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Abstract

In this paper we ask how the returns to academic education compare with the return to two types of training drawing on labour force data from Tanzania's manufacturing sector. The first is vocational training or attending a technical college as part of schooling, the second is on-the-job training in a firm. There has been much dispute in the literature as to whether the returns to vocational or academic training are higher. We show that in addressing this question in a schooling system where entry occurs at differing levels it is necessary to allow both for the entry level into vocation or technical school and for the characteristics of the firm in which the worker is employed. If the firm fixed effect captures a substantial element of unobserved worker quality then the return to vocational education, at the level at which it occurs, exceeds that on academic education. However as the return to education rises with its level the return to any form of vocational training is less than that achieved by those who reach A-Level and above. While those with current training earn more this effect disappears once we allow for firm fixed effects. One interpretation of this result is that the effects of the training get embodied in the quality of the workforce. The paper highlights the importance of panel data which enables the effects of such unobservables to be identified in assessing returns to both vocational education and training.

Keywords: *Vocational and General education in Tanzania, manufacturing, training.*

This study uses data from the fourth and fifth rounds of survey work on Tanzania's manufacturing sector. Round five was conducted between January-February 2002 and round four between November 1999 and January 2000. These rounds were undertaken by combined teams from the Centre for Study of African Economies (CSAE) in Oxford and the Economic and Social Research Foundation (ESRF) in Dar es Salaam. The original three surveys in the early 1990s, upon which this later work builds, were undertaken as part of the Regional Program on Enterprise Development (RPED) organised by the Africa Technical Department of the World Bank. This dataset forms part of an ongoing CSAE research project into manufacturing sector performance in Tanzania and Ghana funded by the ESRC under the Global Poverty Research Group and the Department for International Development (DFID). We are greatly indebted to Måns Söderbom for preventing errors and making many valuable suggestions. John Knight and Adrian Wood raised many insightful queries with respect to an earlier version of this paper which have led us to revise several of our interpretations of the results. Remaining errors are ours.

1 Introduction

The conflict between the wish of educators in Africa to supply vocational education while students and their parents demand an academic one has been a continuing theme in discussions of educational policy in Africa since the now classic works of Foster (1965a,b). Tanzania is a country which has been through a cycle of policy making which began in the 1960s with an attempt to shift the educational system towards a more vocational focus and a restriction on the supply of secondary education (see Psacharopoulos and Loxley (1985) and Knight and Sabot (1990)) and ended in the 1990s with a reversal of many of its key educational policies. While Tanzania's shifts have been more dramatic than most a general trend away from vocational schooling to more general academic education was apparent in the 1990s. This process had powerful backing from those investing in education. The Education Sector Review of the World Bank (1995) argued that the rate of return was much higher to investments in general than in vocational secondary education.

This 'new' view - that it is academic not vocational training that should underlie educational policy - has not gone unchallenged. Bennell (1996 a, b) reports some higher rates of returns to vocational education than the rates of return to general education and argues strongly against any underlying presumption that academic education has a higher return than vocational. A similar argument can be found in Bennell and Sergerstrom (1998). Two papers which report higher returns from vocational than academic education are a study by Neuman and Ziderman (1989) for Israel and one by Moenjak and Worswick (2003) for Thailand.

Indeed research findings do appear to be inconclusive. Zymelman (1976) in a review of school-based vocational training concluded that there was no clear evidence either for or against this type of educational provision. Chung (1995) in a review of the literature undertaken from the 1970s to the early 1990s found that 12 studies on returns to vocational education in developing countries reported higher returns to vocational training, 10 studies reported lower returns to vocational education or not different from other forms of learning, and 5 studies concluded that there is no basis to compare the returns to vocational education with the returns from other forms of learning. Other studies have stressed that the returns to vocational education depend substantially on the general level of economic development, the availability of private sector jobs, and whether or not people are employed in a field related to their training (Bennell and Segerstrom, 1998; Middleton et al., 1993).

In parallel with the concern to promote skills within schools by means of vocational schooling has been the perceived need to promote training within firms to address problems of poor productivity. A large literature has developed arguing that limited skills is the key to understanding poor performance in African countries, particularly in their manufacturing firms,

Pack (2002). The central premise of much of this discussion has been that markets for skills will not operate and that there is a need to subsidise firms to ensure that the training occurs.

In this paper we ask three questions flowing from these concerns. First, what can account for the continuing strong preference for academic education in Africa where the level of development is so low and wage jobs are expanding so slowly (see Kingdon, Sandefur and Teal (2005) for a review of the empirical evidence for this assertion)? Secondly, what can account for the diversity of the findings in the literature regarding the returns from vocational and academic education and is any general answer possible as to which has the higher returns? Thirdly, and most generally, which forms of educational investment are most profitable in terms of increasing incomes - vocational school, technical college, academic education or on-the-job training? We will argue that the answers to all these questions are linked through the shape of the earnings function and the role of firm effects in determining earnings.

