceed the critical value of about 16 in all regressions.

Robustness checks include AREA estimates, which add dummy variables for 7 areas in Switzerland, thereby homogenizing the compared cantons. AREA+CULTURE estimates further add dummy variables for the native language to account for potential difference in the cultural heritage. The LDV estimator homogenizes cantons by including the level of the lagged dependent variable. Similarly, the LDV 2 estimator controls for two lags of the dependent variable, thereby capturing differences in both level and change. The KV and NOGA estimates test whether the effect is due to occupa-

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[19] Appendix A4 shows that common trends might be a more reasonable assumption for work-based education and general school while vocational school students have a different common trend. However, this is for late starters for which the selection process might differ.

[20] Table A1.7 in Appendix A1 provide further robustness checks. Appendix A2 shows the results using general school students as control group instead of vocational school students.

[21] We use the PISA Reading Score as opposed to the PISA Math Score due to fewer observations. However, the qualitative results are the same.

tional choice by restricting the sample of work-based education to commercial apprenticeships and adding dummy variables for the first job, respectively. COUNTRY estimates exploit the fact that foreigners that are less familiar with the Swiss education system are less likely to choose a work-based education. Note that country of origin may affect skills and, hence, educational choice. Therefore it is particularly important to add the control vector for estimates using the share of work-based education in the country of origin as instruments as this share is negatively related to the choice of work-based education otherwise.[22] Finally, CANTON+COUNTRY estimates include both the cantonal share of general school students and the share of work-based education in the country of origin as instruments, allowing to test validity of the instruments formally. The Hansen p-value of the overidentification test supports the exogeneity assumption of the instruments.

The baseline estimation suggests a negative influence of work-based education on openness, while conscientiousness, extraversion, agreeableness and emotional stability increase. However, our robustness checks suggest that some of these effects might reflect endogeneity. The most stable of the results is the increase in emotional stability, which is consistently present across methodologies and samples. Furthermore, the negative effect of work-based education on openness remains stable as well. The positive effect on agreeableness is relatively stable for the IV strategies using the share of general school. However, the results become insignificant though positive in estimates that use the share of work-based education in the country of origin as instrument or employ a simple OLS estimation with lagged dependent variable.

Conscientiousness and extraversion tend to be positive in the IV estimates that use the cantonal share of general schooling as instrument, but are mostly insignificant in estimations that account for potential unobserved heterogeneity across cantons. Using the share of work-based education in the country of origin yields insignificant results for conscientiousness. Furthermore, the simple OLS framework with lagged dependent variable suggests a negative impact on conscientiousness and an insignificant effect on extraversion. Due to these inconsistencies across models, we remain agnostic regarding a potential impact of work-based education on conscientiousness and extraversion.

To aid in interpreting the magnitude of the estimated effects, remember that the dependent variables take values between -6 and 4, have a mean of 0 and a standard deviation of 1. Hence, a coefficient of 1 suggests that work-based education (a change from 0 to 1) results in a change in the order of one standard deviation. Therefore, the estimated effects are economically significant.

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[22] The results shown in Table 3 exclude control variables for Language, Swiss and Time Swiss. Hence, identification rests largely on the difference in the share of work-based education between Switzerland and other countries. Table A1.7 shows that including these control variables, i.e. relying on differences in the share of work-based education across other countries, renders the instrument relatively powerless, though the results remain unaffected.

Table 3: IV Estimates: Work-based Education vs. Vocational School

	OPEN	CONSC	EXTRA	AGREE	STAB
BASE (N=3012)					
Apprentice	-0.760***	0.387***	1.032***	0.599***	0.855***
	(0.232)	(0.143)	(0.270)	(0.148)	(0.149)
Kleibergen	45.381	45.381	45.381	45.381	45.381
AREA (N=3012)					
Apprentice	-0.370	0.254	0.915**	0.263	0.603***
	(0.630)	(0.188)	(0.412)	(0.179)	(0.185)
Kleibergen	22.353	22.353	22.353	22.353	22.353
AREA+CULTURE (N=3012)					
Apprentice	-0.364	0.162	0.865*	0.232	0.403**
	(0.663)	(0.180)	(0.496)	(0.188)	(0.161)
Kleibergen	16.394	16.394	16.394	16.394	16.394
LDV (N=2008)					
Apprentice	0.198	0.189	0.061	0.258*	0.306**
	(0.156)	(0.137)	(0.159)	(0.136)	(0.122)
Kleibergen	39.992	44.905	44.944	43.735	41.769
LDV 2 (N=1004)					
Apprentice	0.022	0.070	0.058*	0.012	0.177
	(0.058)	(0.065)	(0.034)	(0.067)	(0.113)
Kleibergen	38.123	48.146	46.031	42.935	42.387
KV (N=1329)					
Apprentice	-0.815**	0.421**	0.787***	0.566***	0.911***
	(0.413)	(0.172)	(0.164)	(0.173)	(0.256)
Kleibergen	41.594	41.594	41.594	41.594	41.594
NOGA (N=2577)					
Apprentice	-0.967***	0.307**	0.781***	0.606***	0.901***
	(0.197)	(0.120)	(0.284)	(0.196)	(0.148)
Kleibergen	22.207	22.207	22.207	22.207	22.207
ORIGIN (N=3012)					
Apprentice	-0.879***	0.055	1.444***	0.376	0.749***
	(0.100)	(0.161)	(0.324)	(0.273)	(0.178)
Kleibergen	38.761	38.761	38.761	38.761	38.761
CANTON+ORIGIN (N=3012)					
Apprentice	-0.776***	0.470***	1.046***	0.700***	0.906***

	(0.232)	(0.166)	(0.343)	(0.226)	(0.172)
Kleibergen	100.716	100.716	100.716	100.716	100.716
Hansen p-value	0.677	0.549	0.358	0.561	0.833

Notes: The table displays coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with the binary endogenous variable Apprentice and the share of general school in the canton as instrument. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The sample based on the TREE dataset consists of students continuously enrolled in an educational track between 2001 and 2003. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38 for 10% maximal IV size. All estimates include year dummies and the control variables described in Table A1.2. AREA and AREA+CULTURE estimates include dummy variables for 7 large areas in Switzerland and for whether the native language is German, French or Other. LDV refers to estimates that include the lagged dependent variable and LDV 2 includes the first and second lag of the dependent variable. KV restricts the treatment group of apprentices to commercial apprenticeships. NOGA estimates include dummy variables for the first occupation. ORIGIN estimates use the share of work-based education in the country of origin as instrument and displays block-bootstrapped standard errors at the country of origin level. CANTON+ORIGIN uses both instruments simultaneously and displays block-bootstrapped standard errors on the level of the canton. Hence, the Kleibergen statistic has a critical value of 19.93. Hansen p-value refers to the p-value of a Hansen overidentification test. ORIGIN and CANTON+ORIGIN estimates exclude Language, Swiss and Time Swiss as control variables.

Extensions

The following paragraphs extend the analysis of the effect of work-based education on the personality skills of adolescents in two directions. First, we compare the effect of work-based education on female and male students. Second, we use information in 2007 and 2010 to evaluate whether the estimated effects are merely transitory or whether work-based education shifts personality skills permanently.

Heterogeneity of the Treatment Effect

This paragraph analyzes whether the impact of work-based education differs between men and women. To this end, Table 4 displays the pooled OLS results including the lagged dependent variable, the baseline IV estimates with the cantonal shares of general upper secondary education as instrument and the corresponding IV estimates that control for the lagged dependent variable for the samples of men and women separately.

Regarding emotional stability, Table 4 suggests that emotional stability of women is more affected than the emotional stability of men.[23] The decreasing effect on openness is statistically significant on the 1 percent levels for males, but is not significant for females. Further the results indicate, that females profit from work-based education with an increase in conscientiousness. Agreeableness has similar effect sizes for women and men, though statistical significance is more stable for women. Splitting the sample in this way suggests that extraversion is affected for neither women nor men.

Table 4: Heterogeneity of Treatment Effect between Men and Women: Work-based Education vs. Vocational School

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[23] However, Table A2.6 in Appendix 2 suggests that emotional stability is increased for both women and men compared to school-based general education.

	OPEN	CONSC	EXTRA	AGREE	STAB
POLS including LDV					
Female (N=1032)					
Apprentice	-0.085**	-0.089	-0.001	0.074	0.120**
	(0.040)	(0.061)	(0.056)	(0.053)	(0.055)
Male (N=976)					
Apprentice	-0.180*	-0.045	0.051	0.048	0.022
	(0.095)	(0.101)	(0.064)	(0.041)	(0.106)
IV					
Female (N=1548)					
Apprentice	-0.496	0.555***	1.343***	0.553***	0.820***
	(0.321)	(0.149)	(0.412)	(0.183)	(0.174)
Kleibergen	41.012	41.012	41.012	41.012	41.012
Male (N=1464)					
Apprentice	-0.654***	0.298	0.337	1.097***	1.236***
	(0.178)	(0.428)	(0.514)	(0.331)	(0.351)
Kleibergen	17.014	17.014	17.014	17.014	17.014
IV including LDV					
Female (N=1032)					
Apprentice	0.192	0.333**	0.017	0.200*	0.360***
	(0.159)	(0.163)	(0.142)	(0.121)	(0.135)
Kleibergen	36.545	40.494	38.406	41.743	39.261
Male (N=976)					
Apprentice	-0.405*	0.265	-0.247	0.244	0.063
	(0.221)	(0.318)	(0.657)	(0.560)	(0.145)
Kleibergen	15.219	18.365	17.474	14.897	14.415

Notes: The POLS estimates display coefficients and standard errors clustered at the individual level for estimates using OLS with lagged dependent variables. The IV estimates display coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with the binary endogenous variable Apprentice and the share of general school in the canton as instrument. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The sample based on the TREE dataset consists of students continuously enrolled in an educational track between 2001 and 2003. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38 for 10% maximal IV size.

