Safety Valve or Sinkhole? Vocational Schooling in South Africa*

Todd Pugatch
Oregon State University and IZA

October 19, 2012
Preliminary: Please do not cite

Abstract

As an alternative to traditional academic schooling, vocational schooling in South Africa may serve as a safety valve for students encountering difficulty in the transition from school to work. Yet ineffective vocational schooling could also be a sinkhole, offering little chance for success on the labor market. After defining the terms "safety valve" and "sinkhole" in a model of human capital investment with multiple schooling types, I test for evidence of these characteristics using a panel of urban youth in South Africa. I find support for the safety valve role of vocational schooling, with a small increase in vocational enrollment in response to grade failure, compared to a decline of 38 percentage points for academic enrollment. In contrast, I find no evidence that vocational schooling is a sinkhole, with wage and employment returns at least as large as those for academic schooling. The results suggest that vocational schooling plays an important role in easing difficult school to work transitions for South African youth.

JEL classification: I25; J24; J31; O12. *Keywords:* human capital investment; vocational schooling; youth unemployment; South Africa.

*Department of Economics, 303 Ballard Extension Hall, Corvallis OR 97331; todd.pugatch@oregonstate.edu.
I thank Patrick Emerson, Rob Garlick, Laura Kawano, David Lam, Zoë McLaren, Christina Plerhoples, Vimal Ranchhod, and Elizabeth Schroeder for helpful comments. Cally Ardington, Nicola Branson, Jessica Goldberg, and David Lam oriented me to CAPS and graciously shared their programs for formatting the data. Matthew Palm provided research assistance.

1 Introduction

Youth in South Africa face a difficult transition from school to work. Students face wide variation in school quality and high rates of grade failure and repetition. Those in the labor market face an unemployment rate in excess of 50%,[1] with surprisingly few opportunities in the informal sector. Improving the school to work transition for youth, particularly for those from vulnerable circumstances, is a key social and political issue. Vocational schooling, in which about 400,000 students enroll at the secondary and post-secondary levels each year,[2] offers the promise of an alternative educational path for students struggling in the traditional general education system. Vocational education may also be an effective means to provide youth with skills that employers seek. The South African government intends to expand vocational secondary programs by over 6 times current enrollment in the coming years (Oxford Business Group 2012). Yet little is known about what types of students enroll in vocational programs in South Africa, why they choose to enroll, or how they fare on the labor market.

This paper analyzes the role of vocational schooling in the school to work transition of South African youth. Specifically, I examine whether vocational schooling serves as a *safety valve* for students struggling in the general schooling system, experiencing adverse household shocks, or forming new households. I also examine whether vocational schooling benefits students after they leave, or whether (consistent with conventional wisdom in South Africa) it is a *sinkhole* offering little chance for success on the labor market. After defining the terms "safety valve" and "sinkhole" in a model of human capital investment with multiple schooling types, I test for evidence of these characteristics in a panel of urban youth in South Africa. I find support for the safety valve role of vocational schooling, with a small increase in vocational enrollment in response to grade failure,

[1] Data for 15-24 year olds in 2005, compiled in Banerjee, Galiani, Levinsohn, McLaren and Woolard (2008). Unemployment follows the "narrow" definition of the International Labor Organization (ILO), which classifies working age individuals as being in the labor force if during a week of reference they were employed or wanted to work and were available to start working within a week but also had actively looked for work during the past four weeks.

[2] Estimate based on 269,054 enrolled in vocational secondary programs in 2006 (UNESCO Institute for Statistics 2011) and 140,000 average enrollment in universities of technology in 2006-2008 (Bunting and Cloete 2010).

compared to a decline of 38 percentage points for academic enrollment. Vocational schooling also serves as a safety valve for pregnant girls. In contrast, I find no evidence that vocational schooling is a sinkhole, with wage and employment returns at least as large as those for academic schooling. These findings persist after extending the model to account for multi-dimensional ability and splitting the sample among various subsamples of interest. Using the method of Altonji, Elder and Taber (2005), I present evidence that the estimated labor market returns are unlikely to be due to selection on unobserved characteristics. The results suggest that vocational schooling plays an important role in easing difficult school to work transitions for South African youth. Students who struggle to advance in academic programs may find it optimal to enter vocational programs, where they can earn comparable returns.

Vocational schooling has been the subject of considerable previous economic research, much of it focused on estimating comparative returns between vocational and general/academic programs. For the developing world, Bennell (1996) provides an early review, questioning the then-conventional wisdom that academic returns exceeded vocational. Since then, a number of researchers have continued to estimate comparative returns for individual developing countries. A partial list includes Egypt (El-Hamidi 2006), Indonesia (Newhouse and Suryadarma 2011), Taiwan (Rodgers, Zveglich and Wherry 2006), Tanzania (Hawley 2003, Hawley 2008), and Thailand (Kahyarara and Teal 2008), with varying results regarding the direction and magnitude of comparative returns. Two recent studies (Oosterbeek and Webbink 2007, Malamud and Pop-Eleches 2010) rely on policy changes in the Netherlands and Romania, respectively, to isolate plausibly exogenous changes in vocational schooling.[3] Both studies find little difference in labor market outcomes between students with vocational and academic schooling as a result of the policy change, and argue that

[3]Several recent studies (Attanasio, Kugler and Meghir 2011, Card, Ibarrarn, Regalia, Rosas-Shady and Soares 2011, Maitra and Mani 2012) report results from randomized control trials of vocational training programs in developing countries (Colombia, Dominican Republic, and India, respectively), with mixed results for employment and wage returns. Although the nature of the evidence in these studies is compelling, the programs under study are short-term job training programs implemented outside the public education system, making them not strictly comparable to the South African vocational programs that I consider in this paper. Other researchers have also recently conducted experimental studies on vocational training in Africa, but results are not yet ready for citation.

non-random selection into these tracks drives the varying findings of other studies in the literature. Hanushek, Woessmann and Zhang (2011), using data from OECD countries, find initial gains to vocational schooling that are overtaken by academic schooling later in working careers, providing another plausible explanation for contradictory findings regarding returns. Because my sample is composed entirely of young adults, the Hanushek et al. (2011) results call for caution in interpreting my results on labor market returns, as differences between academic and vocational returns may emerge later in working careers.

The notion of vocational schooling as safety valve or sinkhole has been discussed in previous literature. Arum and Shavit (1995) consider whether vocational schooling in the United States "is simply the crude mechanism of social exclusion" (i.e., a sinkhole), but conclude that "vocational education is a safety net that reduces the risk of falling to the bottom of the labor queue" (p. 187). For South Africa, Needham and Papier (2011) refer to a stigma attached to vocational schooling, and the common perception that it is a sinkhole: "Some school [general education] students saw FET college [Further Education and Training, or vocational secondary] education as a second choice education that would result in low-paying jobs with no career prospects" (p. 36). They also reference vocational schooling's safety valve role, citing qualitative evidence of poor previous schooling outcomes among vocational students: "[S]tudents viewed vocational education, particularly FET colleges, as second chance programmes that you went to if you could not make it at [traditional] school" (p. 37). This paper contributes to the literature by formalizing the safety valve and sinkhole concepts in a human capital investment model; documenting the patterns of differential selection into vocational and academic schooling in South Africa; and estimating the wage and employment returns to each type of schooling. These returns estimates, while observational in nature, use high-quality panel data that include complete schooling histories, measures of ability, and actual (rather than potential) work experience, allowing for bias reductions relative to similar estimates from a census or labor force survey.

In the next section, I define the terms "safety valve" and "sinkhole" in a simple model of

human capital investment. Section 3 describes the data and presents descriptive statistics. Section 4 analyzes the role of vocational schooling in youth enrollment choices and labor market outcomes. Section 5 checks for robustness of results, and Section 6 concludes.

2 Theory

2.1 Safety Valves and Sinkholes

Consider a generalization of the standard Becker/Mincer human capital model in which agents may choose between two types of schooling (e.g., academic and vocational).[4] Each type of schooling has associated (and possibly agent-specific) return and cost functions, $R_j(\cdot)$ and $C_j(\cdot)$, for schooling types $j = \{a, v\}$. The cost functions are general and include both the monetary and psychic costs of schooling. These return and cost functions depend on the type-specific stock of schooling S_j, the agent's ability A, and exogenous shifters Z.[5] As is standard, assume that $\log R_j$ is increasing (and possibly concave) in S_j and C_j is increasing and convex in S_j. Also assume that R_j is increasing in A and C_j is decreasing in A: higher ability individuals earn higher returns and face lower costs at any level of schooling. The signs of R_j and C_j are ambiguous with respect to Z.

In addition to possible differences in the curvature of the return and cost functions $R_j(\cdot)$ and $C_j(\cdot)$ between schooling types, I assume that schooling type v carries a fixed cost:

$$C_v(S_v, E(A), Z) = c_v(S_v, E(A), Z|S_v > 0) + \phi \cdot \mathbb{I}(S_v > 0) \tag{1}$$

where $\mathbb{I}(\cdot)$ is the indicator function and ϕ is the fixed cost. The fixed cost ϕ may be pecuniary in nature, such as an application fee for schooling type v, or non-pecuniary, such as a stigma for attending a type v school, or the cost of acquiring information about this type of schooling.

[4] The model developed in Becker (1967) found its most influential empirical counterpart in Mincer (1974). Card (1999) offers a simple and general form of the model that serves as the starting point for my extension to multiple types of schooling considered here.

[5] Without loss of generality, I assume that each agent has acquired sufficient prior schooling to make both types of schooling an option, so that $S_j = 0$ presupposes this level of attainment. In South Africa, students who have completed 9 years of schooling may choose to continue in the academic system or pursue vocational study.

The agent's lifetime, discounted income Y is the sum of the schooling return functions: $Y = R_a(S_a, A, Z) + R_v(S_v, A, Z)$. The agent observes his or her own ability imperfectly, and must base decisions on its expectation $E(A)$. The agent's optimization problem is then:[6]

$$\max_{S_a, S_v} V = \{\log [R_a(S_a, E(A), Z) + R_v(S_v, E(A), Z)] - [C_a(S_a, E(A), Z) + C_v(S_v, E(A), Z)]\} \quad (2)$$

The first order conditions are:

$$\frac{\frac{\partial R_j}{\partial S_j}(S_j, E(A), Z)}{Y} \geq \frac{\partial C_j}{\partial S_j}(S_j, E(A), Z) \text{ for } j = a, v \quad (3)$$

where the weak inequality allows for discrete increments of S_j and corner solutions. This is the standard result that the agent invests in each type of schooling S_j to equate (as closely as possible) its marginal benefits and costs. The fixed cost to schooling type v adds the following participation constraint:

$$\log Y - c_v(S_v, E(A), Z) \geq \phi \quad (4)$$

The first order conditions in (3) and the participation constraint (4) implicitly define the optimal levels of schooling $S_j^* = S_j(E(A), Z)$. If there is heterogeneity in the population in the fixed cost ϕ, the first result is that there exists a threshold ϕ^* above which the agent will choose not to acquire any type 2 schooling.

Now consider comparative statics with respect to ability. Suppose the agent revises his expected ability, such as after failing a grade:

$$\frac{\partial V}{\partial E(A)} = \frac{\sum_{j=\{a,v\}} \frac{\partial R_j}{\partial E(A)}(S_j, E(A), Z)}{Y} - \sum_{j=\{a,v\}} \frac{\partial C_j}{\partial E(A)}(S_j, E(A), Z) \quad (5)$$

[6] I frame the problem as static for simplicity of exposition. The model could be made dynamic in a straightforward manner, adapting the dynamic discrete choice framework of Pugatch (2011).

The first term on the right-hand side of (5) is the (perceived) marginal return resulting from the revision to expected ability, while the second term is the change in schooling costs. The first term is positive and the second negative, making the sign of the derivative unambiguously positive. This positive sign is intuitive: perceived returns will fall when one revises expected ability downward after failing a grade, or rise with gains in expected ability. Costs will rise in response to a failure, or decrease with a gain in expected ability.