In the next section we set out the background as to how enrolment has changed in Tanzanian schools over the period from the 1960s to 2000. In section 3 we set out the earnings function we will use. An extensive literature has been concerned with two econometric problems that arise in estimating such functions in developing countries. The first is the possibility of a selectivity bias as wage earners are not a random sample of the population, Moenjak and Worswick (2003) find a much higher return on vocational education for Thailand when they allow for selectivity. The second problem is that the return on education may be biased up if ability is omitted from the equation. Both these issues are extensively discussed in Söderbom et al (2006*)* for the data that will be used in this paper. They can find no evidence from instrumenting that the returns from education go down, which is in line with virtually all research in this area (see Card (2001) for a review). In this paper we follow their control function approach of using the residuals from an auxiliary for education to test if the results are biased due to the endogeneity of education. In section 4 we set out how we propose to use the data to address the issue of how returns from vocational and academic schools can be compared. Sections 5 reports results for the sample as a whole, section 6 sets out the returns by the size class of firms. In section 7 we assess the role of firm fixed effects and worker quality in determining our results. We return to the most general issue under review - the returns to vocational relative to academic education - in section 8. A final section concludes.

2 Education and training in Tanzania

Since independence the education and training system of Tanzania has gone through distinct regimes, primarily influenced by changing political objectives and economic constraints. In 1961, there were only 3,115 primary schools available with a total capacity of 431,056 pupils Maliyamkono and Kahama (1986), 95 secondary schools with a total capacity of 11,832 pupils,

and a few crafts and technical schools with the total capacity of 1,500 pupils, Ministry of Education (1968). At the university level there was the University of East Africa that admitted students from Kenya, Uganda and Tanzania. The annual intake of Tanzanian students to the University of East Africa was about 200, United Republic of Tanzania (1964).

Tanzania adopted 'Education for Self-Reliance' in 1967; followed by the Musoma Resolution on education of 1974. Major changes that were introduced by these two policy documents included the introduction of Swahili as the sole teaching language in primary schools, the reduction of years spent in primary school from eight to seven years, setting a target to achieve Universal Primary Education (U.P.E.) by November 1977, and the transformation of secondary education into a mass educational system, whereby formal study could end after six years, Ministry of Education (1968).

Reforms which began in the mid 1980s represented, in many respects, a reversal of the policies introduced in 1967. The free education system was replaced by a cost-sharing scheme, and private sector participation in educational provision was enhanced. These reforms of the education system were introduced after severe budget problems and a general economic crisis in the 1970s and 1980s and were part of the social, political and economic reforms introduced in the mid 1980s, Galabawa (2000).

The changes in enrolment rates for the various education levels over the period 1962-2000, shown in Table 1, reflect these changing political priorities. From 1967 to 1981 primary enrolment rose from 37 to 93 per cent of the 7-14 age cohort. This enrolment rate then declined until the early 1990s after which a modest recovery was effected to 84 per cent by 2000. In contrast enrolment rates for secondary and post-secondary level expanded modestly until 1981 and then accelerated rapidly to 2000 such that between 1981 and 2001 enrolment rates at the secondary level more than doubled from 5 to 13 per cent of the relevant age cohorts (see Table 1). The work of Knight and Sabot (1990) used this limited expansion of secondary education until 1980 as the basis for a comparison between Tanzania and Kenya as to the differential effects of investment in education in the two countries**.** Söderbom (et al) (2006) provide a comparison of how the returns to education in Kenya and Tanzania have changed over the period since 1990 using the same data for Tanzania as will be used in this paper.

In the area of training there have also been major changes in policy over the period. Until the end of the 1980s Tanzania had a centralised labour market with a government set pay structure and centrally planned labour supply (including job training) and utilization. Most firms were state owned and some large firms had their own training centres. In the 1990s policies of state control were reversed as part of a move to a market economy. Specific reform measures included privatisation of state owned firm, abolition of centralized labour allocation and gradual elimination of government set wages and the introduction of wage bargaining at an enterprise

TABLE 1
TOTAL ENROLMENT AND PERCENTAGE OF ENROLMENT TO RELEVANT POPULATION COHORTS FOR DIFFERENT LEVELS OF LEARNING INSTITUTIONS IN TANZANIA 1960-2000