Long Run Effects

However, in the long-term, the initial impact of education on personality skills may diminish or even disappear, e.g. because students might start to work after the school-based upper secondary education. Therefore, this section analyses whether the differences still exist in 2007 and 2010, i.e about four to seven years after concluding secondary education. Since not all measures are available in all surveys, we analyze this long-term development for conscientiousness, agreeableness and emotional stability only. Table A1.8 in Appendix A1 displays the employed factor analysis. Figure A1.3 in Appendix A1 shows the developments of the dependent variables for an extended period of time and Table 5 shows the corresponding estimation results. Our results indicate that the impact on personality skills agreeableness and neuroti-

cism remain in the long run. This finding is consistent with idea that personality skills are more malleable during adolescence than during early adulthood. However, the effect on conscientiousness disappears over time.

Table 5: Transcience vs Persistence of the Effect: Estimates: Work-based Education vs. Vocational School

	OPEN	CONSC	EXTRA	AGREE	STAB
2007 (N=757)					
Apprentice		-0.176		0.678***	0.903***
		(0.424)		(0.200)	(0.264)
Kleibergen		30.934		30.934	30.934
2010 (N=650)					
Apprentice		-0.163		0.499**	0.785***
		(0.220)		(0.221)	(0.302)
Kleibergen		47.487		47.487	47.487

Notes: The table displays coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with binary endogenous variable and the share of general high school in the canton as instrument. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The sample based on the TREE dataset consists of students continuously enrolled in an educational track between 2001 and 2003. The sample refers to the year 2007 and 2010, respectively. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38 for 10% maximal IV size.

6. Conclusion

Recent evidence documents that personality skills predict a wide range of life outcomes including educational achievement and labor market outcomes. Hence, information about how education impacts personality skills is crucial. Following the hypotheses of Heckman and Kautz (2013) that work-based education may involve the teaching of valuable personality skills, we provide first evidence regarding the effect of work-based secondary education compared to school-based secondary education on personality skills.

We make use of a large representative PISA 2000 follow-up sample in Switzerland (TREE) and apply an IV approach to control for endogeneity. Identification in our model results from the fact that the share of general secondary education between cantons in Switzerland varies substantially. These differences reflect historically shares set by government, which remain persistent over the last 20 to 30 years. However, since the regional differences in these shares could be correlated with other features of regions related to personality skills, we apply several robustness checks.

The evidence in this paper indicates that education can change personality skills. Our estimates suggest that work-based education increases emotional stability statistically and economically significant, while openness is reduced. Agreeableness might be increased as well, though this effect is less robust in terms of the econometric specification. The re-

sults further indicate that conscientiousness and extraversion tend to be affected positively, but the results are quite unstable.

However, the estimates indicate heterogeneous treatment effects for men and women. In particular, conscientiousness, the tendency to be organized and responsible, which has the most predictive power for a variety of outcomes (Borghans et al. 2008; Heckman and Kautz 2013), could be enhanced in work-based education for females, but not for males. Further, the decreasing effect of work-based education on openness stems from the males reduction in openness. Emotional stability is affected more for women in school-based vocational education.

To sum up, previous research exhibits that personality skills are important for various life outcomes and that personality skills are still malleable in adolescence compared to adulthood. Therefore personality skills deserve greater emphasis in education policy. In this research we provide first evidence that work-based education fosters personality skills differently than full-time school-based education.

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Appendix

Appendix A1: Complementary Tables and Figures

This section displays the tables complementing the tables of the main analysis shown in the paper, i.e. the factor analyses, variable definitions and summary statistics, conditional correlations, information about the instruments, complete estimation results including control variables and further robustness checks of the IV strategies.

Table A1.1: Rotated Factor Loadings of Items to Construct Big Five Personality Trait Approximations

Item	Conscien-tiousness	Emotional Stability	Agree-ableness	Open-ness	Extra-version
Purpose of Working 1	0.04572	**0.41226**	-0.03914	0.07165	-0.08047
Purpose of Working 2	0.01658	**0.49345**	-0.07165	-0.0728	-0.05244
Purpose of Working 3	0.00562	**0.41634**	0.01435	-0.17917	0.09059
Task-centered coping 1	-0.02656	-0.06444	0.01924	-0.02354	**0.58427**
Task-centered coping 2	-0.07593	-0.00511	-0.01518	0.01271	**0.59069**
Leisure Time Valuation 1	-0.01416	-0.07524	**0.47987**	-0.07891	-0.00054
Leisure Time Valuation 2	-0.01466	-0.02778	**0.46843**	-0.06985	0.0472
Leisure Time Valuation 3	0.04977	0.0064	**0.37423**	0.10111	-0.06138
Contact-centered coping 1	0.02974	-0.05563	-0.06695	**0.55564**	0.00096
Contact-centered coping 2	-0.03608	-0.099	-0.02944	**0.56949**	-0.019
Emotion-centered coping 1	**0.25417**	0.01654	-0.02223	-0.03504	0.16678
Emotion-centered coping 2	**0.3741**	-0.0073	0.04474	0.0045	-0.01773
Emotion-centered coping 3	**0.39605**	0.0413	-0.00107	-0.00363	-0.07881
Emotion-centered coping 4	**0.35612**	0.02196	-0.03699	0.01165	-0.09059
Corr SHP	0.58	0.81	0.53	0.22	0.61

Note: Corr SHP denotes the canton-level correlation between the predicted values and the Big Five Inventory 10 values from the Swiss Houshold Panel (SHP). See table 1 for variable definitions, where emotion-centered coping is inverted.

Table A1.2: Explanatory Variables

Variable Name	
Endogenous Variable	
Apprenticeship	Dummy variable that takes the value 1 if an individual is continuously enrolled in apprenticeship training (work-based secondary education) between 2001 and 2003, and 0 otherwise.
Control Group	
Vocational School	Dummy variable that takes the value 1 if an individual is continuously enrolled in full-time school based vocational education between 2001 and 2003, and 0 otherwise.
General (Secondary) Education	Dummy variable that takes the value 1 if an individual is continuously enrolled in general secondary education

	(high school) between 2001 and 2003, and 0 otherwise.
Control Variables	
PISA Read	PISA score in reading in the year 2000
Books	Variable taking values 1 to 7 for 0, 1-10, 11-50, 51-100, 101-250, 251-500, more than 500 books at home in 2000.
ISEI Father	Social status of father according to ISEI in 2000
Age	Age of the individual
Male	Dummy variable that takes the value 1 if the individual is male, and 0 otherwise.
Male*Age	Interaction term of Age and Male
Urban	Dummy variable that takes the value 1 if the individual lives in an urban area in 2000, and 0 otherwise.
Family Structure	Dummy variables that take the value 1 for nuclear, mixed and other family structures, and 0 otherwise. Single is the base category.
Education Mother	Dummy variables that take the value 1 if the mother has the highest education of ISCED2, ISCED3B/ISCED3C and ISCED3A, and 0 otherwise. Mother's education of ISCED5A/ISCED5B/ISCED6 represents the base category.
Live with Parent	Dummy variable that takes the value 1 if the individual lives with at least one parent, and 0 otherwise.
Language	Dummy variable that takes the value 1 if the individual speaks the PISA test language at home in 2000, and 0 otherwise.
Swiss Born	Dummy variable that takes the value 1 if the individual was born in Switzerland, and 0 otherwise.
Swiss Time	Number of years living in Switzerland
Catholic Share	Cantonal share of Catholic inhabitants
Instruments	
Canton 1998	Canton average of the share of general secondary education degrees in 1998
Canton 1980	Canton average of the share of general secondary education degrees in 1980
Country 1998	1998 share of work-based education[24] in the country (CH, DE/AT, FR/BE, IT, ES, PT, YU, TR, OTHER) the individual was born. Due to missing values, YU and OTHER are set to 0.

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[24] Based on the OECD indicator "Students enrolled by type of institution" available at http://stats.oecd.org/.