How will the change in expected ability affect schooling choices? Define the schooling type j-specific change in net returns as:

$$\Delta_j^A \equiv \frac{\frac{\partial R_j}{\partial E(A)}(S_j, E(A), Z)}{Y} - \frac{\partial C_j}{\partial E(A)}(S_j, E(A), Z) \tag{6}$$

Although Δ_j^A is positive for both types of schooling, it need not be equivalent across schooling types, and therefore the agent may alter schooling investments differentially between types in order to satisfy the first-order conditions in (3). I refer to schooling type v as a *safety valve* if $|\Delta_a^A| > |\Delta_v^A|$: if this inequality holds, then schooling of type v is less responsive to revisions in expected ability. This implies, for instance, that students experiencing a grade failure would alter S_v by less than S_a, choosing to decrease schooling of type v by less than the decrease in S_a. Because of discrete increments of S_j and the possibility of corner solutions, we may observe no change in either type of schooling.[7] However, we are more likely to observe no change in the safety valve schooling type S_v than in S_a.

The safety valve result applies equally to external shocks Z: schooling type v would also exhibit the safety valve property if $|\Delta_a^Z| > |\Delta_v^Z|$, so that schooling type 2 would be less responsive to shocks than type a.[8]

The presence of a safety valve type of schooling is a boon for students experiencing negative

[7] Those whose fixed cost of type v schooling type ϕ is sufficiently high will continue to abstain from investing in type v schooling.

[8] The safety valve property requires symmetry with respect to the *relative* magnitudes of responses to positive and negative shocks, so that negative (positive) shocks lead to larger decreases (increases) in type a schooling than type v. The model may be generalized to allow for asymmetry in the absolute magnitudes, however.

shocks, as they can shift their schooling choices in favor of the relatively less affected type (S_v in the running example). They do so until the first-order conditions in (3) are satisfied, and the marginal benefits and marginal costs of each type of schooling chosen return to equilibrium. Nonetheless, the presence of the safety valve may impose a significant cost on students through the labor market returns earned at the new optimal schooling choices. Denoting these labor market returns as $\beta_j \equiv \frac{\partial r_j}{\partial S_j}/Y$, I consider schooling type v to be a *sinkhole* if $\beta_v < \beta_a$ for all $S_v = S_a$. That is, if schooling type v generates lower labor market returns than type a at comparable schooling levels, it is a *sinkhole*, because students must pay for the lower costs (pecuniary or non-pecuniary) of this type of schooling in terms of labor market performance. In other words, a sinkhole schooling type draws in students with low costs, but fails to offer competitive returns on the labor market.[9]

2.2 Empirical Implementation

In this paper, I investigate the hypothesis that vocational schooling acts as a safety valve for South African youth, i.e., that vocational schooling is type v in the notation of the human capital model of Section 2.1. Specifically, I seek evidence that enrollment in vocational schooling responds less than academic schooling to revisions of expected ability and external shocks. To do so, I will run variations of the following regression:

$$D_{it}^j = \alpha_0^j + \alpha_f^j F_{it} + \alpha_z^j Z_{it} + \gamma^j X_{it} + \epsilon_{it}^j \tag{7}$$

where $j = \{a, v\}$ indexes academic schooling a and vocational schooling v; i indexes individuals; and t indexes time periods. The outcome variable D^j is an indicator for enrollment in schooling type j; F is a vector of grade failure history; Z is a vector of external shocks; X is a vector of additional controls, which may include fixed effects for individual, age, schooling level, and calendar year, as well as other control variables; and ϵ is an error term. In this regression, grade failure

[9] Note that the presence of the fixed cost makes it possible to observe an equilibrium in which the marginal returns to schooling type v exceed those of type a, but many students still optimally choose not to invest in type v schooling.

history variables F proxy for revisions to expected ability, making the coefficient α_f^j analogous to Δ_j^A in the model of Section 2.1.[10] Comparing the coefficients α_f^v and α_f^a therefore provides a test of the safety valve hypothesis: if vocational schooling is a safety valve, I should find that $\alpha_f^a < \alpha_f^v < 0$.

Similarly, the safety valve hypothesis suggests that vocational enrollment should be less responsive to external shocks Z, i.e., $|\alpha_z^a| > |\alpha_z^v|$. Due to data limitations that I will explain in the following sections, I will run variations of the safety valve regression (7) on subsets of the failure and shock variables F and Z.

I am also interested in whether vocational schooling is a sinkhole, offering lower labor market returns than academic schooling. Assuming that the type-specific schooling return functions $\log R_j(\cdot)$ are linear in S_j leads to an extension of the standard Mincer regression of (log) wages on years of each type of schooling. To test the sinkhole hypothesis, I run a variant of the standard Mincer regression:

$$Y_{it} = \beta_0 + \beta_a S_{it}^a + \beta_v S_{it}^v + \gamma X_{it} + \epsilon_{it} \tag{8}$$

where Y is a labor market outcome (employment or log wages); S^a and S^v are the stock of academic and vocational schooling, respectively; and all other notation is as before. Vocational schooling is a sinkhole if $\beta_v < \beta_a$. I address the limitations of Mincer regressions in the empirical setting of this paper in Section 4.

3 Data

Vocational schooling is available to South African students beginning in Grade 10, when schooling is no longer compulsory. Students opting for a vocational program may enroll in technical colleges in Grades 10-12 (also known as FET colleges, for Further Education and Training) or National

[10] Individual fixed effects will capture a student's prior expected ability, while age and completed schooling terms will capture average expected ability associated with those variables, allowing the failure terms to isolate changes in expected ability.

Technical Certificate (NTC) programs at equivalent grade levels. Such programs tend to focus on preparing students for skilled trades and service professions, such as metal and electrical work, plumbing, and hospitality. Schools of all types are free to set their own admissions criteria and fees, but may not discriminate on the basis of race, test scores, or the ability to pay. Nonetheless, schools remain highly segregated along racial and class lines (Fiske and Ladd 2004). At the post-secondary level, students with sufficiently high scores on the high school exit ("matric") exam may qualify for admission to public universities. Such universities include traditional academically oriented institutions and universities of technology (formerly known as Technikons). Although academic universities and universities of technology have some overlap in courses of study offered, the universities of technology focus more on trade skills than their academic counterparts, offering engineering, accounting, computer science, design, health services and other subjects. Private higher education institutions are also available at the post-secondary level; although such institutions may offer both academic or vocational courses of study, I consider them as academically oriented institutions in this paper because I am unable to distinguish what course of study a particular student chooses.

I define "vocational" and "academic" schooling as mutually exclusive categories. Vocational schooling includes enrollment in a National Technical Certificate program (such as a technical college) or university of technology; enrollment in all other programs is academic schooling. I will also sometimes refer to "traditional" and "non-traditional" schooling as another set of mutually exclusive categories. Non-traditional schooling includes vocational schooling and higher education programs at an institution other than a public university or a university of technology; enrollment in all other programs is traditional schooling. Because employment while enrolled in school is rare in South Africa, I treat school enrollment and labor market participation as mutually exclusive activities.[11]

I use data from the Cape Area Panel Study (CAPS), a longitudinal study of youth in metropoli-

[11] In my sample, only 3% report ever working and attending school simultaneously. This figure rises to just 5% among those who ever enrolled in a vocational program.

tan Cape Town, South Africa (Lam, Ardington, Branson, Case, Leibbrandt, Menendez, Seekings and Sparks 2008). CAPS sampled about 4,800 youth aged 14-22 in Wave 1 (2002) and currently includes four publicly available waves, the most recent conducted in 2006. In Wave 1, retrospective life histories were collected for each year stretching back to birth, and include information on school enrollment and advancement, job search, and employment. I update this retrospective life history data with information from Waves 2-4 to construct the panel used in this paper. I make several sample restrictions. I drop white youth, as they tend to enjoy living standards comparable to those in developed countries, while my focus here is on youth who tend to face high uncertainty in their schooling and employment outcomes. I keep only those youth observed until at least age 18. I also drop those with inconsistent schooling histories (details described in Appendix A), leaving $N = 2,768$ individuals in the sample. In the analysis, I use only those person-years with at least 9 years of completed schooling, at which point enrollment in vocational schooling becomes a viable option. The resulting dataset includes 17,571 person-year observations. Table 1 shows the panel balance at selected ages, conditional on vocational enrollment history. The sample size drops sharply at later ages due to both the young ages of entry into the panel (i.e., right-censoring) and attrition in later waves. There is evidence of selective censoring and attrition by vocational enrollment status, with vocational enrollees leaving the sample at lower rates than those who never enter a vocational program, arguing for caution when interpreting my results. However, the direction of the potential bias resulting from selective attrition is unclear: if vocational enrollees were both less successful on the labor market than others (i.e., the sinkhole hypothesis) and more likely to leave the sample as a result, then we would expect to see the opposite pattern of attrition than the one observed.

Table 2 presents summary statistics for the sample. Coloured[12] youth make up two thirds of the sample and black/Africans the remainder, as is characteristic of metropolitan Cape Town. Only a

[12] "Coloured" refers to people of mixed racial heritage and descendants of Cape Malay slaves; the term is in common use among South Africans of all races. Coloured people occupied an intermediate position under apartheid in which they faced major restrictions on civil, political and economic activity, but not as severe as the majority black population.

fraction of the sample ever enrolls in vocational or non-traditional programs of study: 8% enroll in a vocational program, while 16% enroll in any non-traditional program. Such small proportions are consistent with the presence of a fixed cost to vocational schooling, as in the model of Section 2.1. Those who enroll in vocational programs complete 0.7 years of study, while non-traditional enrollees complete 1.1 years overall. A little over half (54%) of the sample will have ever worked for pay by the end of the panel, earning a mean annual wage of R34,743, or about US$3,375. Figure 1, panel (a) shows that enrollment in vocational or non-traditional programs begins in the late teen years and peaks at age 19, though never exceeding 8% of the sample at any age. Panel (b) shows that enrollment in academic programs always exceeds that of vocational or non-traditional programs, though the gap narrows in post-secondary schooling, particularly after grade 12, when many students complete their studies.

Who enrolls in vocational or non-traditional programs? Table 3 presents enrollment rates by selected characteristics. Gender and racial differences in enrollment are modest. Although we saw in Table 2 that the overall enrollment rate for vocational programs was relatively low, in Table 3 we see that vocational enrollees tend to be from wealthier backgrounds, comprising 10% of youth from the richest three household income quintiles versus 5% from the poorest two quintiles. They are also highly educated: 22% of those with more than 12 years of schooling have enrolled in a vocational program. The bulk of this group are enrollees in a post-secondary vocational program (i.e., a university of technology); less than 1% of those with more than 12 years of schooling ever enrolled in a vocational secondary program. Vocational enrollment follows a similar pattern with respect to the ability distribution: the highly able choose to enroll in vocational post-secondary or other non-traditional programs more than the less able.[13] Reported school fees are considerably higher for vocational secondary programs than academic, which may partly explain low vocational secondary enrollment. At the post-secondary level, there are no appreciable differences in reported

[13]High ability refers to scoring above the full sample, age-adjusted median on the literacy and numeracy evaluation administered in CAPS Wave 1.

fees between academic and vocational programs.[14]

Vocational enrollment also exhibits an interesting pattern with respect to student re-enrollment histories. Vocational enrollment is low (just 5%) among those who never re-enrolled, i.e., those who never interrupt their studies with a period of dropout. But vocational enrollment rises to 13% among those who re-enroll at least once in their schooling career, with most of this activity in post-secondary vocational programs. Enrollment in vocational secondary programs is 5% among those who re-enroll before completing secondary, compared to an overall vocational secondary enrollment rate of 3%. Similar patterns exist for enrollment in all non-traditional programs. Figure 2 shows that non-traditional programs attract a larger share of re-enrollees than students who never re-enrolled, at both the secondary and post-secondary levels. These patterns suggest that vocational schooling represents an important outlet for those who interrupted their studies to return to formal schooling programs.