Year	Primary	% Age 7-14yrs	Secondary (O-Level)	%Age 14-17yrs	Secondary (A-level)	% Age 17-19yrs	Higher Education	% Age 20-24yrs	Technical College
1962	518,663	33.10	13,690	2.25	485	0.10	203	0.03	299
1963	592,104	33.52	16,604	2.33	572	0.12	305	0.04	327
1964	633,678	35.28	18,830	2.51	1,067	0.21	407	0.05	360
1965	710,200	36.19	20,529	2.69	1,386	0.27	642	0.08	335
1966	740,991	36.33	22,240	2.76	1,596	0.29	740	0.08	350
1967	753,114	37.42	23,842	2.92	1,709	0.31	1,313	0.15	318
1968	765,169	37.95	26,829	3.14	1,214	0.21	1,498	0.17	320
1969	776,109	37.99	27,322	3.19	2,636	0.44	1,975	0.21	305
1970	827,974	38.02	28,322	3.23	2,895	0.47	2,086	0.22	343
1971	902,609	38.67	29,559	3.25	3,044	0.49	2,099	0.21	368
1972	1,003,396	39.72	30,185	3.27	3,228	0.50	2,230	0.22	380
1973	1,106,387	40.23	31,021	3.26	3,481	0.53	2,345	0.22	375
1974	1,288,886	42.26	32,246	3.25	3,680	0.54	2,337	0.20	351
1975	1,532,953	50.22	34,560	3.20	3,767	0.53	2,402	0.20	395
1976	1,954,442	59.32	36,218	3.28	3,729	0.51	2,828	0.23	400
1977	2,020,883	59.83	37,878	3.62	4,082	0.54	3,075	0.24	418
1978	2,751,931	78.66	39,527	3.84	3,842	0.50	3,038	0.23	420
1979	3,076,210	85.52	46,353	3.92	3,884	0.50	3,002	0.22	413
1980	3,359,966	90.56	63,607	4.25	3,685	0.49	3,051	0.22	469
1981	3,538,183	92.79	63,826	4.68	3,776	0.47	3,006	0.21	478
1982	3,512,799	89.93	64,834	4.92	4,310	0.47	3,018	0.21	510
1983	3,561,410	88.05	66,564	4.96	4,655	0.51	3,049	0.20	525
1984	3,483,944	84.76	69,083	5.10	5,127	0.55	3,069	0.19	484
1985	3,169,759	75.10	77,400	5.37	5,697	0.59	3,025	0.18	506
1986	3,158,839	72.73	85,706	5.53	5,936	0.61	3,085	0.18	604
1987	3,159,726	70.85	97,854	6.23	6,192	0.63	3,042	0.17	634
1988	3,165,113	69.27	112,619	7.19	6,221	0.62	3,065	0.16	610
1989	3,258,601	70.23	125,397	7.87	7,012	0.68	3,087	0.15	680
1990	3,373,000	71.47	136,729	8.35	8,513	0.81	3100	0.15	850
1991	3,507,000	77.3	156,250	9.32	10,562	0.97	3221	0.14	1,824
1992	3,600,000	71.1	164,117	9.51	11,786	1.05	3543	0.16	1,698
1993	3,733,000	77.3	168,302	9.52	12,597	1.10	4594	0.19	1,760
1994	3,793,000	76.8	173,620	9.52	12,672	1.07	5407	0.21	1,669
1995	3,878,000	76.5	183,659	9.81	12,716	1.05	7897	0.31	1,896
1996	3,943,000	75.5	185,449	9.71	13,974	1.12	9370	0.35	1,827
1997	4,052,000	77.9	205,562	10.32	18045	1.40	10,781	0.39	1,859
1998	4,032,000	79.2	208,738	10.29	18,165	1.37	12,069	0.43	1,833
1999	4,183,000	82.0	225,866	10.77	21,713	1.59	12,555	0.43	2,049
2000	4,136,000	83.7	238,254	10.97	23,702	1.69	13,442	0.45	2,178

Source: Tanzania Statistical Abstract (1995), Tanzania Economic Surveys (1964, 1968, 1977, 1982, 2001), Tanganyika Five-Year Plan (1964) and Official Statistical from National Bureau of Statistics. The gross enrolment figures from 1991-2000 for primary school are from official source in the Ministry of Education. The gross enrolment figures for other years are author's computation. The information of total population, and population categorised by age groups reported in the census reports summarised in statistical abstracts along with total enrolments information for each education level are used to compute the gross enrolment rates. Figures for technical education from 1990 are from Basic Statistics on higher education prepared by the Ministry of Science, Technology and Higher Education.

level. Due to privatisation, restructuring and closure of some state owned firms, training centres that used to operate under specific companies closed down, VETA (1997). The new Training Act (of 1994) established an autonomous training authority. Employers are now integrated within the training system as they have a say on the matters related to the type of training provided and also contribute to the cost of training through a 2% levy paid annually. While these reforms to the training system were motivated by a wish to enhance the value of training to employers they also clearly show the continuing belief among policy makers that central direction, and subsidisation, of training remains necessary.

3 The specification of the earnings function

Our empirical strategy is to estimate an earnings function of the standard form (Becker (1964), Mincer (1974)) in which we have controls for age and tenure and then introduce education and training allowing for the fact that when the student enters vocational school or technical college may be important for the return to that level of education. As will be discussed in more detail below our data was collected in a way that enables us to identify the path taken by the student through the education system. In particular we know the highest level they completed before entering vocational school or technical college. We also know whether they went on to obtain professional qualifications or received higher education in the form of a bachelor degree or a post-graduate qualification. Our specification is as follows:

$$
\begin{aligned}
LnE_{ijt} = {} & \beta_1 Age_{ijt} + \beta_2 Age_{ijt}^2 + \beta_3 Tenure_{ijt} \\
& + \theta_p Primary_i + \theta_m Middle_i + \theta_o OLevel_i + \theta_a ALevel_i \\
& + \theta_v Vocational_i + \theta_t TechCol_i + \theta_{pr} Professional_i + \theta_{he} Higher_i \\
& + \theta_{pv} Primary\_vocational_i + \theta_{ov} OLevel\_vocational_i + \theta_{av} ALevel\_vocational_i \\
& + \theta_{ot} OLevel\_techCol_i + \theta_{at} ALevel\_TechCol_i \\
& + \omega_c CJT_{ij} + \omega_p PJT_{ij} + \omega_{sc} STC_{ij} \\
& + \mu_j + T_t + \varepsilon_{ijt}
\end{aligned}
\qquad [1]
$$

where i, j and t are subscripts of individual, firm and time respectively.

Ln E is log of real earnings, *Age* the age of the worker, *Tenure* the length of time spent in their current firm, *CJT* is a dummy if the worker is receiving current on-the-job training, *PJT* a dummy for whether a worker received on-the-job training in the past and *STC* is a dummy for whether they went on a short training course in the last six months. *T* are time dummies, μ are firm fixed effects and ε is the error term.