Table A1.3: Summary Statistics of Dependent and Control Variables

	Apprenticeship					School-based Vocational Secondary Education					General Secondary Education				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
OPEN 2001	797	-0.14	0.98	-4.37	1.89	207	0.27	1.00	-3.89	1.72	929	0.05	0.99	-4.00	1.95
CONCS 2001	797	0.15	0.99	-3.48	2.57	207	-0.21	1.10	-3.40	2.24	929	0.04	1.07	-3.88	2.65
EXTRA 2001	797	0.17	1.00	-3.97	1.93	207	-0.13	0.96	-3.08	1.71	929	-0.10	1.04	-4.56	2.15
AGREE 2001	797	0.02	1.00	-3.02	2.21	207	0.11	1.05	-2.98	1.93	929	-0.20	1.09	-3.00	2.16
STAB 2001	797	0.07	1.02	-3.08	2.86	207	-0.21	1.06	-2.68	2.27	929	-0.06	1.02	-2.76	2.82
OPEN 2002	797	-0.20	0.88	-4.12	1.79	207	0.30	0.83	-2.71	1.77	929	0.04	0.91	-3.76	1.84
CONCS 2002	797	0.04	1.02	-3.56	2.69	207	-0.11	1.07	-2.90	2.20	929	0.03	1.03	-3.51	2.60
EXTRA 2002	797	0.12	0.87	-3.68	1.81	207	-0.14	0.85	-2.89	1.53	929	-0.12	0.90	-3.82	1.85
AGREE 2002	797	-0.04	1.03	-3.08	2.03	207	-0.05	1.07	-2.42	1.79	929	-0.13	1.05	-2.76	2.26
STAB 2002	797	0.20	0.98	-3.05	2.53	207	-0.22	0.98	-2.75	2.60	929	-0.07	1.03	-2.85	2.57
OPEN 2003	797	-0.28	1.03	-4.71	1.68	207	0.29	0.92	-2.70	1.65	929	0.04	1.06	-3.75	1.75
CONCS 2003	797	0.04	0.88	-3.37	2.36	207	-0.02	0.87	-2.91	1.96	929	0.06	0.86	-3.11	2.48
EXTRA 2003	797	0.07	1.01	-3.36	1.89	207	-0.17	1.01	-2.88	1.74	929	-0.14	1.06	-4.54	1.82
AGREE 2003	797	-0.02	0.91	-2.41	2.35	207	0.01	0.92	-2.70	1.76	929	-0.12	0.93	-3.02	2.05
STAB 2003	797	0.22	0.90	-2.71	2.57	207	-0.17	0.88	-2.56	2.09	929	-0.04	0.93	-2.88	2.54
PISA Read	2391	515.95	73.19	256.74	738.72	621	530.51	64.10	323.89	728.91	2787	585.54	64.43	338.97	804.70
Books	2391	4.49	1.42	1	7	621	4.58	1.45	1	7	2787	5.50	1.30	1	7
ISEI Father	2391	42.64	15.25	16	90	621	46.39	16.06	19	88	2787	55.03	17.94	16	90
Age	2391	17.87	1.04	16	22	621	17.68	1.03	16	20	2787	17.62	1.04	15	22
Male	2391	0.56	0.50	0	1	621	0.21	0.41	0	1	2787	0.35	0.48	0	1
Urban	2391	0.56	0.50	0	1	621	0.66	0.48	0	1	2787	0.73	0.44	0	1
Single Family	2391	0.08	0.27	0	1	621	0.12	0.33	0	1	2787	0.10	0.29	0	1
Nuclear Family	2391	0.85	0.36	0	1	621	0.84	0.37	0	1	2787	0.86	0.34	0	1
Mixed Family	2391	0.04	0.20	0	1	621	0.03	0.17	0	1	2787	0.02	0.15	0	1
Other Family	2391	0.03	0.16	0	1	621	0.01	0.12	0	1	2787	0.02	0.13	0	1
ISCED2	2391	0.24	0.43	0	1	621	0.18	0.38	0	1	2787	0.09	0.29	0	1
ISCED3B/3C	2391	0.59	0.49	0	1	621	0.57	0.49	0	1	2787	0.49	0.50	0	1
ISCED3A	2391	0.16	0.37	0	1	621	0.23	0.42	0	1	2787	0.42	0.49	0	1
ISCED5A/5B/6	2391	0.01	0.09	0	1	621	0.02	0.14	0	1	2787	0.01	0.09	0	1
Live Parent	2391	0.93	0.25	0	1	621	0.96	0.20	0	1	2787	0.95	0.21	0	1
Language	2391	0.11	0.32	0	1	621	0.15	0.36	0	1	2787	0.11	0.31	0	1
Swiss	2391	0.92	0.27	0	1	621	0.86	0.34	0	1	2787	0.92	0.27	0	1

Swiss Time	2391	14.92	2.27	1	17	621	14.46	2.38	3	17	2787	14.74	1.97	1	17
Catholic Share	2391	47.76	20.95	16	81.2	621	51.79	22.40	16	81.2	2787	50.77	22.01	16	81.2

Table A1.4: Conditional Correlations Using Pooled OLS: Work-based Education vs. Vocational School

	OPEN	CONSC	EXTRA	AGREE	STAB
Pooled OLS Excluding Controls (N=3012)					
Apprentice	-0.492***	0.187***	0.267***	-0.038	0.365***
	(0.060)	(0.063)	(0.077)	(0.052)	(0.077)
Pooled OLS Including Controls (N=3012)					
Apprentice	-0.311***	0.069	0.249***	0.093	0.143*
	(0.070)	(0.070)	(0.074)	(0.065)	(0.077)
PISA Read	-0.002***	0.000	0.001	-0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Books	0.020	0.026	0.008	0.025	0.031*
	(0.019)	(0.022)	(0.021)	(0.023)	(0.018)
ISEI Father	0.005**	-0.002	0.001	0.002	0.000
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Age	-0.037	0.077*	-0.014	0.044	0.027
	(0.041)	(0.038)	(0.065)	(0.056)	(0.062)
Male	-0.995	-0.143	0.144	-0.389	-0.331
	(0.683)	(0.425)	(0.547)	(0.705)	(0.618)
Male*Age	0.028	0.019	-0.003	-0.005	0.047
	(0.038)	(0.024)	(0.032)	(0.040)	(0.036)
Urban	0.053	-0.062	0.063	-0.029	0.034
	(0.036)	(0.068)	(0.067)	(0.054)	(0.067)
Nuclear Family	0.009	-0.100	-0.006	-0.129*	0.203*
	(0.077)	(0.078)	(0.098)	(0.074)	(0.098)
Mixed Family	-0.341*	-0.237	-0.125	-0.030	-0.119
	(0.185)	(0.198)	(0.193)	(0.113)	(0.193)
Other Family	-0.134	0.166	0.138	0.151	0.225
	(0.204)	(0.152)	(0.225)	(0.114)	(0.166)
ISCED2	-0.020	-0.238	-0.172	0.096	-0.036
	(0.267)	(0.141)	(0.227)	(0.132)	(0.089)
ISCED3B/3C	-0.064	-0.294**	-0.014	0.154	-0.086
	(0.273)	(0.138)	(0.204)	(0.105)	(0.070)
ISCED3A	-0.104	-0.252	-0.055	0.127	-0.085
	(0.232)	(0.147)	(0.226)	(0.133)	(0.078)
Live Parent	0.047	-0.066	-0.004	-0.073	0.126
	(0.066)	(0.077)	(0.080)	(0.076)	(0.073)
Language	-0.093	0.017	-0.036	-0.028	-0.150

	(0.082)	(0.080)	(0.125)	(0.102)	(0.110)
Swiss	-0.283	0.213	0.294**	0.360**	0.079
	(0.170)	(0.132)	(0.129)	(0.136)	(0.163)
Swiss Time	0.016	-0.001	-0.027**	-0.021*	0.011
	(0.018)	(0.021)	(0.010)	(0.011)	(0.017)
Catholic Share	-0.000	-0.003*	-0.003	-0.003	-0.007***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Year 2002	-0.016	-0.153**	-0.024	-0.122**	0.059
	(0.037)	(0.063)	(0.071)	(0.052)	(0.055)
Year 2003	-0.059	-0.218**	-0.058	-0.131	0.023
	(0.071)	(0.083)	(0.137)	(0.119)	(0.104)
Constant	1.869**	-0.995	0.046	-0.284	-1.236
	(0.794)	(0.758)	(1.138)	(1.141)	(1.173)

Notes: The table displays OLS coefficients and standard errors clustered at the individual level in parentheses and based on the TREE dataset for students continuously enrolled in an educational track between 2001 and 2003.. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Figure A1.1: National and Regional Share of General Secondary Education (High School) and number of 16-year old in Switzerland

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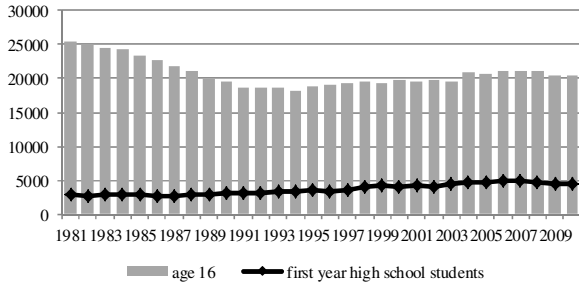
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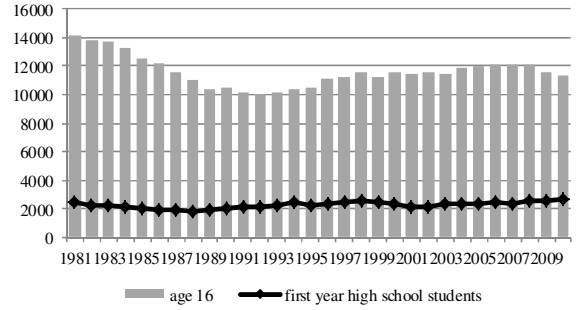
Zürich
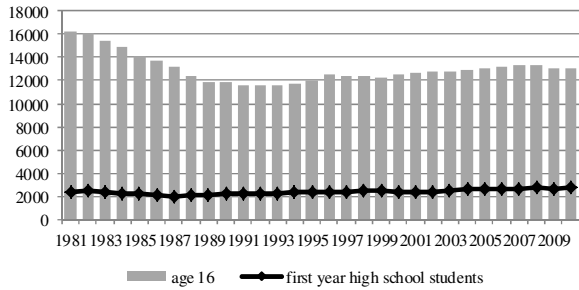
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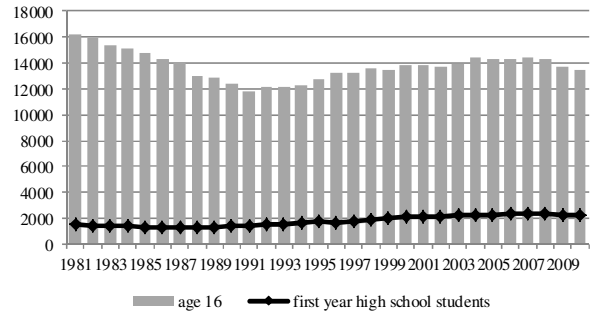
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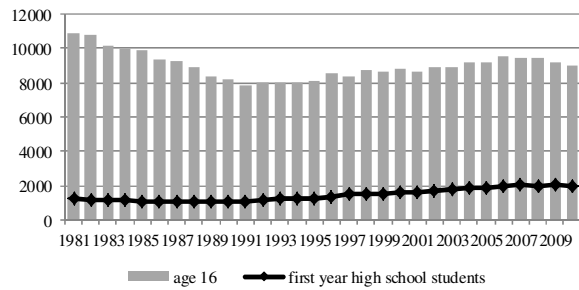
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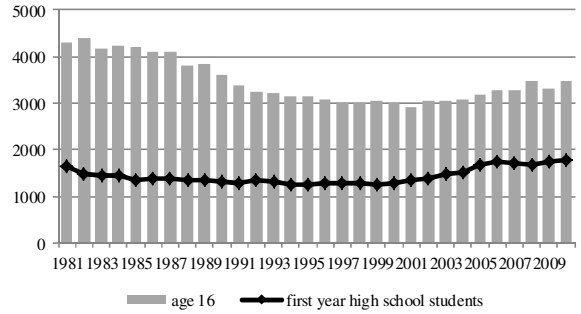
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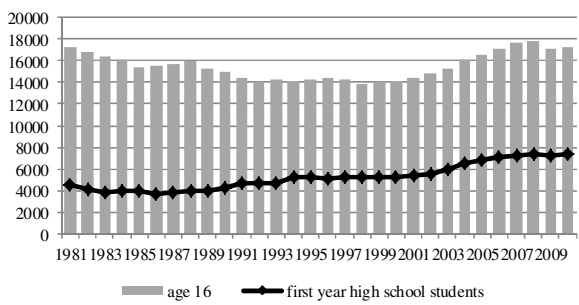
Table A1.5: Summary Statistics of Instruments