What types of jobs do youth perform, and how do these jobs differ among those who enrolled in vocational programs? Table 4 displays the occupational distribution of employed youth in Wave 4, the last available wave of the survey. The most striking pattern is the high rate of missing data: almost 64% of the sample do not report their occupation, making it difficult to draw strong inferences from this table. Focusing on those who did report their occupation, we see that those with some vocational schooling are *less* likely to be employed in skilled trades than those without vocational schooling. This is a curious result, and does not simply reflect the higher prevalence of post-secondary studies among those with vocational schooling, because the discrepancy is less pronounced among those with post-secondary schooling. Indeed, those with vocational schooling are more likely to be employed in managerial/professional, associate professional, and administrative/secretarial positions than those without, suggesting that vocational schooling facilitates access

[14]The regression of (log) school fees on enrollment in various programs yields: $\ln fee = \underset{(173.1)}{5.72} + \underset{(5.3)}{1.76}\, vocsec + \underset{(37.5)}{2.93}\, acadpostsec + \underset{(31.6)}{2.96}\, vocpostsec$, where *vocsec*, *acadpostsec*, and *vocpostsec* are dummies for enrollment in vocational secondary, academic post-secondary, and vocational post-secondary programs, respectively; enrollment in academic upper secondary (grades 10-12) is the omitted category. t-statistics from standard errors clustered by individual in parentheses.

to occupations beyond just the skilled trades.

How do youth transition between academic or vocational enrollment and the labor market? How do such transitions relate to their success or failure in school? Table 5 shows the transition matrix for all person-year observations in the sample. The left column presents the youth's activity in the initial period – enrollment in an academic or vocational program, or work, search or inactivity for those not enrolled in school – and the activity in the subsequent period. Initial period enrollment is further differentiated by its result (pass or fail). Proportions sum to one across each row. The first pattern to note is that enrollment in an academic program is "stickier" than enrollment in a vocational program: 65% of those enrolled in an academic program remain enrolled in school in the following period, with the overwhelming majority remaining in an academic program. By contrast, only 49% of those in a vocational program remain enrolled in school, with 5% switching into an academic program. Vocational schooling immediately precedes labor market entry (or inactivity) more often than does academic schooling.

Also of note are transitions conditional on schooling results. Both academic and vocational students who passed their last grade are more likely to remain enrolled than those who failed. Yet 35% of vocational students who failed their last grade obtain employment the following period, compared to just 12% of students who failed an academic grade. This pattern suggests that employers consider vocational enrollment a valuable signal, regardless of the student's performance.[15]

4 Analysis

The last section presented descriptive evidence on enrollment in academic versus vocational programs and transitions from these programs into the labor market. This section will move beyond this description to provide a more formal analysis of selection into academic versus vocational enrollment and subsequent outcomes.

[15] Although the data allows me to further differentiate transitions by type of failure (e.g., poor grades, withdrawal or incomplete grades), small cell sizes make it difficult to draw strong inferences for vocational students.

4.1 Do struggling students select into vocational schooling?

If vocational schooling is a "safety valve," it would attract a disproportionate share of students who struggle in school. It would also attract a disproportionate number of re-enrollees who struggled on the labor market. Table 6 tests these hypotheses, showing the results of regressions (linear probability models) of enrollment in academic or vocational schooling on measures of grade failure and unemployment. All regressions include individual fixed effects and a full set of completed schooling, age and calendar year dummies, so identification is achieved through variation in school or labor market outcomes that is uncorrelated with time-invariant unobserved heterogeneity, factors common to youth at particular ages or levels of schooling, or macroeconomic conditions. The identification strategy is thus similar to the "schooling as a lottery" idea of Lam, Ardington and Leibbrandt (2011), in which school performance depends on innate characteristics and idiosyncratic stochastic shocks.[16]

In column (1), I find that students who failed their last grade are 38 percentage points less likely to enroll in an academic program. Each previous failure (prior to the result of the last grade) results in an additional 19 percentage point decline in the probability of enrollment in an academic program. Both coefficients are statistically significant at the 1% level. The analogous regression for vocational enrollment in column (3) shows that students who failed their last grade are statistically no less likely to enroll in vocational schooling, while each previous failure leads to a 1 percentage point *increase* in vocational enrollment (significant at 10%). This is strong evidence in favor of the safety valve role for vocational schooling: struggling students are deterred from enrollment in academic programs but are not similarly deterred, and are possibly attracted to, vocational programs. Columns (2) and (4) add work history to the regressions to check if differential employment opportunities are driving the results, but there is almost no change in the failure coefficients. I find that non-employment in the previous period out of school increases the

[16] Direct measures of shocks are excluded from these regressions because data limitations would reduce the sample size and hamper the identification of individual fixed effects. I examine the direct effect of shocks on enrollment in Section 4.2 and robustness of grade failure measures to their inclusion in Section 5.1.

likelihood of enrollment in both academic and vocational programs, but by a greater amount (4 percentage points to 1) for academic programs. Thus schooling of both types appears to serve a safety valve function for youth who were unsuccessful in the labor market.

Columns (5)-(8) of Table 6 repeat the analysis of the first four columns, but restrict attention to re-enrollment, i.e., the sample is restricted to person-years for which the previous period was spent out of school. Here I find qualitatively similar results: struggling students are much less likely to re-enroll in academic programs, with coefficients even larger than for the full sample. Previous grade failure is now a significant negative predictor of re-enrollment in vocational schooling, but the coefficients are less than one-fifth the magnitude of those for academic schooling. Again we see the safety valve role of vocational schooling, this time for previously struggling students considering re-enrollment.

4.2 Do students experiencing a household shock select into vocational schooling?

Another way in which vocational schooling could serve as a safety valve would be to attract a disproportionate share of students experiencing negative household shocks, such as a household member's job loss or death. Data on such shocks are more restricted than for school or labor market outcomes, as they are limited to Waves 1, 3 and 4 of the panel. The brevity of the panel including household shocks makes the use of individual fixed effects infeasible, particularly if we wish to explore how both contemporaneous and lagged shocks influence enrollment choices. Nonetheless, the data on household shocks are quite rich and allow for distinctions between types of negative shocks. Table 7 presents regressions (linear probability models) of academic or vocational enrollment on indicators of contemporaneous and lagged negative household shocks.[17] All regressions include age-adjusted,

[17]Household shocks include death; serious illness or injury; job loss; major financial loss (including business failure or bankruptcy); abandonment or divorce; theft, fire or property damage; or other shock. Health shocks include death, serious illness, or injury. Financial shocks include job loss or major financial loss.

standardized literacy and numeracy evaluation score[18] and dummies for age, completed schooling, calendar year, race, gender, and household per capita income quintile in Wave 1. The identifying assumption is that conditional on these covariates, negative household shocks are unanticipated and unaffected by a youth's current enrollment choice. I consider all types of household shocks, and then look separately at health and financial shocks.

I find in Table 7, Panel A that household shocks have no statistically significant effect on academic or vocational enrollment. The point estimates are generally consistent with the safety valve hypothesis—negative shocks lead to less academic enrollment but more vocational enrollment—but the lack of statistical significance prevents me from drawing a firm conclusion. Results are similar across all types of shocks considered. In Panel B, I restrict attention to re-enrollment only, to examine how shocks affect the enrollment choices of those who are not currently in school. The results for re-enrollment also lack statistical significance.[19]

Households can also be subject to positive shocks, such as unexpected income transfers. In South Africa, public pensions are generous and widely received in households with eligible older members.[20] Although pension income can be fully anticipated due to age-eligibility cutoffs, in practice South African households behave as though the pension was unanticipated (Edmonds 2006). Table 8 shows the youth enrollment response to household pension eligiblity. I regress enrollment in an academic or vocational program on household pension eligibility (contemporaneous and lagged). I follow the literature by distinguishing between pension-eligible grandmothers and grandfathers, whose pension receipt has been found to exert different influences on younger household members (Duflo 2003, Case 2004, Edmonds 2006, Souza 2010). I also follow the literature in employing a regression discontinuity design by including a cubic function of grandparents' age in the regres-

[18] A literacy and numeracy evaluation (LNE) was administered to all youth in the survey in Wave 1. I include the z-score of that test as a proxy for ability.

[19] I also ran regressions in which I combined contemporaneous and lagged shocks into a single dichotomous variable. None of the shock variables was statistically significant.

[20] Age eligibility cutoffs for the pension during the time of the panel were 60 and 65 for women and men, respectively. Although the pension is means tested, take-up is 80% among age-eligible blacks and coloureds. The pension typically is equivalent to coloured median income and 2.5 times black median income (Case 2004).

sion.[21] Information on grandparents' age and co-residence generates a longer panel than that for negative household shocks, allowing me to include individual fixed effects in the regression, along with dummies for calendar year and the young adult's age and completed schooling.[22] Identification therefore comes from comparing the enrollment choices of a particular youth upon a change in the pension eligibility status of co-resident grandparents.

If vocational schooling is a safety valve and pension receipt represents a positive shock to household income, then we would expect to see youth choose vocational schooling less frequently in response to household pension receipt, as such a safety valve becomes less necessary. We might also see a rise in enrollment in academic programs. However, I find no statistically significant influence of household pension eligibility on enrollment in either academic or vocational programs in Table 8. The lack of an effect may be due to households' ability to anticipate pension receipt or to lack of precision in the data.

4.3 Does household formation influence enrollment in vocational schooling?

Household formation can lead to interruptions in human capital investment, making it more difficult for students, particularly women, who choose to marry or have children to succeed in the labor market. Another important way in which vocational schooling could serve as a safety valve would be if it is particularly welcoming to female students who are forming households. In Table 9, I investigate the enrollment choices of females who are forming households. I regress academic or vocational enrollment on pregnancy and marriage events (i.e., getting married rather than marital status) and their lags, along with individual fixed effects, and dummies for age, completed schooling,

[21] I attempted to allow the age polynomial to vary on either side of the eligibility cutoff, but the model was poorly identified due to collinearity. Coefficients on eligibility frequently exceeded unity, a nonsensical result for linear probability models, and had large standard errors.

[22] Retrospective life histories in CAPS include information on co-residence with grandparents, allowing for complete self-reports of co-residence. To create the longer panel, however, I must extrapolate the ages of older household members reported in Waves 1-4 back in time, as well as assume that reported co-residence refers to these older household members. Such extrapolation may increase the measurement error in the data. I impute grandparents' ages and pension eligibility to 0 where missing data makes extrapolation impossible, but I include a dummy variable for such imputation in order to control for non-randomly missing data.

and calendar year. Enrollment, marriage and fertility are often decided simultaneously, of course, so I hesitate to interpret the coefficient estimates causally. However, the results do answer whether enrollment and household formation decisions differ by type of schooling, thereby offering further insight into the safety valve hypothesis.

In column (1) of Table 9, I find that females who become pregnant are 12 percentage points less likely to enroll in academic programs in the year of the pregnancy, and 17 percentage points less likely the year following pregnancy, with coefficients significant at the 1% level. By contrast, in column (2) I find corresponding declines in vocational enrollment of just 1 percentage point each, with statistical significance only for lagged pregnancy. Thus I find that pregnancy is associated with schooling interruptions, but much less so in vocational than academic programs. None of the marriage coefficients is significant. These patterns are strongly consistent with a safety valve role for vocational schooling among females who are forming households. No significant coefficients appear in analogous regressions for re-enrollment in columns (3)-(4), however, suggesting that the safety valve role does not extend to household formation for females who are already out of school.

4.4 How do vocational students fare on the labor market?

Although I have found evidence supportive of the safety valve hypothesis for vocational schooling, a natural follow-up question is whether vocational schooling facilitates good subsequent outcomes for its students. Even if vocational schooling is a safety valve for those currently enrolled, is it a sinkhole when it comes to labor market returns?

Table 10 presents results of regressions estimating the wage and employment returns to schooling, differentiated by type of program (academic or vocational) and level (secondary or post-secondary). These are variations on standard Mincer regressions, and therefore come with the usual caveats against a causal interpretation of coefficients.[23] Indeed, in the preceding sections

[23]I attempted to use grade failure history as instrumental variables for schooling levels to estimate the returns to academic and vocational schooling, but the instruments are weak. This is not surprising, given the lack of predictive power of grade failure for vocational schooling found in Table 6. Similarly, household shocks are too weak to serve as instruments, and pregnancy is an invalid instrument because it likely affects wages directly through labor supply.

we have seen the dimensions of self-selection into academic and vocational schooling: vocational students tend to have struggled more in school and are more likely to be females who are forming households. However, to the extent that this shows that vocational students are adversely selected relative to their peers in academic programs, it would be especially notable to find high Mincerian returns to vocational schooling.