We identify the highest level of education achieved where the dummy variables are for the following levels of education: Primary School, Middle School, O and A-Level Secondary, Professional and Higher Education which is those with a degree. The omitted category is those with no education. We then identify two categories of non-academic education that undertaken at vocational schools and that undertaken at technical colleges. In the case of vocational schools we identify if the student enters vocational school after primary (primary_vocational), after middle school (middle_vocational), after O-level (OLevel_vocational) or after A-Level (ALevel_vocational). Similarly for those using technical college we identify if they enter after O-Level (OLevel-techCol) or after A-level (ALevel_techCol). We will report the returns to middle school but as this was discontinued in the mid 1970s we will focus on the return to other levels as these are of current concern for policy purposes.

This way of classifying students means that the return on vocational school or technical college can differ depending on at which stage the student enters the school or college. The

returns to vocational schooling may well differ depending on the stage of the educational cycle at which it occurs. Söderbom (et al) (2006) document, using this data, that the returns from education are strongly non-linear and convex. In their paper they model education by means of a spline function which allows the returns to education to differ across levels. We wish to measure the increment in earnings which accrue to attending vocational school so this dummy variable approach is the most general specification we can adopt. So can identify the returns to vocational education after primary (ROR_{pv}), after O-Level (ROR_{ov}) and after A-Level (ROR_{av}). A similar argument applies to progress through technical college so we have the returns to technical education after O-Level (ROR_{ot}) and after A-Level (ROR_{at}). The rates of return which we will be reporting are defined as follows:

$$ROR_{pv} = \theta_v + \theta_{pv} - \theta_p \qquad ROR_{ot} = \theta_t + \theta_{ot} - \theta_t$$

$$ROR_{ov} = \theta_v + \theta_{ov} - \theta_o \qquad ROR_{at} = \theta_t + \theta_{at} - \theta_a$$

$$ROR_{av} = \theta_v + \theta_{av} - \theta_a$$

These rates of return are increments in earnings, *not Mincerian returns*, from following alternative paths through the education system. One of our contributions in this paper is to show that rates of return differ depending on how students proceed through the education system. A second contribution follows from our ability to match firm characteristics with the education of the workers. There is work, using the labour force data from these firms, showing that part of the return to education results from a process of sorting so that workers in larger firms receive a higher return on education than those in smaller firms, Fafchamps, Söderbom and Benhassine (2006). To address that issue we will interact all the educational dummies with the log of employment as our measure of firm size. If the effect of size is to increase the return, for example, on O-Level more than it increase the return on vocational after O-Level then it is perfectly possible (as we will see) for the returns to vocational education to be negative. The implications of any such negative returns will be taken up after the results are presented.

We turn now to consider the returns to training in the firm. We have three measures of training; the first (*CJT*) is whether the worker is currently receiving on-the-job training; the second (*PJT*) is whether such training occurred in the past and the third whether the worker has attended a short training course, (*STC*). These are simply dummy variables and thus a very crude measure of training. In their defence it can be argued that training within the firm is actually very difficult to measure and a simple measure of any or none (which is the form our variables takes) at least avoids the problems posed by comparing the range of activities which is the typical pattern of within firm training. The more basic problem with the variable is that it is endogenous in that individuals may be selected for training on the grounds, unobservable to the econometrician, that they are more able. Thus any return to training may capture not the effect of the training but the effects of the selection. While we have not sought to model the selection

process we do have firm-level panel data so we can allow for a range of factors which may be correlated with the training and thus cause potential bias in the estimated returns on training. As we will show these are important factors in leading to over-estimates of the return on training.

4 Data and variables

The data used in this study is from the fourth and fifth rounds of the Tanzanian Manufacturing Enterprise surveys. The fifth round was conducted between January-February 2002 and covered a total of 192 manufacturing enterprises in 6 main industrial locations in Tanzania. The fourth round was conducted between November 1999 and January 2000. These surveys were the follow-up to the three Regional Program of Enterprise Development (RPED) surveys carried out in the early 1990s. We confine ourselves to the fourth and fifth rounds as the education questions were then asked in a way that allows us to make the distinction we require as to when a workers left the main academic stream and entered a vocational school or technical college. As in both the fourth and fifth waves of the survey recall questions were asked we have four years of data spanning the period 1997 to 2000. Table 2 shows summary statistics for education and earnings across these four years.

TABLE 2
Education and Earnings

Highest Level completed	Percentage of Sample	Monthly Earnings in 1994 US$	Percentage of Sample in Vocational School after highest level of general school completed	Percentage of Sample in Technical College after highest level of general school completed	Median Years of Education
(1)	(2)	(3)	(4)	(5)	(6)
Higher Education	2.7	284			16
Professional	5.7	83			13
Technical College	5.3	74			14
Vocational	19.5	43			9
A-Level	1.7	81	2.6	10.4	13
O-Level	10.5	47	27.2	80.0	11
Middle	2.9	48	4.1	9.6	8
Primary	47.1	33	65.7	0	7
None	4.6	28	0.4	0	0
Average		39			
N	2527				

We have a sample of 2527. Column (2) of Table 2 shows how this sample is distributed across the educational categories we can identify. The two categories on which we wish to focus are those who went to technical college, which was 5 per cent of the sample, and those who attended

vocational school, which is 20 per cent of the sample. Clearly vocational school is far more important than technical college and attending vocational school was reasonably common. Column (3) shows the monthly earnings in 1994 US$. Those who have been to technical college earn far more than those who attended vocational school, US$ 74 as compared with US$ 43 per month. Also it is apparent from the Table that the earnings of those with O-Level qualification are very similar to those with vocational training. It will matter when students entered vocational school or technical college. In Column (4) we show when students entered vocational school. While most enter after primary school, 66 per cent, a substantial number, 27 per cent enter after O-Level and a relatively small number, 3 per cent, after A-Level. By far the most common path into technical school is after O-Level, 80 per cent of the sample. This data confirms what we know from how academic and vocational education is structured. Entry levels differ and there is a hierarchy by which entry into technical colleges is limited, in the main, to those with O-Level qualifications.