Canton	N	Area	1980	1998
ZH	79	4	12.5	18.90
BE	198	2	7	13.30
LU	28	6	5.8	11.80
UR	0	6	8.6	11.50
SZ	21	6	5.9	11.90
OW	31	6	6.3	10.60
NW	12	6	5.6	17.50
GL	2	5	10.3	16.00
ZG	18	6	10.7	15.10
FR	147	2	10	20.50
SO	29	2	9	13.90
BS	23	3	18.2	21.10
BL	35	3	16.5	21.10
SH	26	5	6.5	18.80
AR	3	5	7.7	14.60
AI	0	5	6.3	12.70
SG	226	5	6.1	12.60
GR	22	5	7.9	12.50
AG	110	3	9.5	16.30
TG	31	5	6.1	10.50
TI	237	7	17	26.00
VD	124	1	12.5	20.90
VS	137	1	8.4	19.60
NE	111	2	13.5	24.00
GE	206	1	21.3	31.80
JU	77	2	9	25.40

Country	N			1998
CH	1771			0.58
DEAT	8			0.47
ES	4			0.03
FRBE	13			0.11
IT	7			0.00
PT	28			0.00
TR	7			0.00
YU	45			0.00
OTHER	50			0.00

Table A1.6: IV Estimates Using Cantonal Shares of General Schooling: Work-based Education vs. Vocational School (N=3012)

	OPEN	CONSC	EXTRA	AGREE	STAB
Second Stage					
PISA Read	-0.002***	0.000	0.001**	-0.000	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Books	0.018	0.028	0.012	0.028	0.034*
	(0.019)	(0.021)	(0.021)	(0.025)	(0.019)
ISEI Father	0.004*	-0.002	0.003	0.003**	0.002
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Age	-0.010	0.058	-0.062	0.013	-0.016
	(0.042)	(0.037)	(0.068)	(0.047)	(0.058)
Male	-0.768	-0.303	-0.252	-0.645	-0.691
	(0.640)	(0.458)	(0.563)	(0.706)	(0.670)
Male*Age	0.021	0.025	0.010	0.004	0.059
	(0.036)	(0.025)	(0.033)	(0.039)	(0.038)
Urban	0.036	-0.050	0.092	-0.010	0.061
	(0.034)	(0.068)	(0.080)	(0.048)	(0.069)
Nuclear Family	0.035	-0.118	-0.052	-0.158*	0.161
	(0.084)	(0.077)	(0.098)	(0.086)	(0.106)
Mixed Family	-0.298	-0.268	-0.201	-0.080	-0.188
	(0.186)	(0.175)	(0.170)	(0.116)	(0.214)
Other Family	-0.059	0.113	0.008	0.066	0.106
	(0.239)	(0.157)	(0.246)	(0.116)	(0.183)
ISCED2	0.090	-0.316**	-0.364*	-0.028	-0.210*
	(0.277)	(0.159)	(0.188)	(0.136)	(0.114)
ISCED3B/3C	0.030	-0.361**	-0.179	0.047	-0.236***
	(0.286)	(0.157)	(0.165)	(0.106)	(0.087)
ISCED3A	-0.027	-0.306*	-0.189	0.041	-0.207***
	(0.246)	(0.172)	(0.197)	(0.134)	(0.070)
Live Parent	0.015	-0.044	0.051	-0.037	0.176**
	(0.075)	(0.078)	(0.087)	(0.083)	(0.075)
Language	-0.117	0.034	0.006	-0.001	-0.113
	(0.080)	(0.080)	(0.119)	(0.122)	(0.118)
Swiss	-0.235	0.179	0.211	0.306**	0.003
	(0.177)	(0.148)	(0.146)	(0.154)	(0.182)
Swiss Time	0.018	-0.002	-0.031***	-0.023**	0.007
	(0.018)	(0.021)	(0.011)	(0.011)	(0.015)
Catholic Share	-0.001	-0.002	-0.002	-0.002	-0.006***

	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Year 2002	-0.041	-0.136**	0.020	-0.094**	0.098*
	(0.041)	(0.062)	(0.073)	(0.047)	(0.054)
Year 2003	-0.105	-0.185**	0.023	-0.079	0.096
	(0.080)	(0.079)	(0.143)	(0.102)	(0.094)
Apprentice	-0.760***	0.387***	1.032***	0.599***	0.855***
	(0.232)	(0.143)	(0.270)	(0.148)	(0.149)
Constant	1.728**	-0.895	0.293	-0.124	-1.011
	(0.862)	(0.724)	(1.257)	(1.020)	(1.017)
First Stage					
CANTON	-0.077***	-0.079***	-0.074***	-0.081***	-0.081***
	(0.011)	(0.011)	(0.013)	(0.012)	(0.013)
PISA Read	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Books	-0.023	-0.022	-0.026	-0.021	-0.024
	(0.045)	(0.047)	(0.046)	(0.046)	(0.048)
ISEI Father	-0.012***	-0.012***	-0.012***	-0.011***	-0.012***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Age	0.047	0.026	0.020	0.029	0.029
	(0.062)	(0.061)	(0.068)	(0.063)	(0.061)
Male	0.972	0.839	0.817	0.862	1.291
	(0.838)	(0.772)	(0.768)	(0.816)	(0.814)
Male*Age	-0.002	0.005	0.005	0.003	-0.021
	(0.047)	(0.043)	(0.043)	(0.045)	(0.046)
Urban	-0.005	0.002	-0.002	-0.006	-0.028
	(0.161)	(0.164)	(0.168)	(0.169)	(0.154)
Nuclear Family	0.103	0.081	0.105	0.090	0.083
	(0.127)	(0.137)	(0.126)	(0.128)	(0.127)
Mixed Family	0.267	0.279	0.330	0.297	0.314
	(0.297)	(0.299)	(0.256)	(0.302)	(0.318)
Other Family	0.707*	0.676*	0.811**	0.632	0.629
	(0.398)	(0.406)	(0.370)	(0.415)	(0.414)
ISCED2	0.926***	0.942***	0.923***	0.956***	0.975***
	(0.316)	(0.327)	(0.320)	(0.333)	(0.293)
ISCED3B/3C	0.794***	0.820***	0.778***	0.815***	0.874***
	(0.300)	(0.313)	(0.297)	(0.316)	(0.276)
ISCED3A	0.782**	0.797**	0.779**	0.813**	0.883***

	(0.309)	(0.323)	(0.304)	(0.324)	(0.286)
Live Parent	-0.286	-0.283	-0.269	-0.260	-0.267
	(0.180)	(0.180)	(0.171)	(0.174)	(0.179)
Language	-0.243	-0.223	-0.197	-0.201	-0.218
	(0.321)	(0.310)	(0.315)	(0.303)	(0.284)
Swiss	0.285	0.283	0.357	0.259	0.266
	(0.235)	(0.226)	(0.229)	(0.225)	(0.214)
Swiss Time	0.008	0.007	0.011	0.012	0.003
	(0.024)	(0.023)	(0.024)	(0.024)	(0.027)
Catholic Share	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Year 2002	-0.071	-0.036	-0.039	-0.055	-0.041
	(0.060)	(0.059)	(0.069)	(0.060)	(0.061)
Year 2003	-0.098	-0.041	-0.026	-0.064	-0.047
	(0.124)	(0.124)	(0.140)	(0.122)	(0.121)
Constant	2.748*	3.112**	2.908**	2.942**	3.096**
	(1.411)	(1.427)	(1.437)	(1.368)	(1.368)
Kleibergen	45.381	45.381	45.381	45.381	45.381

Notes: The table displays coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with binary endogenous variable and the share of general high school in the canton as instrument. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The sample based on the TREE dataset consists of students continuously enrolled in an educational track between 2001 and 2003. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38 for 10% maximal IV size.

