Abstract Title Page
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Title: The Impact of Vocational Schooling on Human Capital Development in Developing Countries: Evidence from China

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Abstract Body

Limit 4 pages single-spaced.

Background / Context:

Description of prior research and its intellectual context.

A critical question faced by developing countries is how to effectively build human capital to promote and sustain economic growth. As the economies of developing countries shift from lower value-added to higher value-added industries and experience technological change, their need for human capital also increases (Heckman and Yi, 2012; Autor, Levy, and Murnane, 2003). Indeed, higher value-added jobs must be staffed with employees who are equipped with greater skills (Bresnahan et al., 2002; Bresnahan, 1999; Katz and Krueger, 1998). Without a labor force with sufficient skills, developing economies could ultimately stagnate (Hanushek and Woessman, 2012; Hanushek and Woessman, 2008; Mincer, 1984).

A number of developing countries currently identify vocational education and training (VET) as a key approach to building human capital. For example, the promotion of VET at the high school level (*"vocational high school"*, which we use interchangeably with VET throughout the paper) has become a policy priority among emerging economies such as Brazil, Indonesia, Mexico and China (Newhouse and Suryadarma, 2011; National Congress of Brazil, 2011; Ministry of National Education of Indonesia, 2006; China State Council, 2010). The rationale underlying these policies is that increases in the proportion of vocational—as opposed to academic—high school enrollments can more effectively build human capital.

For VET to successfully build human capital in these countries, however, it must meet two prerequisites. The first prerequisite is that VET must help students learn specific (vocational) skills. Vocational high school, in particular, must help youth acquire specific, medium-level skills that can either directly be used in the labor market after graduation or serve as a foundation for vocational college (Kuczera et al., 2008).

Second, in addition to specific skills, for VET to be considered successful, it must help students acquire general skills (Kuczera et al., 2008; Chiswick, Lee and Miller, 2002). The international literature shows that a solid foundation of general or cognitive skills (for example, in math, reading and/or science) helps employees succeed in the workplace (Levy and Murnane, 2004). Similarly, the mastery of general skills has been shown to have a significant and long-term impact on the wages of high school graduates (Tyler, Murnane, and Willett, 1995). Labor markets are also prone to change, and job stability for individuals (as well as economic stability for countries) requires lifelong learning, which is contingent on a foundation in general skills (Kezdi, 2006). Indeed, for these reasons, almost all countries require (at least in theory) vocational high schools to teach general skills (Kuczera et al., 2008).

Despite the increasing interest in VET among policymakers, there is surprisingly little evidence from developing countries as to whether vocational high school, especially in comparison to academic high school, actually helps students acquire specific and general skills. Cross-national studies based on international tests such as the PISA do show that students in vocational high school have much lower levels of *general* skills (math, reading and science) than students in academic high school (by almost half a standard deviation among countries that take the PISA, see OECD, 2010). However, since the PISA data do not contain detailed information on student background characteristics (such as prior test scores) that are necessary to adjust for selection bias, the PISA data are not suitable for measuring the causal impacts of attending vocational versus academic high school. Furthermore, because the PISA data are cross-sectional

and not longitudinal, they cannot show how much vocational high school contributes to gains in student learning.

In fact, we are only aware of one study that uses longitudinal data from a developing country to measure the impact of attending vocational versus academic high school. Using longitudinal data from Indonesia in the 1990s, Chen (2009) finds that attending vocational school has little impact on students' general skills. Unfortunately, limitations of the data used in the Chen study prevent the use of more rigorous causal methods that control for selection bias. Specifically, the Chen study relies on a relatively small sample of students (fewer than 1000). Because this sample does not have enough vocational and academic high school students that share a common set of characteristics (i.e., a common support) the OLS regressions used in the study may give biased results as they are based on linear extrapolations away from common support (King and Zeng, 2006). Similar to studies based on the PISA data, Chen (2009) also does not measure the impact of attending vocational high school on specific skills.

Purpose / Objective / Research Question / Focus of Study:
Description of the focus of the research.

We aim to begin to fill what appears to be a gap in the literature on VET in developing countries by examining whether vocational high school students are, in fact, learning specific and/or general skills. Toward this overall aim, we seek to accomplish three goals. First, we seek to assess the impact of attending vocational versus academic high school on the dropout rates, specific skills and general skills of the *average* student that is attending academic and vocational high schools. Second, we seek to estimate the *heterogeneous impacts* of attending vocational versus academic high school on the dropout rates and skill levels of disadvantaged (low-income or low-ability) students. Third, we aim to establish whether vocational high school leads to any absolute gains in specific and general skills.