At the same time as the workers were interviewed information was also collected about the firms in which they were employed. This data referred to the year before the earnings data. We have matched the firm level data with the earnings data such that, for example, firm data for 1992 is matched to the earning for 1993. A similar procedure is used throughout the period. The earnings variable was obtained by taking the total monthly earnings, plus any allowances received which include food, clothing and housing. In addition any annual and/or Christmas bonuses were also included.

5 Rates of Return on Vocational and Academic Education in the Sample

In this section we present our empirical results assessing the effects of vocational and general education and job training on earnings. Table 3 shows the first three regressions that will the basis for our initial analysis. All the regressions control for gender, tenure and age and whether or not the worker is employed in the capital city. In Column (1) we report the most basic regression where education is modeled simply as the highest level achieved. In Column (2) we relax the assumption, implicit in Column (1), that the returns to vocational education and technical college are the same whatever the entry level of the student. In Column (3) we allow for the process of sorting, documented by Fafchamps, Söderbom and Benhassine (2006), by which workers in certain kind of firms may receive a higher return on education than those in other types of firm. We do this initially by allowing for firm fixed effects.

Before presenting the results it is useful to set out how these differing sets of controls will affect the results. We will discuss the returns to vocational education but exactly the same issues apply in assessing the returns to going to technical college. The return to vocational school

Table 3: Dependent Variable: Ln (Earnings in 1994 US$)

	(1)	(2)	(3)
Male	0.095	0.114	0.116
	(1.81)	(2.23)*	(4.00)**
Capital City	0.146	0.140	0.000
	(2.46)*	(2.41)*	(.)
Age	0.056	0.055	0.050
	(5.15)**	(5.17)**	(8.92)**
Age ^2	-0.056	-0.056	-0.052
	(4.19)**	(4.19)**	(7.61)**
Tenure	-0.002	-0.001	0.007
	(0.50)	(0.18)	(3.90)**
Primary	0.242	0.244	0.079
	(3.65)**	(3.73)**	(1.56)
Middle	0.459	0.459	0.251
	(3.75)**	(3.73)**	(3.32)**
O-Level	0.603	0.612	0.343
	(7.45)**	(7.67)**	(5.91)**
A-Level	1.115	1.129	0.603
	(5.94)**	(6.03)**	(6.56)**
Vocation	0.505	0.827	0.826
	(6.64)**	(7.89)**	(2.44)*
Technical College	0.896	0.978	0.765
	(8.74)**	(4.19)**	(5.45)**
Professional	1.077	1.094	0.704
	(7.36)**	(7.40)**	(10.66)**
Higher Education	2.138	2.156	1.400
	(14.76)**	(14.88)**	(17.34)**
Training current	0.221	0.208	0.011
	(2.32)*	(2.25)*	(0.26)
Training past	0.031	0.029	-0.036
	(0.71)	(0.65)	(1.34)
Short Training Course	0.150	0.134	0.079
	(2.02)*	(1.79)	(2.09)*
Vocation_primary		-0.438	-0.645
		(4.58)**	(1.92)
Vocation_middle		-0.222	-0.300
		(1.24)	(0.85)
Vocation_O-Level		-0.108	-0.369
		(0.97)	(1.10)
Vocation_A-Level		0.395	-0.126
		(1.34)	(0.35)
Technical College_O-Level		-0.136	-0.209
		(0.53)	(1.48)
Technical College_A-Level		0.333	-0.085
		(1.12)	(0.45)
Constant	2.016	2.009	2.374
	(8.74)**	(8.89)**	(20.83)**
R-squared	0.39	0.41	0.29
	OLS	OLS	Firm Fixed Effects
P value on the hypothesis that vocation and technical interacted with entry level = 0:		0.00	0.00

Number of observations = 2527, number of firms in column (3) = 234. Robust t statistics in parentheses * significant at 5%; ** significant at 1%. All equations include time dummies.