Table A1.7: Robustness of IV Estimates Exploiting Cantonal Shares of General Schooling: Work-based Education vs. Vocational School (N=3012)

	OPEN	CONSC	EXTRA	AGREE	STAB
REDUCED					
CANTON	0.017**	-0.018***	-0.014**	-0.026***	-0.030***
	(0.007)	(0.003)	(0.006)	(0.004)	(0.007)
2SLS					
Apprentice	-0.931**	1.029***	0.798***	1.445***	1.701***
	(0.443)	(0.223)	(0.276)	(0.180)	(0.346)
Kleibergen	45.381	45.381	45.381	45.381	45.381
1980					
Apprentice	-0.701***	0.325**	0.937**	0.520***	0.558**
	(0.247)	(0.148)	(0.436)	(0.193)	(0.241)
Kleibergen	23.575	23.575	23.575	23.575	23.575
NO CONTROL					
Apprentice	-0.892***	0.807***	1.287***	0.791***	1.422***

		(0.228)	(0.153)	(0.496)	(0.125)	(0.221)
Kleibergen		70.652	70.652	70.652	70.652	70.652
WEIGHTS						
Apprentice		-0.818***	0.387*	0.993***	0.431**	0.821***
		(0.228)	(0.230)	(0.379)	(0.193)	(0.258)
Kleibergen		19.107	19.107	19.107	19.107	19.107
ORIGIN Including Country Variables						
Apprentice		-0.840***	-0.238**	0.869**	-0.099*	0.260
		(0.128)	(0.098)	(0.418)	(0.051)	(0.166)
Kleibergen		0.696	0.696	0.696	0.696	0.696
CANTON+ORIGIN Including Country Variables						
Apprentice		-0.757**	0.384**	1.028***	0.605***	0.857***
		(0.335)	(0.162)	(0.332)	(0.226)	(0.196)
Kleibergen		79.758	79.758	79.758	79.758	79.758
Hansen p-value		0.144	0.820	0.749	0.637	0.309

Notes: The table displays coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with the binary endogenous variable Apprentice and the share of general school in the canton as instrument. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The sample based on the TREE dataset consists of students continuously enrolled in an educational track between 2001 and 2003. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38 for 10% maximal IV size. All estimates include year dummies and the control variables described in Table A1.2. REDUCED refers to the reduced form estimates, i.e. CANTON refers to the cantonal share of school-based upper secondary education. 2SLS displays estimates from a 2SLS IV estimation. 1980 uses cantonal average of general high school in 1980 instead of 1998 as instrument. Estimates NO CONTROL have no control variables. WEIGHTS weight observations using population weights. ORIGIN estimates use the share of work-based education in the country of origin as instrument and displays block-bootstrapped standard errors at the country of origin level. CANTON+ORIGIN uses both instruments simultaneously and displays block-bootstrapped standard errors on the level of the canton. Hence, the Kleibergen statistic has a critical value of 19.93. Hansen p-value refers to the p-value of a Hansen overidentification test.

Table A1.8: Transcience vs Persistence of the Effect: Rotated Factor Loadings

Variable	STAB	AGREE	CONSC
Task-centered coping 1	0.1342	-0.0215	**0.7825**
Task-centered coping 2	-0.0152	0.1329	**0.8042**
Contact-centered coping 1	0.0436	**0.8700**	0.0624
Contact-centered coping 2	-0.0511	**0.8695**	0.0246
Emotion-centered coping 1	**0.5640**	-0.0728	0.3368
Emotion-centered coping 2	**0.7855**	0.0143	0.077
Emotion-centered coping 3	**0.8092**	0.0133	0.0206
Emotion-centered coping 4	**0.7346**	-0.0246	0.0077

See Table 1 for variable definitions, where emotion-centered coping is inverted.

Figure A1.3: Long-Term Development of Personality Skills by Education Track

Appendix A2: Work-based Education vs. General Education

This section displays the results shown in the paper and appendix A1 using an alternative control group, namely the students enrolled in general schools continuously between 2001 and 2003. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38 for 10% maximal IV size. Unless noted otherwise, estimates include year dummies and the control variables described in Table A1.2. OLS estimates display coefficients and s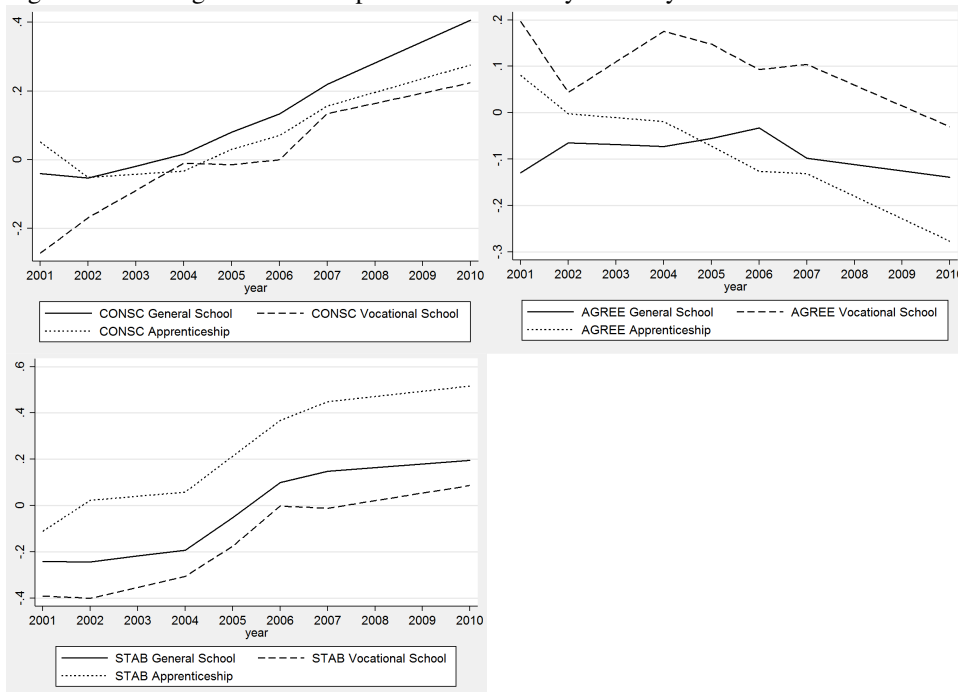tandard errors clustered at the individual level in parentheses. IV estimates display coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with the binary endogenous variable Apprentice and the share of general school in the canton as instrument. ORIGIN estimates use the share of work-based education in the country of origin as instrument and displays block-bootstrapped standard errors at the country of origin level. CANTON+ORIGIN uses both instruments simultaneously and displays block-bootstrapped standard errors on the level of the canton. Hence, the Kleibergen statistic has a critical value of 19.93. Hansen p-value refers to the p-value of a Hansen overidentification test.

Table A2.1: Conditional Correlations Using Pooled OLS: Work-based Education vs. General School (N=5178)

	OPEN	CONSC	EXTRA	AGREE	STAB
Pooled OLS Excluding Controls					
Apprentice	-0.252***	0.030	0.242***	0.134**	0.220***
	(0.042)	(0.049)	(0.039)	(0.051)	(0.055)
Pooled OLS Including Controls					
Apprentice	-0.230***	0.005	0.309***	0.198**	0.212***
	(0.041)	(0.033)	(0.047)	(0.074)	(0.046)
PISA Read	-0.002***	0.001	0.000	-0.001*	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Books	0.007	0.019	0.007	0.012	0.024
	(0.018)	(0.016)	(0.013)	(0.018)	(0.016)
ISEI Father	0.001	0.001	0.004***	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.026	0.056	0.057**	0.039	0.038
	(0.030)	(0.043)	(0.027)	(0.049)	(0.055)
Male	-0.528	0.143	0.352	-0.409	-0.742
	(0.480)	(0.423)	(0.502)	(0.442)	(0.470)
Male*Age	0.002	0.008	-0.015	-0.002	0.072**
	(0.026)	(0.024)	(0.028)	(0.024)	(0.028)
Urban	0.059	-0.069	0.025	-0.019	0.042
	(0.046)	(0.043)	(0.048)	(0.040)	(0.057)
Nuclear Family	0.057	-0.064	0.082	-0.068	0.173***
	(0.063)	(0.074)	(0.060)	(0.071)	(0.056)

Mixed Family	-0.124	-0.074	-0.089	-0.033	-0.032
	(0.133)	(0.116)	(0.170)	(0.147)	(0.119)
Other Family	0.069	0.101	0.032	0.059	0.136
	(0.174)	(0.117)	(0.170)	(0.151)	(0.138)
ISCED2	0.143	0.010	-0.326***	0.022	-0.040
	(0.208)	(0.170)	(0.097)	(0.085)	(0.097)
ISCED3B/3C	0.139	-0.051	-0.110	0.166	-0.041
	(0.202)	(0.179)	(0.107)	(0.115)	(0.093)
ISCED3A	0.118	-0.037	-0.150	0.138	-0.023
	(0.193)	(0.158)	(0.102)	(0.133)	(0.119)
Live Parent	0.078	-0.022	0.022	-0.027	0.082
	(0.069)	(0.045)	(0.086)	(0.046)	(0.050)
Language	0.043	0.109	0.074	0.048	0.041
	(0.068)	(0.091)	(0.082)	(0.068)	(0.049)
Swiss	-0.016	0.102	0.229*	0.126	0.065
	(0.130)	(0.101)	(0.128)	(0.088)	(0.148)
Swiss Time	-0.010	0.005	-0.027**	-0.000	0.006
	(0.019)	(0.015)	(0.011)	(0.012)	(0.017)
Catholic Share	-0.000	-0.001	-0.003**	-0.001	-0.005*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Year 2002	-0.002	-0.117**	-0.086**	-0.028	-0.009
	(0.030)	(0.048)	(0.031)	(0.050)	(0.058)
Year 2003	-0.017	-0.158*	-0.173***	-0.053	-0.061
	(0.058)	(0.078)	(0.060)	(0.099)	(0.106)
Constant	1.457**	-1.405*	-1.090*	-0.441	-2.009*
	(0.631)	(0.802)	(0.599)	(1.033)	(1.068)