Columns (1)-(3) of Table 10 present regressions of log wages on years of schooling. When scaled by 100, coefficients represent the approximate percentage return to an additional year of schooling.[24] Regressions also include LNE score; work experience, age and their squares; and race, gender, and calendar year dummies. Column (1) is the canonical Mincer regression of log wages on overall years of schooling and these controls.[25] I find that each additional year of schooling correlates with wage gains of 10 percent. Column (2) distinguishes between academic and vocational schooling, with vocational returns of 19 percent versus 9 percent for academic; the p-value on the difference is 0.23. These results are similar to those of Attanasio et al. (2011), who also find 19 percent wage increases for women who participate in a vocational training program in Colombia.[26] Column (3) further distinguishes each type of schooling by level (primary/secondary and post-secondary for academic, secondary and post-secondary for vocational), and finds larger gains to post-secondary within each schooling category (though the differences are not statistically significant). Although academic and vocational secondary each produce comparable returns of 9-10 percent, in post-secondary the return to vocational schooling doubles that of academic schooling (28 versus 14 percent), though

[24] I measure schooling in *completed* years, i.e., attending but failing a grade does not count toward one's stock of schooling. Data on employment come from life history data and the concurrent waves of the panel, but wages were collected only in Waves 1-4. Regressions in Tables 10 and 14 include data on all years of schooling, rather than just those with at least 9 years as in previous regressions, in order to increase the sample size. However, all those in the sample achieve at least 9 years schooling by the end of the panel, and are the same individuals used in all other analyses in the paper. Restricting the sample to person-years with at least 9 years schooling leads to qualitatively similar results.

[25] Wages refer to self-reported earnings on current or most recent jobs held among those not enrolled in school, regardless of current employment status. Restricting the sample to those currently employed produces similar results but with larger standard errors due to the decreased sample size.

[26] The Colombia results are experimental, but the program is a short-term training course implemented by private institutions, and therefore not directly comparable to the South African vocational programs considered here.

the difference is not significant.[27] Although the results in columns (2)-(3) are not strong enough to conclude that the return to vocational exceeds academic schooling, I can at least conclude that there is no evidence in favor of the sinkhole hypothesis that academic returns exceed vocational. The absence of such evidence is particularly striking because the potentially negative selection into vocational schooling found in the preceding sections of the paper should lead to downward bias in estimates of vocational returns.

The obvious concern with these results is that students may select into levels and types of schooling based on unobserved attributes, leading to inconsistent estimates of schooling returns. To assess the importance of this concern, I examine whether estimates of returns vary substantially when excluding the control variables mentioned above. If these controls help to mitigate bias due to omitted ability or other unobserved characteristics, then finding similar returns to schooling regardless of their inclusion suggests that any remaining omitted variable bias is likely to be small. On the other hand, if estimated returns attenuate substantially upon including the controls, then one has more cause to worry that selection on unobservables drives the results.

To formalize this idea, I follow Altonji et al. (2005) in calculating the ratio of selection on unobservables to selection on observables required to explain away the entire estimated returns for each schooling measure.[28] A ratio greater than one in absolute value indicates that the covariance between unobserved characteristics and schooling must exceed the covariance between included control variables and schooling to explain away the entire return.[29] A negative ratio indicates

[27] One might worry that the larger observed returns to vocational post-secondary schooling is driven by students who attended private tertiary institutions, which I classify as academic. However, excluding such institutions from the definition of academic post-secondary schooling *increases* the gap between vocational and academic post-secondary returns to 29 versus 9 percent, with the p-value of the difference equal to 0.09.

[28] Intuitively, the motivation for the procedure is the assumption that "selection on the unobservables is the same as selection on the observables" (Altonji et al. 2005, p. 169). Formally, in the Mincer regressions (8) that I run in this paper, the assumption is $cov(S_v, \epsilon) = cov(X, \epsilon)$, and analogously for S_a. Altonji et al. (2005) argue that this assumption is no more restrictive than the standard OLS assumptions $cov(S_v, \epsilon) = 0$ and $cov(X, \epsilon) = 0$.

[29] The implicit counterfactual of zero return to vocational schooling is not a straw man, as it would be no exaggeration to claim that South African conventional wisdom holds that vocational schooling is worthless. This perception among students in academic programs was noted in Section 1; the same study found a similar perception even among vocational students: "FET college students were at times apprehensive about the recognition of their qualifications and the extent to which the FET college qualification would recommend them to prospective employers" (Needham and Papier 2011, p. 38).

that the schooling coefficient estimated with controls *increases* relative to the coefficient estimated without controls, a surprising result if we expect the controls to proxy for (upward) ability bias. Altonji et al. (2005) interpret ratios greater than three as large, and ratios greater than one as indicative of a nonzero treatment effect even in the presence of selection on unobservables. I report this ratio for each coefficient as "U/O" in Table 10. Details of the procedure are in Appendix B.

Given the high-quality data of the panel, I expect the included controls to account for much of the selection into schooling, and the results in Table 10 support this claim. In column (2), I find U/O ratios of 3.0 and 2.4 for academic and vocational schooling, respectively, indicating that selection on unobservables is unlikely to be so large as to explain away these coefficients. In column (3), only the ratio for vocational secondary is less than one in absolute value, which is not surprising given that this coefficient is not statistically different from zero. The negative U/O ratios for academic and vocational post-secondary reflect increases in these coefficients relative to their counterparts estimated without control variables.

Columns (4)-(6) show regressions analogous to the first three columns, but with employment as the outcome.[30] As these are linear probability models, coefficients (scaled by 100) may be interpreted as percentage point changes in the likelihood of employment for an additional year of schooling. In column (4) I find the employment return to schooling is 6 percentage points. In column (5), I find that the employment return to vocational schooling is 15 percentage points versus 6 p.p. for academic schooling, with the p-value of difference equal to 0.06. When differentiating schooling by level, I find a similar pattern as with wages: larger returns to post-secondary than secondary schooling within each type of program, and notably larger post-secondary vocational returns than academic. Unlike with wages, however, for employment the effect of an additional year of post-secondary vocational schooling is both larger and statistically different from that of

[30]The sample is restricted to non-enrolled youth. Employment while enrolled in school is rare in South Africa, with only 3% of the sample reporting ever working and attending school simultaneously. I do not distinguish between full-time or part-time employment, as information on hours worked is available only in the concurrent waves of the panel, not the life history. Where data on working hours are available, 79% of the employed sample work full-time (defined as an average of at least 35 hours per week).

post-secondary academic schooling. All of the U/O ratios in columns (4)-(6) are negative and exceed one in absolute value, suggesting that selection on unobservables does not drive the results. Again, the sinkhole hypothesis of systematically lower labor market returns for vocational schooling does not find support in the data.[31,32]

Another way to gauge the importance of selection on unobservables is to restrict the analysis of Table 10 to a subsample for whom the sinkhole hypothesis is likely to hold: the negatively selected subsample of those who have previously failed a grade. These results (not shown but available upon request) are quite similar to those for the full sample, with no significant differences between academic and schooling coefficients. The statistical significance of the vocational coefficient in the wage equation (analagous to column 2) falls to 10% in this analysis, however, and its U/O ratio falls to 2.2. Nonetheless, there is little evidence favoring the sinkhole hypothesis even among this group of struggling students.

An important caveat here, however, is that this sample is quite young (with maximum age 26), so that the returns we observe correspond to early career outcomes only. Academic schooling may provide general skills whose returns rise faster than those of vocational skills over a worker's lifetime, as shown for OECD countries in Hanushek et al. (2011).

[31] I find qualitatively similar results using pooled, semi-annual samples of the South Africa Labour Force Survey (LFS): vocational schooling provides larger wage and employment returns than academic schooling, with coefficients significantly different from each other at the 1% level. I restrict the sample to black and coloured youth from the Western Cape ages 14-26 observed between September 2002-September 2006 for maximum comparability with CAPS. Unlike CAPS, however, the LFS lacks data on vocational post-secondary schooling, work experience and ability. Results not shown but available upon request.

[32] I have also allowed for non-linearity in returns at particular levels of academic or vocational schooling (e.g., "sheepskin effects" at schooling levels particularly valued in the labor market) by including dummies for each completed grade of academic and vocational schooling in the Mincer wage and employment regressions. Due to insufficient observations, only those dummies from grades 10 to 13 are identified. Grade-level specific point estimates of vocational returns exceed those of academic without exception, with all differences between grades 10-12 significant at 5% or below. These results provide strong evidence against the sinkhole hypothesis.

5 Robustness checks

5.1 Allowing for simultaneous grade failure and household shocks

In Section 4, I evaluated the safety valve hypothesis by considering the effect of grade failure and various types of shocks on enrollment separately. Including grade failure and shocks in the same regression is arguably inappropriate because shocks could influence grade outcomes directly, leading to an instance of what Angrist and Pischke (2008) call "bad control." Moreover, the potential collinearity between grade failure and shocks and the limited data on certain types of shocks could present obstacles to identification. Nonetheless, it would be instructive to see if the safety valve role of vocational schooling in response to grade failure is robust to the direct inclusion of shocks in enrollment regressions.

Table 11 examines this issue. Column (1) repeats the baseline estimates of enrollment on grade failure of Table 6. The subsequent columns add different types of shocks as control variables, analogous to those shocks considered in Section 4. The coefficients on grade failure change somewhat, but the safety valve hypothesis continues to hold: grade failure is a negative and significant predictor of enrollment in academic programs, but not vocational. Additional regression results (not shown) show no association between grade failure and negative shocks, bolstering my interpretation of grade failure as a revision to expected ability rather than the consequence of negative shocks.

5.2 Allowing for multi-dimensional ability

One might object that the model of Section 2 treats ability as uni-dimensional, when in fact it is multi-dimensional, with students possessing expectations about their academic- and vocational-specific abilities. If this is the case, then the regressions in Table 6 are misspecified. A straightforward extension of the model would allow for such multi-dimensional ability (i.e., allowing academic- and vocational-specific abilities A_a and A_v, respectively) and modify the safety valve definition so

that vocational enrollment is less responsive to own-ability revisions than is academic enrollment.[33]

Table 12 presents regressions testing this extension of the model. In column (1), I find that academic enrollment declines by 39 percentage points in response to a recent academic failure, and an additional 19 percentage points for each previous academic failure. Additionally, academic enrollment falls 8 p.p. in response to a recent vocational failure, suggesting that students who fare poorly in either type of program tend to leave academic schooling altogether. Coefficients barely change when work experience controls are added in column (2). By contrast, in column (3) I find that although vocational enrollment does decline in response to a recent vocational failure, the magnitude (19 percentage points) is less than half that of a recent own-program failure in column (1). Previous vocational failures have no statistically significant effect on vocational enrollment. Even more notably, vocational enrollment increases 1 percentage point for each recent and previous academic failure, suggesting that vocational programs do indeed represent a safety net for students who struggle in academic programs. Results are again robust to inclusion of work experience in column (4).

5.3 Heterogeneity in the enrollment response to grade failure

Is the safety valve role of vocational schooling limited to students of a particular schooling level (i.e., secondary or post-secondary), gender, race, or economic background? This subsection is the first of several to check the robustness of the main results along these dimensions. In Table 13, I explore heterogeneity in the enrollment response of academic and vocational schooling to grade failure, and whether the response observed in Table 6 is limited to particular subsamples. Specifically, I regress enrollment on previous schooling and labor market outcomes, analogous to columns (1) and (3) of Table 6, separately for students at the secondary/post-secondary levels, males and females, blacks and coloureds, and the bottom two/top three quintiles of household income. Panel A of Table 13

[33]This extension would make the framework similar to a Roy model in which the agent has expectations over academic- and vocational-specific ability endowments. The agent would choose the schooling track that offers higher expected return, with revisions in expected returns due to failure altering choices for those at the margin.

shows the academic enrollment response, while Panel B shows the vocational enrollment response.

In Panel A, columns (1)-(2), I find that students who failed their last grade are less likely to enroll in academic programs at both the secondary and post-secondary levels. The magnitude of this response is considerably higher at the secondary level: a 46 percentage point decline for secondary, compared to 10 percentage points for post-secondary. Moreover, each previous grade failure leads to a 24 percentage decrease in academic enrollment at the secondary level. Looking at the same columns in Panel B, we see that students who have failed are not similarly deterred from enrolling in vocational progams, with only a 1 percentage point drop in secondary vocational enrollment for recent grade failure. The safety valve role of vocational programs exists at both major levels of schooling.