Figure 1

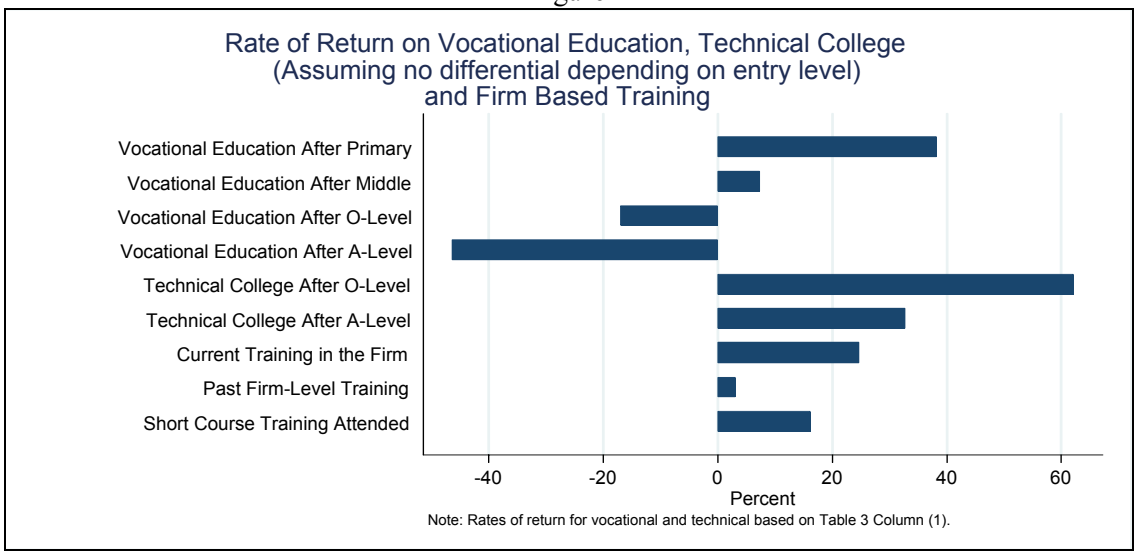


Figure 2

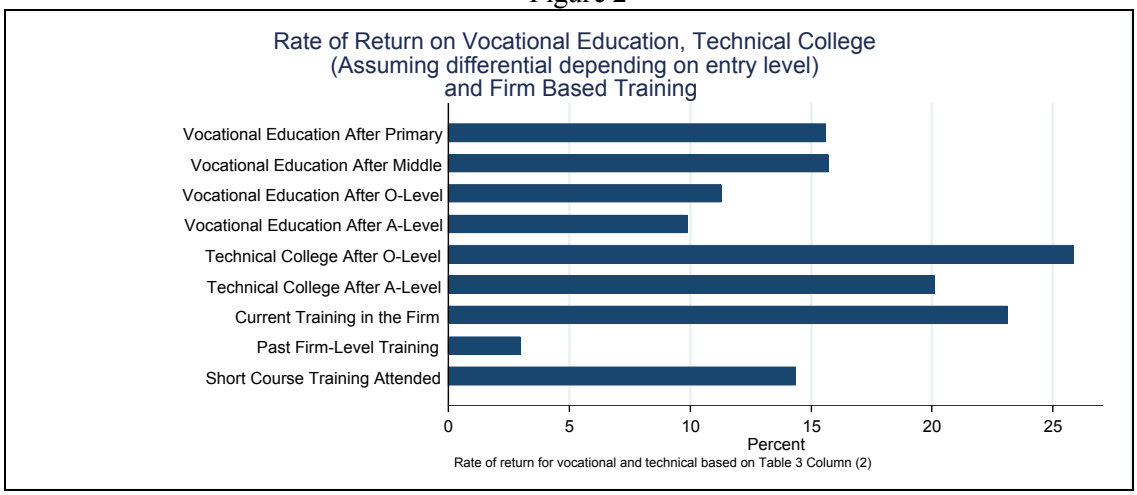
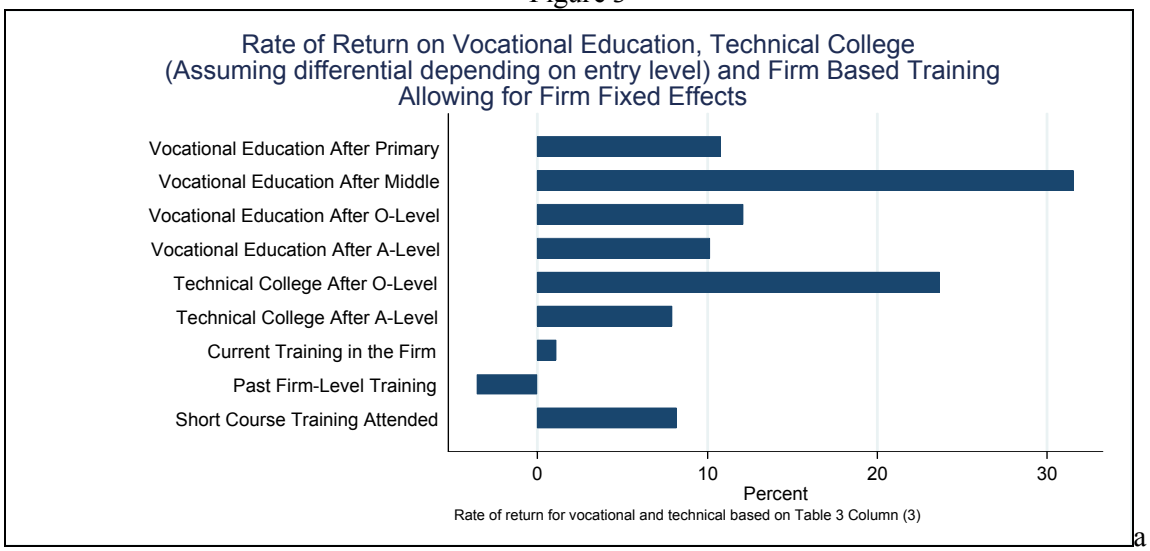


Figure 3



a

reported in Table 3 Column (1) is, using the notation from equation (1), $ROR_{pv} = \theta_v - \theta_p$. The ROR will depend on two aspects of the educational path followed by the worker. The first is when entry to vocational school occurred and the second is the type of firms in which the worker is employed. The first of these is allowed for in the return reported in Column (2) which is: $ROR_{pv} = \theta_v + \theta_{pv} - \theta_p$. The second is more complex because firm characteristics may affect each of the three terms in the expression for the ROR differentially. The results are reported in Table 3 Column (3).