Table A2.2: OLS Estimates Including Lagged Dependent Variable: Work-based Education vs. General School

	OPEN	CONSC	EXTRA	AGREE	STAB
Base POLS (N=3452)					
Apprentice	-0.059**	-0.052	0.052*	0.013	0.133***
	(0.025)	(0.042)	(0.030)	(0.030)	(0.032)
Base 2002 (N=1726)					
Apprentice	-0.062**	-0.093*	0.099***	-0.029	0.214***
	(0.027)	(0.053)	(0.029)	(0.049)	(0.048)
Base 2003 (N=1726)					
Apprentice	-0.049	0.008	-0.009	0.072***	0.031
	(0.030)	(0.025)	(0.033)	(0.027)	(0.024)

Table A2.3: IV Estimates Using Cantonal Shares of General Schooling: Work-based Education vs. General School

	OPEN	CONSC	EXTRA	AGREE	STAB

Second Stage					
Apprentice	-0.915***	0.372***	0.393**	0.577***	0.880***
	(0.263)	(0.108)	(0.197)	(0.123)	(0.116)
PISA Read	-0.003***	0.001***	0.000	0.000	0.003***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Books	-0.023	0.035**	0.010	0.029*	0.054***
	(0.018)	(0.017)	(0.014)	(0.017)	(0.019)
ISEI Father	-0.002	0.003*	0.004***	0.002*	0.003**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.013	0.035	0.052	0.017	0.001
	(0.033)	(0.047)	(0.034)	(0.050)	(0.050)
Male	-0.545	0.152	0.354	-0.399	-0.726
	(0.449)	(0.420)	(0.500)	(0.454)	(0.490)
Male*Age	0.008	0.005	-0.016	-0.006	0.066**
	(0.024)	(0.024)	(0.028)	(0.025)	(0.030)
Urban	-0.027	-0.023	0.036	0.028	0.126**
	(0.061)	(0.043)	(0.051)	(0.041)	(0.054)
Nuclear Family	0.076	-0.075	0.079	-0.079	0.154**
	(0.074)	(0.071)	(0.061)	(0.068)	(0.065)
Mixed Family	-0.065	-0.106	-0.096	-0.065	-0.090
	(0.149)	(0.100)	(0.177)	(0.141)	(0.132)
Other Family	0.141	0.063	0.023	0.019	0.066
	(0.178)	(0.127)	(0.177)	(0.151)	(0.139)
ISCED2	0.205	-0.023	-0.333***	-0.013	-0.101
	(0.207)	(0.191)	(0.103)	(0.128)	(0.111)
ISCED3B/3C	0.176	-0.071	-0.115	0.145	-0.077
	(0.199)	(0.200)	(0.113)	(0.146)	(0.087)
ISCED3A	0.079	-0.016	-0.145	0.159	0.015
	(0.199)	(0.192)	(0.102)	(0.153)	(0.108)
Live Parent	0.024	0.007	0.029	0.003	0.135***
	(0.063)	(0.042)	(0.080)	(0.050)	(0.044)
Language	-0.024	0.145	0.082	0.085	0.107*
	(0.076)	(0.095)	(0.084)	(0.077)	(0.056)
Swiss	-0.020	0.105	0.230*	0.129	0.070
	(0.133)	(0.102)	(0.131)	(0.094)	(0.150)
Swiss Time	-0.003	0.001	-0.028**	-0.004	-0.001
	(0.020)	(0.016)	(0.012)	(0.014)	(0.017)

Catholic Share	-0.002	-0.000	-0.002**	-0.001	-0.003
	(0.002)	(0.001)	(0.001)	(0.002)	(0.003)
Year 2002	-0.045	-0.094*	-0.081**	-0.005	0.033
	(0.031)	(0.051)	(0.037)	(0.050)	(0.056)
Year 2003	-0.099	-0.114	-0.163**	-0.008	0.018
	(0.062)	(0.087)	(0.072)	(0.098)	(0.095)
Constant	2.233**	-1.821**	-1.185**	-0.871	-2.766***
	(1.045)	(0.805)	(0.522)	(0.955)	(0.904)
First Stage					
CANTON	-0.071***	-0.072***	-0.073***	-0.074***	-0.078***
	(0.017)	(0.017)	(0.018)	(0.017)	(0.016)
PISA Read	-0.010***	-0.011***	-0.010***	-0.010***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Books	-0.130***	-0.133***	-0.132***	-0.133***	-0.126***
	(0.022)	(0.021)	(0.021)	(0.023)	(0.023)
ISEI Father	-0.017***	-0.017***	-0.016***	-0.016***	-0.015***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age	0.009	0.004	-0.003	-0.004	-0.032
	(0.082)	(0.080)	(0.083)	(0.083)	(0.080)
Male	-0.312	-0.260	-0.375	-0.254	-0.374
	(0.714)	(0.687)	(0.710)	(0.742)	(0.694)
Male*Age	0.047	0.044	0.051	0.044	0.050
	(0.041)	(0.039)	(0.041)	(0.042)	(0.040)
Urban	-0.283*	-0.291**	-0.297*	-0.296*	-0.277*
	(0.151)	(0.148)	(0.152)	(0.151)	(0.142)
Nuclear Family	-0.018	0.011	0.013	0.010	0.025
	(0.144)	(0.145)	(0.147)	(0.154)	(0.155)
Mixed Family	0.231	0.224	0.190	0.216	0.232
	(0.277)	(0.275)	(0.274)	(0.286)	(0.283)
Other Family	0.248	0.289	0.328	0.274	0.314
	(0.313)	(0.309)	(0.299)	(0.321)	(0.301)
ISCED2	0.283	0.227	0.246	0.295	0.302
	(0.427)	(0.398)	(0.404)	(0.429)	(0.391)
ISCED3B/3C	0.131	0.098	0.108	0.159	0.173
	(0.392)	(0.366)	(0.370)	(0.392)	(0.360)
ISCED3A	-0.196	-0.254	-0.246	-0.188	-0.175
	(0.406)	(0.369)	(0.375)	(0.402)	(0.365)

Live Parent	-0.208	-0.254**	-0.250**	-0.227*	-0.233*
	(0.126)	(0.129)	(0.124)	(0.118)	(0.123)
Language	-0.417**	-0.401**	-0.394**	-0.402**	-0.360**
	(0.166)	(0.171)	(0.171)	(0.171)	(0.165)
Swiss	0.175	0.141	0.144	0.132	0.153
	(0.218)	(0.209)	(0.207)	(0.205)	(0.201)
Swiss Time	-0.005	-0.003	-0.003	-0.002	-0.008
	(0.034)	(0.033)	(0.033)	(0.033)	(0.031)
Catholic Share	-0.004	-0.004	-0.004	-0.004	-0.004
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Year 2002	-0.038	-0.033	-0.028	-0.024	0.002
	(0.079)	(0.080)	(0.080)	(0.079)	(0.075)
Year 2003	-0.058	-0.040	-0.035	-0.024	0.030
	(0.158)	(0.158)	(0.160)	(0.158)	(0.150)
Constant	8.621***	8.854***	8.953***	8.844***	9.281***
	(2.431)	(2.366)	(2.425)	(2.428)	(2.358)
Kleibergen	14.624	14.624	14.624	14.624	14.624

Table A2.4: Robustness of IV Estimates Exploiting Cantonal Shares of General Schooling: Work-based Education vs. General School (N=5178)

	OPEN	CONSC	EXTRA	AGREE	STAB
REDUCED					
CANTON	0.014**	-0.008***	-0.012**	-0.022***	-0.033***
	(0.007)	(0.002)	(0.005)	(0.003)	(0.005)
2SLS					
Apprentice	-0.834*	0.490***	0.701***	1.283***	1.947***
	(0.493)	(0.111)	(0.267)	(0.314)	(0.585)
Kleibergen	14.624	14.624	14.624	14.624	14.624
AREA					
Apprentice	-0.655**	0.317**	0.267**	0.326***	0.502***
	(0.267)	(0.142)	(0.115)	(0.093)	(0.136)
Kleibergen	22.761	22.761	22.761	22.761	22.761
AREA+CULTURE					
Apprentice	-0.536**	0.237	0.146	0.274**	0.264*
	(0.252)	(0.149)	(0.132)	(0.112)	(0.135)
Kleibergen	31.053	31.053	31.053	31.053	31.053
LDV (N=3452)					
Apprentice	-0.114*	0.123	0.056	0.360***	0.413***
	(0.059)	(0.093)	(0.100)	(0.111)	(0.086)
Kleibergen	13.645	14.385	14.569	13.610	12.838
LDV 2 (N=1726)					
Apprentice	-0.041	0.011	0.032	0.146***	0.246***
	(0.036)	(0.103)	(0.027)	(0.052)	(0.035)
Kleibergen	13.524	14.371	14.549	13.796	12.184
1980					
Apprentice	-0.858***	0.429***	0.222	0.548***	0.663***
	(0.293)	(0.121)	(0.290)	(0.165)	(0.190)
Kleibergen	7.810	7.810	7.810	7.810	7.810
KV (N=3495)					
Apprentice	-1.361***	0.586***	0.681***	0.487***	0.879***
	(0.260)	(0.215)	(0.198)	(0.114)	(0.190)
Kleibergen	8.351	8.351	8.351	8.351	8.351
NOGA (N=3576)					
Apprentice	-0.750***	0.282	0.312**	0.471**	0.872***