In columns (3)-(8) of Table 13, I find similar patterns in the enrollment response to failure across genders, races, and economic background: grade failure leads to sizable and statistically significant declines in academic enrollment, but no effect on vocational enrollment (with the exception of previous grade failures leading to a 2 p.p. *increase* for blacks). Vocational schooling is a safety valve for both males and females, blacks and coloureds, and youth from the poorest and least poor households.[34]

As with the full sample, there is little enrollment response to household shocks when splitting the sample among these subgroups. To the extent there is a response to shocks, however, it bolsters the safety valve hypothesis: household shocks lead to declines in academic enrollment of 5 and 4 percentage points (significant at 10%) among post-secondary and female students, respectively, with no significant change in vocational enrollment. Similarly, pregnancy correlates with large declines in academic enrollment among students regardless of schooling level, race or economic background, but little to no declines in vocational enrollment.[35]

[34]Households are classified into income quintiles based on per capita income in Wave 1.

[35]Results not shown, but available upon request.

5.4 Heterogeneity in labor market outcomes

The previous series of robustness checks suggested that the safety valve role of vocational schooling extends to several subsamples of interest. Both secondary and post-secondary students; males and females; blacks and coloureds; and youth from the richest and poorest households enroll less frequently in academic programs in response to grade failure, but the decline is less pronounced or statistically insignificant for vocational enrollment.

Given this robustness in the safety valve role of vocational schooling for enrollment choices, it is also sensible to explore heterogeneity in labor market outcomes among these subsamples. Table 14 presents Mincer regressions for wages and employment, respectively, analogous to columns (2) and (4) of Table 10, separately for black and coloured youth. In columns (1)-(2) of Table 14, I find larger wage returns to vocational than academic schooling for both black and coloured youth, though the difference is not significant for either group. In columns (3)-(4), I find that vocational schooling generates larger employment returns for coloured youth, but not for blacks. For coloureds the difference is striking: an additional year of vocational schooling is associated with an 19 percentage-point increase in the probability of employment, nearly three times as large as an additional year of academic schooling (with the difference significant at 5%). For black youth, vocational schooling does not appear to be a sinkhole—vocational wage and employment returns are not significantly different from academic—but they do not reap the employment *gains* accruing to coloureds.[36] Selection on unobservables is unlikely to explain any of these results: the ratio of selection on unobservables to observables required to explain away the schooling coefficients is often negative—indicating that returns increase upon including observable characteristics—or otherwise large.

[36] I conducted a similar exercise for males, females, and the poorest two and richest three quintiles of youth by household income. There is no evidence in favor of the sinkhole hypothesis (i.e., that labor market returns for academic schooling exceed those of vocational schooling) for any of these groups. Moreover, I found few gender differences in wage and employment returns for either type of schooling. The differences between youth from the poorest and richest households are quite similar to the differences between blacks and coloureds, which is unsurprising given that blacks are disproportionately represented in the poorest two quintiles. Restricting the sample to those who ever enrolled in a vocational program results in insignificant differences between academic and vocational schooling coefficients in wage and employment regressions. Results available upon request.

Given the importance of social networks in securing employment for South African youth (Magruder 2010), one potential mechanism explaining this result is the greater success enjoyed by coloured youth in using vocational schooling to acquire jobs through formal means rather than informal networks.[37] If youth need credible evidence of skills to access jobs through formal channels rather than relying on social networks, vocational schooling might provide an such a credential. In columns (5)-(6), I explore this possibility by regressing an indicator for job acquisition through formal channels (defined as responding to a job advertisement, sending a CV, visiting a firm, or using an employment agency, as opposed to using informal social networks) on years of schooling of each type among the sample of employed youth.[38] The results reveal that the marginal increase in success rates from formal search associated with academic schooling is an identical 5 percentage points for black and coloured youth. However, each year of vocational schooling is associated with a 22 percentage point increase in successful formal search for coloured youth, compared to no significant increase for blacks. Paired with the results from columns (3)-(4), this result suggests that employers view black youth with vocational schooling less favorably than otherwise similar coloureds when evaluating job candidates. Vocational schools catering to black youth may do well to place extra emphasis on job placement to rectify this disparity.

6 Conclusion

This paper has presented evidence on the role of vocational schooling in the school to work transition of South African youth. I have found evidence that vocational schooling acts as a safety valve for students who struggle academically: grade failure is associated with modest increases in vocational

[37]Note that examining job acquisition through formal versus informal channels is not equivalent to the question of whether the jobs themselves are in the formal or informal sector. South Africa is notable for its low rates of informality (Banerjee et al. 2008) and lack of small firms (Magruder 2011). Unfortunately the data are not well suited to explore this question because information that could be used to determine job sector is collected only in CAPS Wave 2.

[38]Sample sizes drop substantially in these regressions because information on search method is available only in the concurrent waves of the panel, rather than in retrospective life histories, and because I restrict the sample to employed youth in order to avoid conflating the employment returns found in column (3)-(4) with the search method.

enrollment, compared to substantial declines in academic enrollment. Vocational schooling also serves as a safety valve for pregnant girls, in contrast to academic schooling, which exhibits large enrollment declines following pregnancy. Household shocks, both positive and negative, have no statistically significant effects on enrollment in either type of schooling, however. The safety valve hypothesis is robust to allowing for multi-dimensional ability, with own-program failure leading to smaller enrollment declines for vocational than academic schooling. Moreover, students who fail in an academic program are more likely to enroll in a vocational program, while those who fail in a vocational program are less likely to enroll in an academic program. The results persist across a number of subsamples of interest, and are also robust to allowing for simultaneous grade failure and household shocks.

Given this evidence for the safety valve role for vocational schooling, one might worry that an associated cost is lower labor market returns compared to academic schooling, i.e., that vocational schooling is a sinkhole. Estimates of wage and employment returns fail to provide evidence for the sinkhole hypothesis, however. To the extent that differences emerge between returns to academic and vocational schooling, the point estimates tend to be greater for vocational, though the differences are imprecise and do not occur across all subsamples of interest. Although I have shown that these estimated returns are unlikely to be explained away by selection on unobserved characteristics, they nonetheless come with the usual caveats against the causal interpretation of Mincer regressions, however, and the additional caveat that the relative returns may shift in favor of academic schooling as workers age (Hanushek et al. 2011). Nonetheless, the absence of evidence favoring academic schooling is notable in this context, considering the low esteem South Africans hold for vocational schooling and the evidence in this paper that its students are adversely selected.

If vocational schooling has the salutary effects that I find, particularly for struggling students, why don't more students enroll? At the post-secondary level, limited open seats and relatively strict admissions requirements at universities of technology are likely barriers to expanded enrollment. At the secondary level, qualitative evidence suggests that stigma and information costs limit student

enrollment in vocational programs, drawing students who feel they have no other choice (Needham and Papier 2011). If this is the case, then efforts by school administrators to promote vocational programs as a practical alternative to the traditional system should yield benefits.

South African policymakers frequently express concerns about slow student progression through schools and high rates of youth unemployment, with economists finding ample evidence to support such concerns. The evidence presented here suggests that vocational schooling, a small and often overlooked educational institution, plays an important role for vulnerable students both while they remain in school and when they enter the labor market.

References

Altonji, Joseph G., Todd E. Elder, and Christopher R. Taber, "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," *Journal of Political Economy*, February 2005, *113* (1), 151–184.

Angrist, Joshua D. and Jorn-Steffen Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, 1 ed., Princeton University Press, December 2008.

Arum, Richard and Yossi Shavit, "Secondary Vocational Education and the Transition from School to Work," *Sociology of Education*, July 1995, *68* (3).

Attanasio, Orazio, Adriana Kugler, and Costas Meghir, "Subsidizing Vocational Training for Disadvantaged Youth in Colombia: Evidence from a Randomized Trial," *American Economic Journal: Applied Economics*, July 2011, *3* (3), 188–220.

Banerjee, Abhijit, Sebastian Galiani, James A. Levinsohn, Zoe McLaren, and Ingrid Woolard, "A Symposium on Fostering Growth in South Africa: Why Has Unemployment Risen in the New South Africa?," *Economics of Transition*, 2008, *16* (4), 715–40.

Becker, Gary S., *Human Capital a Theoretical and Empirical Analysis, With Special Reference to Education*, Columbia University Press, 1967.

Bellows, John and Edward Miguel, "War and Local Collective Action in Sierra Leone," *Journal of Public Economics*, December 2009, *93* (11-12), 1144–1157.

Bennell, Paul, "General versus Vocational Secondary Education in Developing Countries: A Review of the Rates of Return Evidence," *Journal of Development Studies*, December 1996, *33* (2), 230–247.

Bunting, Ian and Nico Cloete, "Institutional Types in Higher Education in South Africa," February 2010.

Card, David, "The Causal Effect of Education on Earnings," *Handbook of labor economics. Volume 3A. 1999*, 1999, pp. 1801–63.

____ , Pablo Ibarrarn, Ferdinando Regalia, Rosas-Shady, and Yuri Soares, "The Labor Market Impacts of Youth Training in the Dominican Republic," *Journal of Labor Economics*, April 2011, *29* (2).

Case, Anne, "Does Money Protect Health Status? Evidence from South African Pensions," *Perspectives on the economics of aging. 2004*, 2004, pp. 287–305.

Duflo, Esther, "Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa," *World Bank Economic Review*, 2003, *17* (1), 1–25.

Edmonds, Eric V, "Child Labor and Schooling Responses to Anticipated Income in South Africa," *Journal of Development Economics*, December 2006, *81* (2), 386–414.

El-Hamidi, Fatma, "General or Vocational Schooling? Evidence on School Choice, Returns, and 'Sheepskin' Effects from Egypt 1998," *Journal of Policy Reform*, June 2006, *9* (2), 157–176.

Fiske, Edward B. and Helen F. Ladd, *Elusive Equity: Education Reform in Post Apartheid South Africa*, Brookings Institution Press, July 2004.

Hanushek, Eric A., Ludger Woessmann, and Lei Zhang, "General Education, Vocational Education, and Labor-Market Outcomes over the Life-Cycle," *National Bureau of Economic Research Working Paper Series*, 2011, *No. 17504.*

Hawley, Joshua D., "Comparing the payoff to vocational and academic credentials in Thailand over time," *International Journal of Educational Development*, November 2003, *23* (6), 607–625.

___ , "Vocational-technical schooling and occupational matching in Thailand: differences between men and women," *Asia Pacific Journal of Education*, June 2008, *28*, 189–205.

Kahyarara, Godius and Francis Teal, "The Returns to Vocational Training and Academic Education: Evidence from Tanzania," *World Development*, November 2008, *36* (11), 2223–2242.

Lam, D., Cally Ardington, Nicola Branson, Anne Case, Murray Leibbrandt, Alicia Menendez, Jeremy Seekings, and Meredith Sparks, "The Cape Area Panel Study: A Very Short Introduction to the Integrated Waves 1-2-3-4 Data," October 2008.

Lam, David, Cally Ardington, and Murray Leibbrandt, "Schooling as a lottery: Racial differences in school advancement in urban South Africa," *Journal of Development Economics*, July 2011, *95* (2), 121–136.

Magruder, Jeremy, "High Unemployment Yet Few Small Firms: The Role of Centralized Bargaining in South Africa," 2011.

Magruder, Jeremy R., "Intergenerational Networks, Unemployment, and Persistent Inequality in South Africa," *American Economic Journal: Applied Economics*, January 2010, *2* (1), 62–85.

Maitra, Pushkar and Subha Mani, "Learning and Earning: Evidence from a Randomized Evaluation in India," 2012.

Malamud, Ofer and Cristian Pop-Eleches, "GENERAL EDUCATION VERSUS VOCATIONAL TRAINING: EVIDENCE FROM AN ECONOMY IN TRANSITION," *The Review of Economics and Statistics*, February 2010, *92* (1).

Mincer, Jacob, *Schooling, Experience, and Earnings*, 1st ed., Natonal Bureau of Economic Research, May 1974.

Needham, Seamus and Joy Papier, "Practical matters: What young people think about vocational education in South Africa," Technical Report, City & Guilds Centre for Skills Development, London June 2011.

Newhouse, David and Daniel Suryadarma, "The Value of Vocational Education: High School Type and Labor Market Outcomes in Indonesia," *World Bank Economic Review*, 2011, *25* (2), 296–322.