Setting:
Description of the research location.

The study covers a representative sample of 100 vocational and 30 academic high schools from 7 cities in Shaanxi and Zhejiang provinces (China). Shaanxi province is an inland province in Northwest China and ranks 15th out of 31 provinces in terms of GDP per capita (NBS, 2012). Zhejiang is a coastal province that ranks fifth in terms of GDP per capita (NBS, 2012).

Population / Participants / Subjects:
Description of the participants in the study: who, how many, key features, or characteristics.

The participants include 7,114 vocational high school students in 184 computer major classes (in 100 schools) as well as 2,957 academic high school students in 59 classes (in 30 schools).

Intervention / Program / Practice:
Description of the intervention, program, or practice, including details of administration and duration.

Policymakers in China have a strong interest in using VET to build human capital and drive economic growth (China State Council, 2010). The strong interest has resulted in the expansion of vocational high school enrollments from 11.7 million to 22.1 million students between 2001 and 2011 and annual investments of more than 21 billion dollars (NBS, various years; MOF and NBS, 2011).

Research Design:
Description of the research design.

To identify the causal impacts of attending vocational versus academic high school, we first use coarsened exact matching (CEM) in combination with a rich set of student covariates (including pre-test scores in both specific and general skills and "local" residence) (Iacus et al., 2012a). The CEM procedure produces a high degree of balance across the observable covariates. After matching the data using CEM, we also run regression analyses on the matched set of students. By running regression analyses on top of the matched student data, our causal estimators are doubly-robust in the sense that the estimators are unbiased if either the matching procedure or the regression specification is correctly specified (Ho et al., 2007; Bang and Robins, 2005).

We next take advantage of a fuzzy regression discontinuity design to identify the causal effects. Specifically, we use variation in a student's high school entrance exam (HSEE) score relative to an HSEE score cutoff. In China, HSEE scores determine entry into academic high school. Every county has a different cutoff for whether a student's score makes him/her eligible to enter academic high school. Students with HSEE scores that are equal to or higher than the HSEE score cutoff in their county can go to academic high school. By contrast, students with HSEE scores that are lower than the cutoff can only go to vocational high school (unless they choose to go into the labor market).

Data Collection and Analysis:
Description of the methods for collecting and analyzing data.

We conduct baseline and endline surveys of 7,114 vocational high school students (in 100 schools) and 2,957 academic high school students (in 30 schools) in October 2011 and May 2012. Besides collecting a wide range of student, teacher, and school background variables in our surveys, we also measured three key outcome variables.

Our first outcome was whether a student from the baseline survey had dropped out by May 2012. To identify dropouts, our enumerators filled in a student-tracking form for each class during the endline survey. Moreover, after the field survey was over, our enumerators called the parents or guardians of the students to further ascertain whether students marked dropped out on our tracking form had in fact dropped out.

A multi-step procedure was used to obtain reliable and valid measures of specific and general skills (our second and third outcomes) and gains in those skills. First, we collected a large pool of computer and math exam items (questions) from official sources. Second, after piloting the large pool of exam items with more than 300 students, we designed vertically scaled (equated) baseline and endline exams using item response theory (IRT). Third, we administered and closely proctored the standardized computer and math exams during the baseline (October 2011) and endline surveys (May 2012).

To assess the impact of attending vocational versus academic high school on student dropout rates, specific skills and general skills, we conduct three types of analyses: (a) ordinary least squares (OLS); (b) matching; and (c) instrumental variable (or IV) analysis.

Findings / Results:
Description of the main findings with specific details.

Estimates from (coarsened exact) matching and instrumental variables analyses show that attending vocational (relative to academic high school) substantially reduces general skills without improving specific skills. Attending vocational high school also increases dropout, especially among disadvantaged (low-income and low-ability) students. We also use comparable (equated or scaled) baseline and follow-up test scores to measure absolute gains in specific and general skills among the students. We find that students who attend vocational high school experience absolute reductions in their general skills. That is, not only does vocational high school fail to teach any new general skills, it causes students to lose general skills they learned in the past.

Conclusions:
Description of conclusions, recommendations, and limitations based on findings.

Taken together, our findings indicate that the promotion of vocational schooling as a substitute for academic schooling can in fact be detrimental to building human capital in developing countries such as China. Policymakers in China itself may wish to cease the large, almost indiscriminate investment into the vocational high school system. Instead policymakers may wish to reduce investment into vocational high schools and direct more resources toward the more effective approach to human capital development: academic high school.

Appendices

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Appendix A. References

References are to be in APA version 6 format.

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Appendix B. Tables and Figures

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