	(0.197)	(0.218)	(0.152)	(0.185)	(0.148)
Kleibergen	6.855	6.855	6.855	6.855	6.855
NO CONTROL					
Apprentice	-1.142**	0.608***	0.597***	0.742***	1.388***
	(0.501)	(0.078)	(0.224)	(0.151)	(0.202)
Kleibergen	19.257	19.257	19.257	19.257	19.257
WEIGHTS					
Apprentice	-0.984***	0.161	0.267	0.113	0.563
	(0.252)	(0.361)	(0.236)	(0.361)	(0.383)
Kleibergen	2.958	2.958	2.958	2.958	2.958

Table A2.5: IV Estimates Exploiting Share of Work-Based Education in Country of Origin: Work-based Education vs. General School (N=3012)

	OPEN	CONSC	EXTRA	AGREE	STAB
ORIGIN Excluding Country Variables					
Apprentice	-0.879***	0.055	1.444***	0.376	0.749***
	(0.100)	(0.161)	(0.324)	(0.273)	(0.178)
Kleibergen	38.761	38.761	38.761	38.761	38.761
CANTON+ORIGIN Excluding Country Variables					
Apprentice	-0.776***	0.470***	1.046***	0.700***	0.906***
	(0.232)	(0.166)	(0.343)	(0.226)	(0.172)
Kleibergen	100.716	100.716	100.716	100.716	100.716
Hansen p-value	0.677	0.549	0.358	0.561	0.833
ORIGIN Including Country Variables					
Apprentice	-0.840***	-0.238**	0.869**	-0.099*	0.260
	(0.128)	(0.098)	(0.418)	(0.051)	(0.166)
Kleibergen	0.696	0.696	0.696	0.696	0.696
CANTON+ORIGIN Including Country Variables					
Apprentice	-0.757**	0.384**	1.028***	0.605***	0.857***
	(0.335)	(0.162)	(0.332)	(0.226)	(0.196)
Kleibergen	79.758	79.758	79.758	79.758	79.758
Hansen p-value	0.144	0.820	0.749	0.637	0.309

Table A2.6: Heterogeneity of Treatement between Men and Women: Work-based Education vs. General School

	OPEN	CONSC	EXTRA	AGREE	STAB
OLS including LDV					

Female (N=1918)					
Apprentice	-0.071**	-0.014	0.085*	0.012	0.132***
	(0.034)	(0.040)	(0.047)	(0.044)	(0.040)
Male (N=1534)					
Apprentice	-0.046	-0.092	0.017	0.009	0.125**
	(0.038)	(0.061)	(0.040)	(0.032)	(0.045)
IV					
Female (N=2877)					
Apprentice	-0.725**	0.595***	0.380	0.560***	0.873***
	(0.349)	(0.125)	(0.284)	(0.157)	(0.175)
widstat	20.433	20.433	20.433	20.433	20.433
Male (N=2301)					
Apprentice	-0.944***	-0.281	0.358	0.529	0.794*
	(0.279)	(0.493)	(0.234)	(0.339)	(0.460)
widstat	4.313	4.313	4.313	4.313	4.313
IV including LDV					
Female (N=1918)					
Apprentice	-0.045	0.180*	0.091	0.325***	0.417***
	(0.049)	(0.101)	(0.133)	(0.111)	(0.103)
Kleibergen	18.818	20.150	20.768	19.058	17.909
Male (N=1534)					
Apprentice	-0.328*	0.001	0.056	0.391	0.365**
	(0.172)	(0.223)	(0.141)	(0.344)	(0.153)
Kleibergen	3.989	4.124	3.957	3.963	3.678

Table A2.7: Transcience vs Persistence of the Effect: Estimates: Work-based Education vs. General School

	OPEN	CONSC	OPEN	AGREE	STAB
2007 (N=1381)					
Apprentice		0.239		0.334	1.255***
		(0.178)		(0.208)	(0.142)
Kleibergen		12.366		12.366	12.366
2010 (N=1195)					
Apprentice		0.255		0.512***	1.195***
		(0.199)		(0.129)	(0.153)
Kleibergen		18.050		18.050	18.050

Appendix A3: Relationship Between Dependent Variables and Big Five Concept Dimensions

A major concern related to our dependent variables is that our measures capture particular facets rather than the concept of the Big Five personality traits. Hence, this section discusses the relationship between the dependent variables employed in this paper and the conceptual framework of the Big Five personality traits.

This analysis entails two steps. First, Table A3.1 displays the results of the baseline IV estimates using the cantonal average of the Big Five Inventory 10 in the Swiss Household Panel (SHP) as dependent variable. Table A3.1 shows that our results hold if we use the cantonal averages of the Big Five Inventory-Ten as dependent variable, thereby confirming the link between our personality skill measures and the conceptual framework of the Big Five.

Furthermore, table A3.2 shows rotated factor loadings for an extended set of variables that can be related to other facets of the Big Five personality Traits. Concretely, measures related to intrinsic work motivation in terms of learning something new and fully using the competences are closely related to the measures capturing how relevant a purpose of the work is. Measures capturing persistence are closely related to task-centered coping and feeling sad or fearful are closely related to emotion-centered coping. However, feeling active or enthusiastic are more closely related to persistence and task-centered coping than to leisure time valuation, suggesting that our measure of extraversion captures a rather particular facet while the other measures are more robust to variation in the measured facet dimension. Table A3.3 confirms our main results in terms of these measures encompassing a broader set of facets.

Table A3.1: Big Five Association: Big Five Inventory Ten on Cantonal Level as Dependent Variables

	OPEN	CONSC	EXTRA	AGREE	STAB	OPEN	CONSC	EXTRA	AGREE	STAB
	Vocational School vs Apprentices (N=1004)					General School vs Apprentices (N=1726)				
Apprentice	-0.646**	0.423**	0.688	0.519***	0.897***	-0.875***	0.296**	0.361	0.587***	0.956***
	(0.298)	(0.191)	(0.445)	(0.155)	(0.209)	(0.268)	(0.127)	(0.240)	(0.119)	(0.106)
N	1004	1004	1004	1004	1004	1726	1726	1726	1726	1726
Kleibergen	45.847	45.847	45.847	45.847	45.847	14.574	14.574	14.574	14.574	14.574

Notes: The table displays coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with binary endogenous variable and the share of general high school in the canton as instrument. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The left and right panels compare apprentices to full-time students in vocational and general schools, respectively. The sample based on the TREE dataset consists of students continuously enrolled in an educational track between 2001 and 2003. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38. The SHP estimates use the cantonal averages of the Big Five Measures in the Swiss Household Panel as dependent variable.

Table A3.2: Big Five Association: Rotated Factor Loadings

Variable	STAB	CONSC	OPEN	AGREE	EXTRA
Intrinsic Work Motivation 1	0.0568	0.1637	**0.6974**	-0.0028	0.0269
Intrinsic Work Motivation 2	0.0474	0.1604	**0.7018**	-0.0602	0.0445
Purpose of Working 1	-0.0828	-0.0129	**0.5651**	0.443	0.1132
Purpose of Working 2	-0.1491	0.0036	**0.6207**	0.2957	0.0327
Purpose of Working 3	-0.0534	0.0638	**0.7324**	0.0401	0.0986
Persistence 1	0.0472	**0.6796**	0.0433	0.0531	0.0377
Persistence 2	0.0604	**0.695**	0.0823	0.0145	0.0027
Persistence 3	0.0724	**0.7468**	0.0914	-0.0315	-0.0152
Persistence 4	0.0173	**0.7619**	0.1009	-0.0634	-0.0378
Task-Centered Coping 1	0.1466	**0.3904**	0.0726	0.0541	-0.0587
Task-Centered Coping 2	0.0392	**0.3966**	0.1318	0.1729	-0.047
Feeling Active	0.2572	**0.4545**	0.0424	0.2226	0.0312
Feeling Enthusiastic	0.2752	**0.3868**	0.1001	0.3087	0.0177
Leisure Time Valuation 1	0.0054	-0.0581	-0.0146	-0.0171	**0.7855**
Leisure Time Valuation 2	-0.018	0.0472	0.0916	0.0301	**0.7887**
Leisure Time Valuation 3	0.0812	-0.0159	0.1384	0.234	**0.6949**
Contact-centered coping 1	0.0595	0.0347	0.087	**0.8034**	0.0248
Contact-centered coping 2	-0.0639	-0.0268	0.0346	**0.8005**	0.1054
Feeling Sad	**0.6932**	-0.0338	-0.0444	0.0249	0.0287
Feeling Fearful	**0.7301**	-0.006	-0.0499	0.0424	0.0413
Emotion-centered coping 1	**0.5587**	0.0776	0.035	-0.0228	-0.0805
Emotion-centered coping 2	**0.7394**	0.1139	-0.0291	-0.01	0.0553
Emotion-centered coping 3	**0.6749**	0.1488	0.0124	-0.0421	0.0048
Emotion-centered coping 4	**0.5976**	0.0972	-0.0111	-0.0539	-0.0658
Corr SHP	0.82	-0.10	0.05	0.29	0.36
Corr Main	0.87	0.46	0.81	0.92	0.99

Notes: Intrinsic Work Motivation 1 and 2 refer to questions how important is it to have a job where I can learn something new and where I can fully deploy my competences, respectively. Persistence measures one to four refer to the following questions: "If I am resolved to do something, I manage to persevere.", "If I start something, I finish it", "Even if I come across problems in a task, I stick with it." And "Even in a cumbersome task, I persevere until I have finished it". Feeling active, enthusiastic, sad and fearful refer to the extent to which the respondent has felt in this way during the previous month. For the remaining variables, Table 1 displays definitions. The variables entering emotional stability are inverted. Corr SHP denotes the canton-level correlation between the predicted values and the Big Five Inventory 10 values from the Swiss Houshold Panel (SHP). Corr Main denotes the correlation of the predicted values with the predicted values used in the main estimation.