Oosterbeek, Hessel and Dinand Webbink, "Wage effects of an extra year of basic vocational education," *Economics of Education Review*, August 2007, *26* (4), 408–419.

Oxford Business Group, "South Africa: Raising higher education," http://www.oxfordbusinessgroup.com/economic_updates/south-africa-raising-higher-education February 2012.

Pugatch, Todd, "Bumpy Rides: School to Work Transitions in South Africa," *Unpublished paper, University of Michigan*, 2011.

Souza, P., "Moral Hazard in the Family," *Unpublished paper, Yale University*, 2010.

UNESCO Institute for Statistics, 2011.

van der Meulen Rodgers, Yana, Joseph E. Zveglich, and Laura Wherry, "Gender Differences in Vocational School Training and Earnings Premiums in Taiwan," *Feminist Economics*, October 2006, *12* (4), 527–560.

Wooldridge, Jeffrey M., *Econometric Analysis of Cross Section and Panel Data*, 1 ed., The MIT Press, October 2001.

A Data Definitions

The data come from retrospective life history data collected in Wave 1 of CAPS, augmented with life events recorded in Waves 2-4.[39] The Wave 1 retrospective life histories record events by youth's age, where age refers to the age at which the event occurred in the case of living arrangements and marriage, and to age at the beginning of the calendar year in the case of enrollment and progression through school, labor force participation, and pregnancy. I follow this convention in mapping Wave 2-4 responses to youth's age.

I make several sample restrictions. I exclude whites. I keep only those observed until at least age 18. Those who report advancing two or more grades in a year, or without continuous information on enrollment, are dropped from the sample. I drop those whose educational histories, by the definitions below, place them with less than 9 or more than 16 years of completed schooling. Excluding whites and those not observed until age 18 accounts for 55% of the observations dropped from the sample.

Schooling level covers grades 1-16, with National Technical Certificate (NTC) 1, 2, and 3 mapped to grades 10, 11, and 12, respectively. Students enrolled in university or university of technology programs that include grade 12 are considered enrolled in grade 12. I define "vocational" and "academic" schooling as one set of mutually exclusive categories, and "traditional" and "non-traditional" schooling as another set of mutually exclusive categories. Vocational schooling includes enrollment in National Training Certificate, university of technology or other technical program; enrollment in all other programs is academic schooling. Non-traditional schooling includes vocational schooling and higher education programs at an institution other than a university or a university of technology; enrollment in all other programs is traditional schooling.

Reporting successful completion of the grade level or reporting enrollment in a higher grade level in a subsequent year is considered passing the level for grades 1-12. Beginning at grade 13, reporting successful completion of the grade level or "no grade/continuing" are considered passing the level, up to a maximum of 16 years completed schooling. I make this distinction because "no grade/continuing" is the modal response for those enrolled in the post-secondary education sector, indicating that most youth are continuing in their programs of higher education, whereas "passing" reports at these levels drop considerably. Unfortunately, I am unable to determine whether students are making satisfactory progress towards degree completion. All other results while enrolled are considered failure. I define "dropout" as non-enrollment following a year of enrollment, and "re-enrollment" as enrollment following a year of non-enrollment. Grades failed represent the accumulation of periods of enrollment in which the agent did not pass the grade, and therefore may include events such as withdrawal, illness or residential moves rather than outright academic failure.

Labor force participation variables (i.e., work and search) and wages are conditional on non-

[39]The Cape Area Panel Study Waves 1-2-3 were collected between 2002 and 2005 by the University of Cape Town and the University of Michigan, with funding provided by the US National Institute for Child Health and Human Development and the Andrew W. Mellon Foundation. Wave 4 was collected in 2006 by the University of Cape Town, University of Michigan and Princeton University. Major funding for Wave 4 was provided by the National Institute on Aging through a grant to Princeton University, in addition to funding provided by NICHD through the University of Michigan.

enrollment at a given age, where reports of enrollment supersede reports of labor market participation. School fees are conditional on enrollment, and include total household expenditure on fees and other educational expenses in real rand per year (base year 2002). Wages are full-time annual equivalent based on 160 working hours per month (those reporting monthly hours above 160 are considered full-time and do not receive an adjustment). Wages and school fees are available only at the time of the interview, rather than as retrospective histories; predicted values are imputed based on observed characteristics for purposes of estimation. For both expected wages and school fees, I replace predicted values below the minimum value observed in the sample with the first percentile from the data, in order to avoid non-positive predicted values and extreme outliers. Work experience includes only those periods of simultaneous work and non-enrollment; I exclude work experience while enrolled in school.[40] All variables measured in monetary values are in real South African rand per year (base year 2002), unless otherwise noted. The South African rand traded at 10.3 per US dollar in August, 2002 when CAPS Wave 1 began.

Other covariates are largely self-explanatory. Ability quartiles refers to full sample (i.e., before all restrictions imposed) rank of age-adjusted score on the literacy and numeracy evaluation (LNE) administered to all CAPS respondents in Wave 1. Household income quintiles are derived from the distribution of household per capita income reported in Wave 1 of CAPS.[41] The pension-eligible grandfather/grandmother indicator is set to one if there is at least one grandmother/grandfather on the household roster who is of pension-eligible age (60 for females, 65 for males) and the young adult reports living with a grandparent at the given age . The variable definition also makes note of changes in the household roster reported in Waves 2-4.

B The Sinkhole Hypothesis and Selection on Unobservables

To investigate the sinkhole hypothesis that vocational schooling generates lower labor market returns than vocational schooling, I regress a labor market outcome y on S_a and S_v, the stocks of academic and vocational schooling, respectively. The parameters of interest are β_a and β_v, the coefficients on academic and vocational schooling. The concern with such regressions is that individuals will select into academic and vocational schooling non-randomly, leading to inconsistent estimates of β_a and β_v.

To formalize this concern, suppose there is an index u that captures this selection effect, so that the true model (with constant term omitted for ease of exposition) is:[42]

$$y = \beta_a S_a + \beta_v S_v + \gamma u + \epsilon \tag{9}$$

Omitting u from the regression means that the composite error term $\gamma u + \epsilon$ will be correlated with the regressors of interest. Focusing on the consequence for estimating β_a, consider the linear projection of u on S_a and S_v:

[40] Only 3% of individuals in the sample ever worked and enrolled in school simultaneously.

[41] Due to non-response, 6% of the sample uses imputed values for household income, based on multiple imputation conducted by CAPS.

[42] This derivation of omitted variable bias follows Wooldridge (2001) closely.

$$u = \delta_a S_a + \delta_v S_v + r \tag{10}$$

Substituting (10) into (9) yields:

$$y = (\beta_a + \gamma\delta_a)S_a + (\beta_v + \gamma\delta_v)S_v + \gamma r + \epsilon \tag{11}$$

Written in this form, the familiar omitted variables bias formula for $\hat{\beta}_a$ follows:

$$\text{plim } \hat{\beta}_{a,NC} = \beta_a + \gamma\delta_a \tag{12}$$

where the subscript NC denotes "no controls."

Now suppose there is a set of controls X that is related to the selection term u in the following way:

$$u = X\beta_X + \tilde{u}$$

The availability of these controls allows me to rewrite the model as:

$$y = \beta_a S_a + \beta_v S_v + \gamma(X\beta_X + \tilde{u}) + \epsilon \tag{13}$$

Analogously to (10), write the linear projection of the omitted variable $\tilde{u}$ on the observables as:

$$\tilde{u} = \theta_a S_a + \theta_v S_v + X\theta_X + \nu \tag{14}$$

Substituting (14) into (13) yields the counterparts to (11) and (12):

$$y = (\beta_a + \gamma\theta_a)S_a + (\beta_v + \gamma\theta_v)S_v + X(\beta_X + \gamma\theta_X) + \gamma\nu + \epsilon \tag{15}$$

$$\text{plim } \hat{\beta}_{a,C} = \beta_a + \gamma\theta_a \tag{16}$$

where C refers to the model with controls.

Following Bellows and Miguel's (2009) application of Altonji et al.'s (2005) methodology, taking the ratio of (16) over the difference in the probability limits (12)-(16) under the null hypothesis $\beta_a = 0$ yields:

$$\text{plim } \frac{\hat{\beta}_{a,C}}{\hat{\beta}_{a,NC} - \hat{\beta}_{a,C}} = \frac{\theta_a}{\delta_a - \theta_a}$$

The numerator on the right-hand side is the partial correlation between academic schooling S_a and $\tilde{u}$, the remaining selection term after including the controls X. The denominator is this term subtracted from the partial correlation between academic schooling S_a and u, the selection term that includes the controls X. If the denominator is small relative to the numerator and the controls X are representative of all possible controls,[43] then the selection term remaining after controls are included ($\tilde{u}$) is not likely to be an important source of inconsistency for β_a.

[43] Altonji et al. (2005) formalize this argument.

The interpretation of this ratio becomes somewhat clearer if I further assume that $\delta_v = \theta_v = \theta_X = 0$, in which case we have:

$$\begin{aligned} \delta_a &= \frac{cov(S_a, u)}{var(S_a)} \\ \theta_a &= \frac{cov(S_a, \tilde{u})}{var(S_a)} \\ \text{plim } \left(\hat{\beta}_{a,NC} - \hat{\beta}_{a,C}\right) &= \gamma \frac{cov(S_a, u - \tilde{u})}{var(S_a)} \\ &= \gamma \frac{cov(S_a, X\beta_X)}{var(S_a)} \end{aligned}$$

Again setting $\beta_a = 0$ under the null hypothesis yields:

$$\text{plim } \frac{\hat{\beta}_{a,C}}{\hat{\beta}_{a,NC} - \hat{\beta}_{a,C}} = \frac{cov(S_a, \tilde{u})}{cov(S_a, X\beta_X)} \tag{17}$$

The ratio on the right-hand side represents how strong the relationship between the residual unobservable $\tilde{u}$ and S_a must be relative to that of the controls X to explain a non-zero estimate of $\hat{\beta}_a$ when $\beta_a = 0$. A large ratio suggests that omitted variable bias is unlikely to explain away the entire effect of academic schooling on y. Altonji et al. (2005) interpret ratios greater than 3 as large, and ratios greater than 1 as suggestive of nonzero treatment effects in the presence of possible selection on unobservables. A similar argument can be made for the corresponding expression for the vocational schooling coefficient β_v.

The assumptions used to arrive at (17) are admittedly restrictive. In particular, the assumptions that $\delta_v = \theta_v = 0$ are potentially problematic, as they require that vocational schooling S_v is unrelated to the unobservables u and $\tilde{u}$ that determine selection into academic schooling. (The assumption $\theta_X = 0$ is not problematic, as it follows from the definition of a linear projection.) Nonetheless, these assumptions are required to arrive at the familiar omitted variables bias formula when there are more than two regressors, and are therefore often invoked (Wooldridge 2001, p. 62).

Table 1: Panel attrition, by vocational enrollment history

		proportion censored at age			
	N	18	20	22	24
Full sample	2,768	0.00	0.26	0.56	0.81
vocational enrollment					
never	2,565	0.00	0.27	0.57	0.82
any	203	0.00	0.14	0.40	0.76
secondary	75	0.00	0.15	0.40	0.73
post-secondary	130	0.00	0.13	0.39	0.78

Cells show number of observations (unweighted) or percent of sample (weighted) with missing enrollment information by age.

Table 2: Summary statistics

Variable	Obs	Mean	S.D.
female	2,768	0.56	0.50
black	2,768	0.34	0.48
coloured	2,768	0.66	0.48
age, Wave 1	2,768	18.4	2.2
Ever enrolled in:			
any vocational	2,768	0.08	0.27
vocational secondary	2,768	0.03	0.17
vocational post-secondary	2,768	0.05	0.22
other higher education	2,768	0.09	0.29
non-traditional	2,768	0.16	0.37
Completed schooling, conditional on enrollment:			
total	2,768	11.2	1.5
academic	2,768	11.2	1.4
any vocational	203	0.7	0.8
vocational secondary	75	0.3	0.5
vocational post-secondary	130	0.8	0.8
other higher education	222	0.5	0.7
non-traditional	404	1.1	0.9
ever worked	2,768	0.54	0.50
wage (annual FTE, maximum)	1,910	34,743	29,705

Sample is CAPS life history data: young adults observed until at least age 18 with valid schooling histories. Other sample restrictions are described in Appendix A. Vocational secondary includes technical colleges and National Training Certificate (NTC) programs. Vocational post-secondary includes universities of technology. "Other higher education" includes post-secondary programs other than university or university of technology. "Non-traditional" includes any vocational or other higher education. Wage is full-time equivalent (FTE) based on 160 hours/month, and is the maximum wage reported over Waves 1-4, denominated in constant South African rand (base year 2002). Survey weights applied.