The implications for these alternative approaches to the calculation of the ROR are most readily seen by presenting the point estimates as we do in Figures 1 to 3. Figure 1 reports the implied estimates for the rates of return run from Table 3 Column (1). By the rate of return we mean the increment in earnings which accrues at each of the levels of education specified. For those who enter vocational school after primary, which is 67 per cent of our sample, there is an increment in earnings of nearly 40 per cent. For those who enter after O-Level, which is 27 per cent of our sample, there is a fall of 20 per cent and for those who enter after A-level, only 3 per cent of our sample, there is a massive negative differential of over 40 per cent. For those going to technical college, either after O-level or A-Level the returns are 60 and 25 per cent respectively.

In Figure 2 we relax the assumption that the returns do not depend on the path and the result is to produce a very different pattern of returns. We note from the tests reported in Table 3 that the assumption that the path does not matter is clearly rejected by the data. The return to vocational education after primary is now 15 per cent and the returns to technical college after O-Level is 25 per cent. In summary allowing for the differential return on vocational training depending on when it occurred in the educational path of the worker the returns are now positive at all levels but, at the path most workers followed, much lower than in Figure 1.

In Figure 3 we allow for firm fixed effects, again the data suggest these are a very important determinant of earnings. Once we allow for firm fixed effects the returns to both vocational and technical college are reduced although for vocational training the returns remain at 10 per cent or above while for those attending technical college after O-level the return remains above 20 per cent. The effects on the firm-level job training dummies are much greater. Current training now has a very small and wholly insignificant effect on earnings, while past training has a point estimate that is negative. It remains true that attending a short training course is associated with an increase in earnings of nearly 10 per cent and this is significant at the 5 per cent level.

6 Rates of Returns on Vocational and Academic Education by Firm Size

How should these results be interpreted? In particular should we control for fixed effect when assessing the returns to education? It is possible to argue that such controls are inappropriate. As Fafchamps, Söderbom and Benhassine (2006) argue education may well be more productive in certain types of firms and thus part of the return to education accrues in the form of a better "match" between the firm and the worker. However certain controls may be crucial for understanding how vocational and other technical training impacts on earnings and one is that the effect may differ by the size of the firm. There are two reasons why firm size may matter. The first is that large firms are over-represented in our sample. The second follows from our concern to identify the path through the educational system that the worker has taken. To see the implications of firm size we can write the ROR allowing for the effects of size as: $ROR^{s}_{pv} = \theta_v + \theta_v \cdot ll + \theta_{pv} - \theta_p - \theta_p \cdot ll$ where ll is the log of firm size. Size may increase both the returns to attending vocational school and the return from attending primary in a way that reduces the *ROR* on vocational school if the effect on primary is larger than the effect on having attended vocational school. In Table 4 Column (1) we report the results for extending the specification of Table 3 by allowing for the effects of size on the returns to education, Table 4 Column (2) allows for firm fixed effects in this more general specification. (Table 4 Column (3) allows for the possible endogeneity of education and will be considered below.) The implied rate of return, which can be obtained from Table 4, now varies by firm size and below we will report results for small firms (those with 10 employees) and large firms (defined as those with 100 employees). The p value decisively rejects the hypothesis that these interaction terms are not significantly different from zero. We appear to have convincing evidence from Table 4 that we must allow not only for the entry point into any level of vocational education but the fact that the returns to this will differ depending on the size of the firm.

We show in Figure 4 the returns to the highest level of education completed by firm size. The point estimates come from Table 4 column (1). As we would anticipate from the results of Fafchamps, Söderbom and Benhassine (2006) the returns on education, at all levels, are higher in larger firms, in the case of those with professional qualifications massively so. In Figure 4 we are reporting on the returns from the highest level of education reached, not the net returns to vocational and technical education. The results for that are reported in Figure 5 which shows that for large firms the returns to vocational and technical college after O-level are substantially negative. In fact the only form of vocational or technical college that has a more than marginal positive return is vocational school after primary.

The reason for these results is apparent from the interaction terms between firm size and education reported in Table 4. Firm size has a much bigger impact on academic educational

Table 4: Earnings (Ln (Earnings in 1994 US$)) and Education (in years)

	Earnings			Education
	(1)	(2)	(3)	(4)
Male	0.143	0.106	0.095	-0.553
	(2.96)**	(3.69)**	(3.26)**	(3.35)**
Capital City	0.133	0.000	0.000	0.000
	(2.68)**	(.)	(.)	(.)
Age	0.038	0.047	0.049	0.330
	(4.33)**	(8.43)**	(8.74)**	(10.43)**
Age ^2	-0.037	-0.048	-0.050	-0.396
	(3.33)**	(7.06)**	(7.34)**	(10.45)**
Tenure	-0.001	0.008	0.006	-0.083
	(0.48)	(4.31)**	(3.30)**	(7.90)**
Primary	0.204	0.192	0.128	
	(1.43)	(1.82)	(1.17)	
Middle	0.158	0.373	0.275	
	(0.64)	(2.11)*	(1.51)	
O-Level	0.400	0.364	0.243	
	(2.37)*	(3.32)**	(2.01)*	
A-Level	0.586	0.388	0.256	
	(2.52)*	(2.84)**	(1.74)	
Vocation	0.676	0.836	0.669	
	(4.62)**	(2.46)*	(1.93)	
Technical College	0.426	0.671	0.515	
	(1.03)	(2.63)**	(1.95)	
Professional	-0.184	0.147	-0.008	
	(0.65)	(0.88)	(0.05)	
Higher Education	1.323	1.313	1.120	
	(3.47)**	(4.64)**	(3.80)**	
Training current	-0.250	-0.314	-0.310	
	(1.40)	(2.95)**	(2.91)**	
Training past	-0.103	-0.157	-0.160	
	(1.14)	(2.37)*	(2.41)*	
Short Training Course	0.146	0.057	0.042	
	(0.96)	(0.53)	(0.40)	
Vocation_primary	-0.423	-0.551	-0.483	
	(2.39)*	(1.59)	(1.39)	
Vocation_middle	-0.450	-0.207	-0.169	
	(1.51)	(0.54)	(0.44)	
Vocation_O-Level	-0.313	-0.356	-0.338	
	(1.55)	(1.03)	(0.98)	
Vocation_A-Level	-0.089	-0.348	-0.363	
	(0.35)	(0.93)	(0.97)	
Technical College_O-Level	-0.046	-0.313	-0.332	
	(0.12)	(1.53)	(1.63)	
Technical College_A-Level	0.126	-0.449	-0.489	
	(0.31)	(1.83)	(1.99)*	