Table A3.3: Big Five Association: Estimations

	OPEN	CONSC	EXTRA	AGREE	STAB	OPEN	CONSC	EXTRA	AGREE	STAB
	Vocational School vs Apprentices (N=1977)					General School vs Apprentices (N=3402)				
Apprentice	-0.346	0.001	0.917***	0.499***	1.112***	-0.474	-0.345**	0.333	0.318*	1.195***
	(0.731)	(0.160)	(0.354)	(0.143)	(0.221)	(0.340)	(0.174)	(0.222)	(0.164)	(0.136)
Kleibergen	45.916	45.916	45.916	45.916	45.916	14.863	14.863	14.863	14.863	14.863

Notes: The table displays coefficients and standard errors clustered at the cantonal level in parentheses of an IV estimation with binary endogenous variable and the share of general high school in the canton as instrument. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The left and right panels compare apprentices to full-time students in vocational and general schools, respectively. The sample based on the TREE dataset consists of students continuously enrolled in an educational track between 2001 and 2003 and refers to the years 2002 and 2003. Kleibergen refers to the Kleibergen-Paap F statistic, which has a critical value of 16.38 for 10% maximal IV size. The table use different measures for openness, conscientiousness, extraversion and emotional stability than the main paper.

Appendix A4: Late Starters

This section displays the results for 3 groups of late starters. Late starters entails all individuals, that were neither working nor in work-based education in 2001 and were continuously enrolled in either work-based education or school-based education between 2002 and 2004. Late starters^2 refers to all individuals, that were neither working nor in work-based education in 2001 or 2002 and were continuously enrolled in either work-based education or school-based education between 2003 and 2005.Table A4.1 shows the OLS results with lagged dependent variable for these 2 groups of late starters, while Figures A4.1 and A4.2 display the corresponding development over time graphically.

This exercise allows to evaluate the robustness of our analysis in three directions. First, analysing a sample of individuals who are not entering secondary education directly after mandatory schooling allows to gauge the external validity of our results. Concretely, external validity of our results is largely supported by the fact that qualitative results remain the same as shown in Tables A4.1 and A4.2.

Secondly, observing personality skills before the treatment allows to analyze whether apprenticeship affects personality skills measured shortly after the start of the education. Since the estimated impact is often significant and even larger in 2002 than in 2003, we conclude that work-based education affects personality skills quite swiftly, suggesting that the personality skill measures of observations in the main analysis are already affected in 2001.

Thirdly, the development of personality skills of late^2 starters between 2001 and 2002 shows whether the assumption of a common trend between control and treatment group is true. Rather surprisingly, Figure A4.2 suggests that the common trend assumption is more appropriate for the general school and work-based education group than for the vocational school and work-based education group.

However, these robustness checks suffer from two main shortcomings. First, the number of observations is low, suggesting that the data might be insufficient to conduct such an analysis. Second, late starters might represent a different selection of individuals than observed in the main analysis, in which case this robustness check only serves to address external validity, while it fails to check internal validity. This view is supported by the fact that the graphs display heterogeneous developments over time, also supporting the hypothesis that early and late starters are not identical.

Table A4.1: OLS Estimates Including Lagged Dependent Variable: Work-based Education vs. Vocational School

	Vocational School vs Apprentices					General School vs Apprentices				
	OPEN	CONSC	EXTRA	AGREE	STAB	OPEN	CONSC	EXTRA	AGREE	STAB
POLS Late (N=586/1508)										
Apprentice	-0.126*	0.026	0.025	-0.041	0.165**	-0.052	-0.045	0.082	0.045	0.127**
	(0.072)	(0.093)	(0.068)	(0.086)	(0.076)	(0.045)	(0.055)	(0.052)	(0.052)	(0.050)
Late 2002 (N=293/754)										
Apprentice	-0.111	0.068	0.053	-0.035	0.290**	-0.058	-0.072	0.088*	0.066	0.143*
	(0.070)	(0.164)	(0.062)	(0.142)	(0.128)	(0.043)	(0.094)	(0.049)	(0.086)	(0.085)
Late 2003 (N=293/754)										
Apprentice	-0.130*	-0.036	-0.008	0.001	0.013	-0.041	-0.011	0.059	0.037	0.113***
	(0.076)	(0.063)	(0.075)	(0.064)	(0.064)	(0.047)	(0.041)	(0.052)	(0.043)	(0.043)
POLS Late^2 (N=122/264)										
Apprentice	-0.015	0.257	0.061	0.424**	0.429***	-0.119	0.006	0.120	0.088	0.257*

	(0.171)	(0.274)	(0.161)	(0.147)	(0.102)	(0.096)	(0.118)	(0.088)	(0.106)	(0.126)
Late^2 2002 (N=61/132)										
Apprentice	-0.051	0.334	0.007	0.618**	0.676**	-0.136	-0.032	0.109	0.181	0.303
	(0.172)	(0.420)	(0.191)	(0.214)	(0.244)	(0.081)	(0.198)	(0.090)	(0.212)	(0.231)
Late^2 2003 (N=61/132)										
Apprentice	0.040	0.022	0.135	-0.040	0.108	-0.096	0.038	0.120	-0.048	0.134
	(0.223)	(0.294)	(0.158)	(0.130)	(0.160)	(0.115)	(0.084)	(0.094)	(0.087)	(0.090)

Notes: The table displays OLS coefficients and standard errors clustered at the individual level in parentheses and based on the TREE dataset for 2002 and 2003 pooled and separately. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The left and right panels compare apprentices to full-time students in vocational and general schools, respectively. The late starter sample consists of students continuously enrolled in an educational track between 2002 and 2004 and not working or enrolled in work-based education in 2001. Similarly, the late^2 starter sample consists of students continuously enrolled in an educational track between 2003 and 2005 and not working or enrolled in work-based education in 2001 and 2002. All estimates include control variables displayed in Table A1.2 and the lagged dependent variables.

Figure A4.1: Graphical Representation of Personality Skills Change for Late Starters
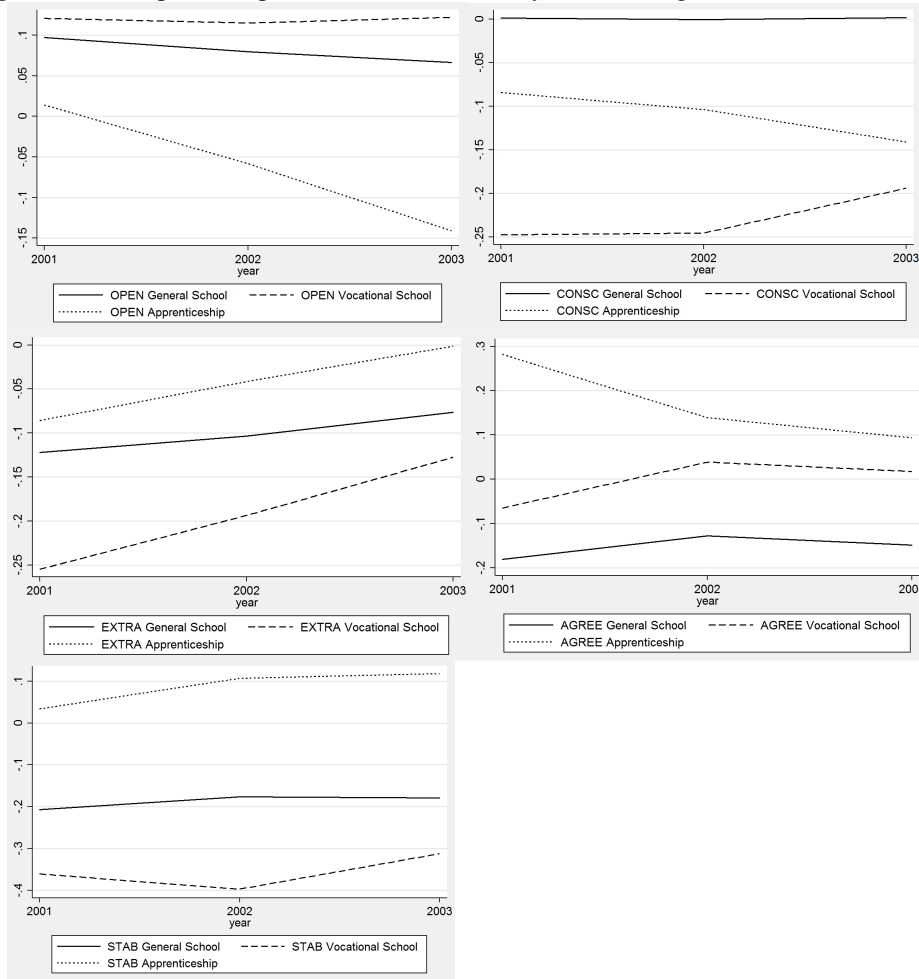
Figure A4.2: Graphical Representation of Personality Skills Change for Late^2 Starters