Table 3: Vocational enrollment, by selected characteristics

	Ever enrolled in:			
	vocational			non-traditional
	secondary	post-secondary	any	
male	0.03	0.05	0.08	0.17
female	0.03	0.05	0.08	0.16
race				
black	0.02	0.05	0.07	0.13
coloured	0.03	0.05	0.08	0.18
household income				
poorest two quintiles	0.02	0.03	0.05	0.10
richest three quintiles	0.03	0.07	0.10	0.21
schooling				
9-11 years	0.03	0.00	0.03	0.03
12 years	0.04	0.06	0.10	0.19
$>$ 12 years	0.003	0.22	0.22	0.55
ability				
low	0.03	0.02	0.05	0.11
high	0.03	0.09	0.12	0.22
Re-enrollment history				
never	0.02	0.04	0.05	0.09
at least once	0.05	0.08	0.13	0.28
at least once before completing secondary	0.07	0.04	0.11	0.16

Sample is CAPS life history data: young adults observed until at least age 18 with valid schooling histories and at least 9 years completed schooling. Other sample restrictions are described in Appendix A. Vocational secondary includes technical colleges and National Training Certificate (NTC) programs. Vocational post-secondary includes universities of technology. "Any non-traditional" includes any vocational schooling or other higher education programs (non-university or university of technology). "High ability" refers to scoring above full sample age-adjusted median score on literacy and numeracy evaluation administered in Wave 1.

Table 4: Occupational composition of employed, Wave 4

		Schooling			Vocational schooling		Post-secondary schooling	
	Full sample	< 12 years	12 years	> 12 years	no	yes	academic	vocational
managerial/professional	1.9	1.7	0.8	4.6	1.4	7.1	3.0	10.7
associate professional/technical	3.9	2.4	3.5	8.2	3.5	7.6	7.9	9.6
administrative/secretarial	5.0	2.7	8.0	4.4	4.6	9.0	5.1	1.5
skilled trades	3.6	5.7	2.5	0.9	3.9	0.9	1.1	0.0
services/sales	10.3	10.3	10.1	10.8	10.7	6.2	12.5	4.2
production	2.8	3.0	3.4	0.9	2.9	2.0	1.2	0.0
elementary/unskilled	9.0	11.9	7.7	4.4	9.6	2.2	5.6	0.0
data missing	63.6	62.5	64.0	65.8	63.5	65.1	63.7	73.9

Table shows proportion of sample in occupational category among individuals employed in Wave 4 with at least 9 years of schooling. Survey weights applied. "Vocational schooling" refers to ever being enrolled in vocational schooling (technical college, NTC, or university of technology). "Post-secondary schooling" limits sample to those with at least some completed post-secondary schooling.

Table 5: Transition matrix

		t				
		academic	vocational	work	search	inactive
$t-1$	academic	0.63	0.02	0.08	0.06	0.21
	pass	0.70	0.02	0.07	0.05	0.15
	fail	0.38	0.01	0.12	0.11	0.38
	vocational	0.05	0.44	0.16	0.07	0.27
	pass	0.06	0.50	0.12	0.05	0.26
	fail	0.01	0.19	0.35	0.12	0.32
	work	0.04	0.01	0.60	0.06	0.29
	search	0.04	0.00	0.33	0.42	0.21
	inactive	0.16	0.01	0.08	0.06	0.68

Table shows transitions between states by person-year, within schooling categories defined at top. Restricted to person-years with 9 or more years completed schooling, so that vocational programs are an enrollment option. Proportions calculated using survey weights, with raw counts in parentheses.

Table 6: Enrollment response to grade failure and previous employment, by program type

Program type	academic		vocational		Re-enrollment only: academic		Re-enrollment only: vocational	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
failed last grade enrolled	-0.38	-0.37	0.00	0.00	-0.50	-0.50	-0.08	-0.08
	(0.014)***	(0.015)***	(0.01)	(0.01)	(0.063)***	(0.064)***	(0.041)*	(0.041)*
previous grades failed	-0.19	-0.18	0.01	0.01	-0.72	-0.71	-0.03	-0.03
	(0.013)***	(0.013)***	(0.005)*	(0.005)*	(0.073)***	(0.073)***	(0.03)	(0.03)
not employed last period		0.04		0.01		0.00		0.00
		(0.010)***		(0.005)***		(0.01)		(0.01)
Observations	17,571	17,571	17,571	17,571	7,220	7,220	7,220	7,220
R-squared	0.70	0.70	0.29	0.29	0.79	0.79	0.54	0.54
No. individuals	2,768	2,768	2,768	2,768	2,444	2,444	2,444	2,444
Includes work experience		x		x		x		x

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample is person-years from estimation sample described in Appendix A, with completed education 9 years or more, from CAPS life history panel. All regressions include individual fixed effects and age, completed schooling, and calendar year dummies. Work experience variables include dummy for non-employment in last period of non-enrollment and cumulative work experience. Vocational programs include technical colleges, NTC and universities of technology. Re-enrollment refers to enrollment after at least one year of non-enrollment. All regressions use survey weights.

Table 7: Enrollment response to household shocks, by program type

Program type		academic			vocational	
Type of shock	all	health	financial	all	health	financial
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: full sample						
household shock	-0.03	-0.02	-0.03	0.01	0.00	0.02
	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)	(0.02)
household shock$(t-1)$	0.01	0.01	-0.01	0.01	0.00	0.01
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Observations	1,946	1,946	1,946	1,946	1,946	1,946
R-squared	0.32	0.32	0.32	0.05	0.05	0.05
No. individuals	1,946	1,946	1,946	1,946	1,946	1,946
Panel B: Re-enrollment only						
household shock	0.00	0.00	-0.01	0.00	-0.01	0.01
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
household shock$(t-1)$	0.00	-0.01	0.00	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	1,370	1,370	1,370	1,370	1,370	1,370
R-squared	0.04	0.04	0.04	0.05	0.05	0.05
No. individuals	1,370	1,370	1,370	1,370	1,370	1,370

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample is person-years from estimation sample described in Appendix A, with completed education 9 years or more, for ages in which relevant HH shock variable observed in Waves 1, 3, 4. All regressions include standardized LNE score and dummies for age, completed schooling, race, gender, and HH per capita income quintile in Wave 1. All regressions use survey weights. Vocational programs include technical colleges, NTC and universities of technology. Household shocks include death; serious illness or injury; job loss; major financial loss (including business failure or bankruptcy); abandonment or divorce; theft, fire or property damage; or other shock. Health shocks include death, serious illness, or injury. Financial shocks include job loss or major financial loss.

Table 8: Enrollment response to household pension eligibility, by program type

Program type	academic	vocational	Re-enrollment only academic	Re-enrollment only vocational
	(1)	(2)	(3)	(4)
pension-eligible grandmother	-0.01	-0.02	0.00	0.01
	(0.04)	(0.01)	(0.05)	(0.01)
pension-eligible grandfather	-0.01	-0.01	0.04	0.00
	(0.07)	(0.03)	(0.07)	(0.01)
pension-eligible grandmother$(t-1)$	-0.02	0.00	-0.05	0.01
	(0.04)	(0.01)	(0.04)	(0.01)
pension-eligible grandfather$(t-1)$	-0.02	-0.01	0.00	0.00
	(0.07)	(0.02)	(0.04)	(0.01)
Observations	17,571	17,571	7,220	7,220
R-squared	0.66	0.29	0.75	0.53
No. individuals	2,768	2,768	2,444	2,444

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample is person-years from estimation sample described in Appendix A, with completed education 9 years or more. "Pension-eligible grand(mother/father)" refers to co-residence with grandmother at least 60 years old or grandfather at least 65 years old, respectively. All regressions include individual fixed effects; dummies for age, completed schooling, and calendar year; and cubics in grandmother and grandfather's age. Observations with missing grandparent age information impute age and pension eligibility dummy to 0, and include indicator for presence of imputed data. All regressions use survey weights. Vocational programs include technical colleges, NTC and universities of technology. Re-enrollment refers to enrollment after at least one year of non-enrollment.

Table 9: Female enrollment and household formation, by program type

Program type	academic	vocational	Re-enrollment only academic	Re-enrollment only vocational
	(1)	(2)	(3)	(4)
pregnancy	-0.12	-0.01	0.02	-0.01
	(0.033)***	(0.01)	(0.03)	(0.01)
pregnancy$(t-1)$	-0.17	-0.01	0.00	-0.01
	(0.030)***	(0.005)**	(0.02)	(0.01)
marriage	-0.01	0.00	0.03	0.00
	(0.07)	(0.01)	(0.03)	(0.01)
marriage$(t-1)$	0.09	0.01	-0.01	0.01
	(0.06)	(0.01)	(0.02)	(0.01)
Observations	6,039	6,039	1,209	1,209
R-squared	0.74	0.37	0.70	0.88
No. individuals	1,480	1,480	559	559

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample is person-years from estimation sample described in Appendix A, females only, with completed education 9 years or more, from CAPS life history panel. All regressions include individual fixed effects and age, completed schooling, and calendar year dummies. Vocational programs include technical colleges, NTC and universities of technology. Re-enrollment refers to enrollment after at least one year of non-enrollment. All regressions use survey weights.

Table 10: Labor market outcomes and schooling type

	(Log) wages			Employment		
	(1)	(2)	(3)	(4)	(5)	(6)
schooling	0.10			0.06		
	(0.012)***			(0.005)***		
academic		0.09			0.06	
		(0.012)***			(0.005)***	
vocational		0.19			0.15	
		(0.076)**			(0.047)***	
academic primary and secondary			0.09			0.06
			(0.013)***			(0.005)***
academic post-secondary			0.14			0.16
			(0.037)***			(0.014)***
vocational secondary			0.10			0.05
			(0.16)			(0.07)
vocational post-secondary			0.28			0.27
			(0.108)***			(0.051)***
Observations	3,185	3,185	3,185	15,897	15,897	15,897
R-squared	0.26	0.26	0.26	0.36	0.36	0.36
No. individuals	1,621	1,621	1,621	2,768	2,768	2,768
H_0: academic=vocational		0.23			0.06	
H_0: academic=vocational (secondary)			0.94			0.92
H_0: academic=vocational (post-secondary)			0.22			0.04
U/O: schooling	3.1			-2.0		
U/O: academic		3.0			-2.0	
U/O: vocational		2.4			-3.8	
U/O: academic primary and secondary			2.3			-2.1
U/O: academic post-secondary			-11.1			-1.2
U/O: vocational secondary			0.7			-2.2
U/O: vocational post-secondary			-11.3			-4.2

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Unit of observation is person-year. Wages are log of monthly FTE wages based on 160 hours/month. Wages refer to self-reported earnings on current or most recent jobs held among those not enrolled in school, regardless of current employment status, FTE based on 160 hours worked/month. Employment restricted to periods when not enrolled in school. All regressions include race, gender, and calendar year dummies; and controls for age-adjusted LNE z-score, experience, experience squared, age, and age squared. Vocational schooling includes NTC and other technical secondary, and universities of technology. Reported test statistics are p-values of indicated null hypothesis. U/O ratio: ratio of selection on unobservables/observables required to explain away effect of schooling variable on outcome, obtained as $\frac{\beta_C}{\beta_{NC}-\beta_C}$, where β_C is schooling coefficient from model with included controls and β_{NC} is schooling coefficient from model without controls. Controls as indicated and described above. See Appendix B for details. Survey weights applied.

Table 11: Enrollment response to grade failure by program type: robustness to other shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: academic									
failed last	-0.38	-0.50	-0.25	-0.50	-0.25	-0.50	-0.25	-0.38	-0.41
grade enrolled	(0.014)***	(0.032)***	(0.065)***	(0.032)***	(0.065)***	(0.032)***	(0.065)***	(0.014)***	(0.022)***
previous grades	-0.19	-0.26	-0.13	-0.26	-0.13	-0.26	-0.13	-0.19	-0.19
failed	(0.013)***	(0.036)***	(0.067)*	(0.036)***	(0.067)*	(0.035)***	(0.067)*	(0.013)***	(0.023)***
R-squared	0.70	0.82	0.72	0.82	0.72	0.82	0.72	0.70	0.78
Panel B: vocational									
failed last	0.00	-0.02	0.00	-0.02	0.00	-0.02	0.00	0.00	0.00
grade enrolled	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
previous grades	0.01	0.02	0.00	0.02	-0.01	0.02	0.00	0.01	0.00
failed	(0.005)*	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.005)*	(0.01)
R-squared	0.29	0.59	0.61	0.59	0.61	0.59	0.61	0.29	0.37
Observations	17,571	6,577	4,454	6,577	4,454	6,577	4,454	17,571	6,039
No. individuals	2,768	2,753	2,687	2,753	2,687	2,753	2,687	2,768	1,480

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample is person-years from estimation sample described in Appendix A, with completed education 9 years or more, from CAPS life history panel. Vocational programs include technical colleges, NTC and universities of technology. Re-enrollment refers to enrollment after at least one year of non-enrollment. All regressions include individual fixed effects and age, completed schooling, and calendar year dummies. Survey weights applied. Key to included shocks in each regression, by column:
(1) none
(2) any household shock, including death; serious illness or injury; job loss; major financial loss (including business failure or bankruptcy); abandonment or divorce; theft, fire or property damage; or other shock.
(3) any household shock$(t-1)$
(4) death, serious illness or injury
(5) death, serious illness or injury$(t-1)$
(6) job loss; major financial loss; theft, fire or property damage
(7) job loss; major financial loss; theft, fire or property damage$(t-1)$
(8) pension eligibility (regression discontinuity specification)
(9) pregnancy, marriage and their first lags (females only)

Table 12: Enrollment response to program-specific grade failure and previous employment, by program type

Program type	academic		vocational	
	(1)	(2)	(3)	(4)
failed last academic grade enrolled	-0.39	-0.38	0.01	0.01
	(0.014)***	(0.015)***	(0.005)**	(0.005)**
previous academic grades failed	-0.19	-0.18	0.01	0.01
	(0.014)***	(0.014)***	(0.005)**	(0.005)**
failed last vocational grade enrolled	-0.08	-0.07	-0.19	-0.19
	(0.035)**	(0.032)**	(0.058)***	(0.058)***
previous vocational grades failed	-0.05	-0.03	-0.20	-0.19
	(0.16)	(0.16)	(0.17)	(0.17)
not employed last period		0.04		0.01
		(0.010)***		(0.005)***
Observations	17,562	17,562	17,562	17,562
R-squared	0.70	0.70	0.30	0.30
No. individuals	2,768	2,768	2,768	2,768
Includes work experience		x		x

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample is person-years from estimation sample described in Appendix A, with completed education 9 years or more, from CAPS life history panel. All regressions include individual fixed effects and age, completed schooling, and calendar year dummies. Work experience variables include dummy for non-employment in last period of non-enrollment and cumulative work experience. Vocational programs include technical colleges, NTC and universities of technology. All regressions use survey weights.

Table 13: Enrollment response to grade failure and previous employment, subsamples by program type

Subsample	secondary	post-secondary	male	female	black	coloured	poorest two quintiles	richest three quintiles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: academic								
failed last	-0.46	-0.10	-0.37	-0.39	-0.33	-0.41	-0.42	-0.34
grade enrolled	(0.017)***	(0.022)***	(0.023)***	(0.018)***	(0.017)***	(0.022)***	(0.018)***	(0.022)***
previous grades	-0.24	-0.02	-0.21	-0.18	-0.16	-0.20	-0.21	-0.16
failed	(0.017)***	(0.02)	(0.020)***	(0.017)***	(0.016)***	(0.021)***	(0.017)***	(0.019)***
R-squared	0.72	0.70	0.69	0.71	0.68	0.72	0.71	0.70
Panel B: vocational								
failed last	-0.01	-0.01	0.00	0.00	0.00	-0.01	0.00	-0.01
grade enrolled	(0.006)*	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
previous grades	0.00	0.02	0.01	0.01	0.02	0.00	0.01	0.01
failed	(0.01)	(0.01)	(0.01)	(0.01)	(0.007)**	(0.01)	(0.01)	(0.01)
R-squared	0.27	0.30	0.29	0.30	0.29	0.30	0.29	0.30
Observations	8,905	8,666	7,110	10,461	8,516	9,055	8,671	8,900
No. individuals	1,587	1,181	1,141	1,627	1,439	1,329	1,467	1,301

Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample is person-years from estimation sample described in Appendix A, with completed education 9 years or more, from CAPS life history panel. Regressions for secondary include only person-years with 9-11 years schooling, while regressions for post-secondary include only person-years with at least 12 years schooling. Poorest and richest quintiles based on household per capita income in Wave 1. All regressions include individual fixed effects and age, completed schooling, and calendar year dummies. Vocational programs include technical colleges, NTC and universities of technology. Re-enrollment refers to enrollment after at least one year of non-enrollment. All regressions use survey weights.

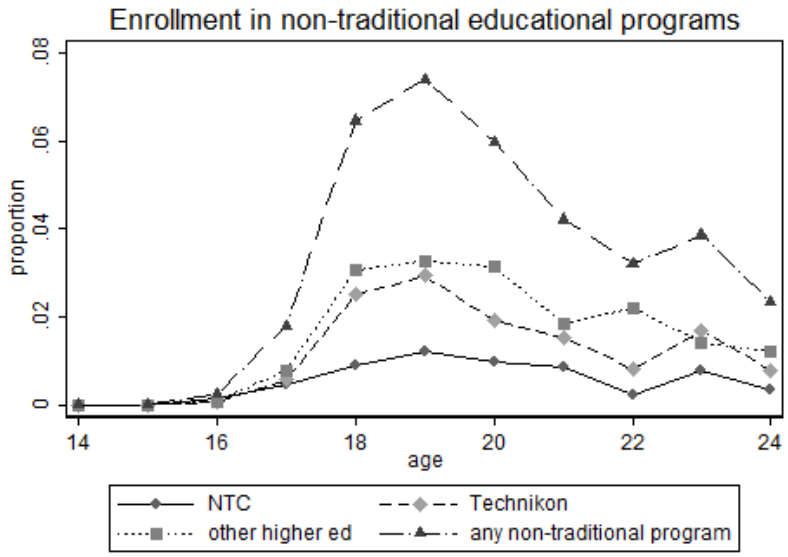
Table 14: Schooling type and labor market outcomes, by race

Outcome	(log) wages		employment		formal search	
Race	black	coloured	black	coloured	black	coloured
	(1)	(2)	(3)	(4)	(5)	(6)
academic	0.09	0.09	0.04	0.07	0.05	0.05
	(0.022)***	(0.014)***	(0.005)***	(0.006)***	(0.026)**	(0.016)***
vocational	0.27	0.19	0.04	0.19	-0.12	0.22
	(0.120)**	(0.081)**	(0.03)	(0.063)***	(0.18)	(0.089)**
Observations	1,037	2,148	8,238	7,659	499	915
R-squared	0.16	0.23	0.28	0.39	0.06	0.06
No. individuals	629	992	1,439	1,329	386	711
H_0: academic=vocational	0.13	0.26	0.91	0.05	0.33	0.05
U/O: academic	6.2	2.7	-1.9	-2.0	4.4	3.2
U/O: vocational	-53.2	3.0	-1.1	-2.9	-5.4	-103.4

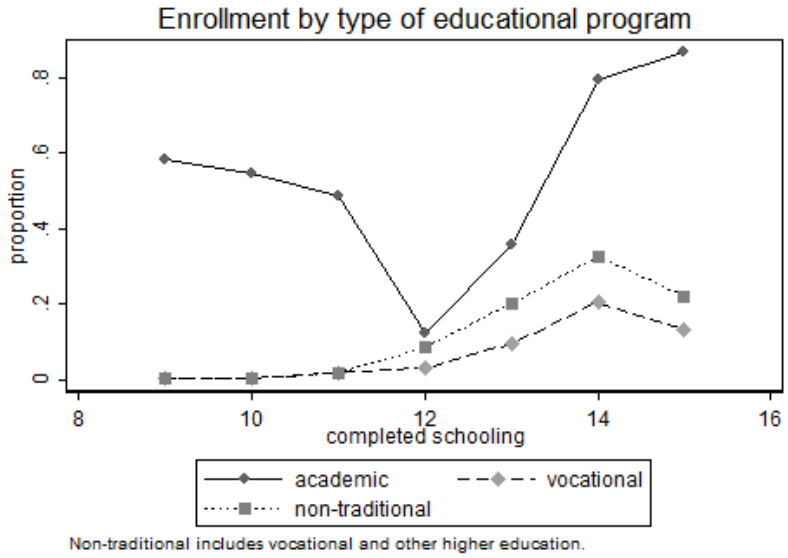
Robust standard errors in parentheses, clustered by individual. * significant at 10%; ** significant at 5%; *** significant at 1%. Unit of observation is person-year. Wages are log of monthly FTE wages based on 160 hours/month. Wages refer to self-reported earnings on current or most recent jobs held among those not enrolled in school, regardless of current employment status, FTE based on 160 hours worked/month. Employment restricted to periods when not enrolled in school. Dependent variable in formal search regressions is indicator for job acquisition through formal method. Formal method of job acquisition refers to responding to ad, sending CV, visiting firm, or using employment agency. All regressions include race, gender, and calendar year dummies; and controls for age-adjusted LNE z-score, experience, experience squared, age, and age squared. Vocational schooling includes NTC and other technical secondary, and universities of technology. Reported test statistics are p-values of indicated null hypothesis. U/O ratio: ratio of selection on unobservables/observables required to explain away effect of schooling variable on outcome, obtained as $\frac{\beta_C}{\beta_{NC}-\beta_C}$, where β_C is schooling coefficient from model with included controls and β_{NC} is schooling coefficient from model without controls. Controls as indicated and described above. See Appendix B for details. Survey weights applied.

Figure 1: Enrollment, by program type

(a)



(b)



Panel (a) shows proportion enrolled in non-traditional schooling categories, by age. NTC includes National Training Certificate and technical college programs at secondary level. "Other higher ed" includes post-secondary programs other than university or university of technology. "Non-traditional" includes any vocational or other higher education. Panel (b) shows enrollment rates by completed schooling. "Vocational" includes NTC, technical colleges, and universities of technology. "Non-traditional" includes vocational and other higher education programs.

Figure 2: Program choice and re-enrollment

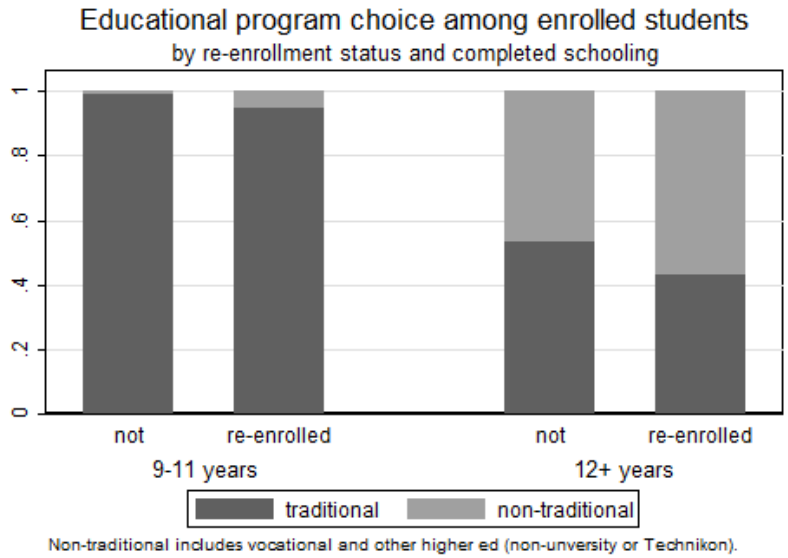


Figure shows shares of enrolled students in type of program, by re-enrollment status. A re-enrolled student is one who is enrolled after at least one year out of school; "not" is all other students. "Non-traditional" programs include any vocational program or other higher education.