Table continued below.

Primary_ll	0.011	-0.033	-0.034	
	(0.26)	(1.08)	(1.12)	
Middle_ll	0.078	-0.038	-0.039	
	(1.10)	(0.78)	(0.81)	
O-Level_ll	0.047	-0.007	-0.008	
	(0.98)	(0.23)	(0.28)	
A-Level_ll	0.100	0.048	0.043	
	(2.26)*	(1.61)	(1.43)	
Vocation_ll	0.031	0.001	0.001	
	(1.08)	(0.07)	(0.07)	
Technical College_ll	0.066	0.055	0.054	
	(1.14)	(1.45)	(1.45)	
Professional_ll	0.230	0.122	0.120	
	(3.86)**	(3.68)**	(3.64)**	
Higher Education_ll	0.031	-0.016	-0.017	
	(0.49)	(0.30)	(0.34)	
Training_current_ll	0.089	0.078	0.077	
	(2.19)*	(3.15)**	(3.10)**	
Training_past_ll	0.027	0.032	0.033	
	(1.14)	(1.85)	(1.88)	
Training_stc_ll	-0.014	0.003	0.006	
	(0.38)	(0.12)	(0.24)	
Ll	0.060	0.054	0.059	0.189
	(1.34)	(1.04)	(1.14)	(0.76)
Residuals from Column (4)			0.017	
			(2.35)*	
Education_Father				0.054
				(2.76)**
Education_Mother				0.051
				(2.58)**
Farmer_Father				-0.636
				(4.15)**
Faremt_Mother				-0.233
				(1.46)
Professional_Father				0.714
				(3.24)**
Professional_Mother				0.301
				(0.88)
Constant	2.183	2.245	2.290	2.663
	(9.70)**	(11.21)**	(11.40)**	(2.55)*
Observations	2527	2527	2527	2527
R-squared	0.48	0.31	0.31	0.15
Number of firm		234	234	234
P value on test that education interacted with firm size coefficients = 0	0.00	0.00		

Robust t statistics in parentheses * significant at 5%; ** significant at 1%
All equations include time dummies.

Figure 4

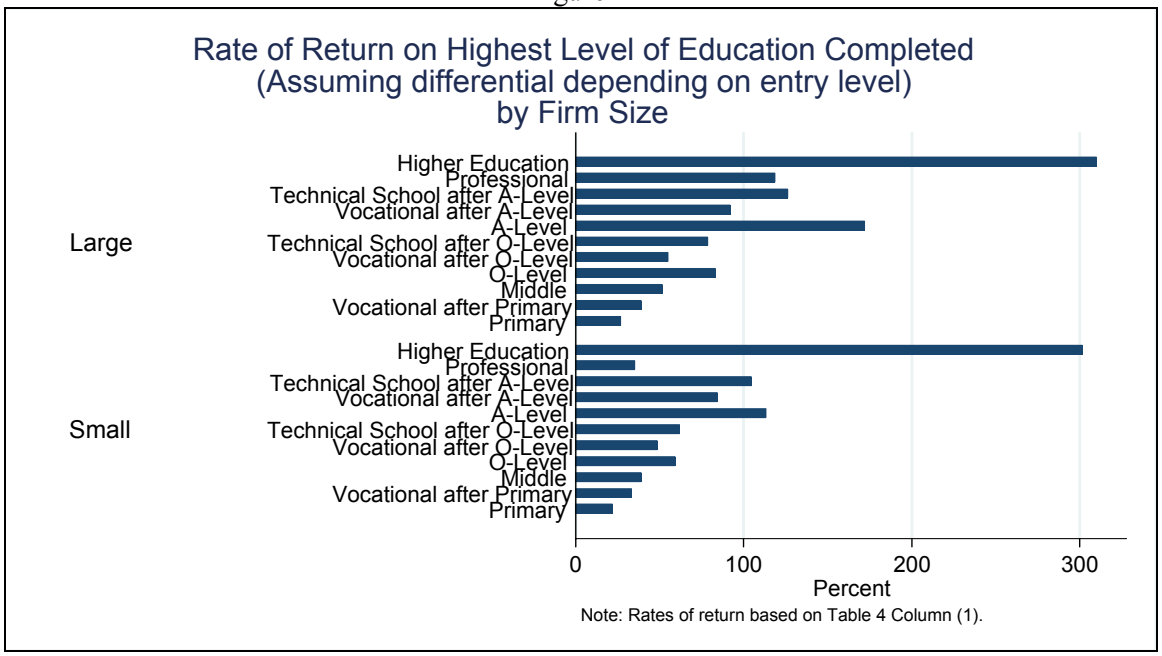
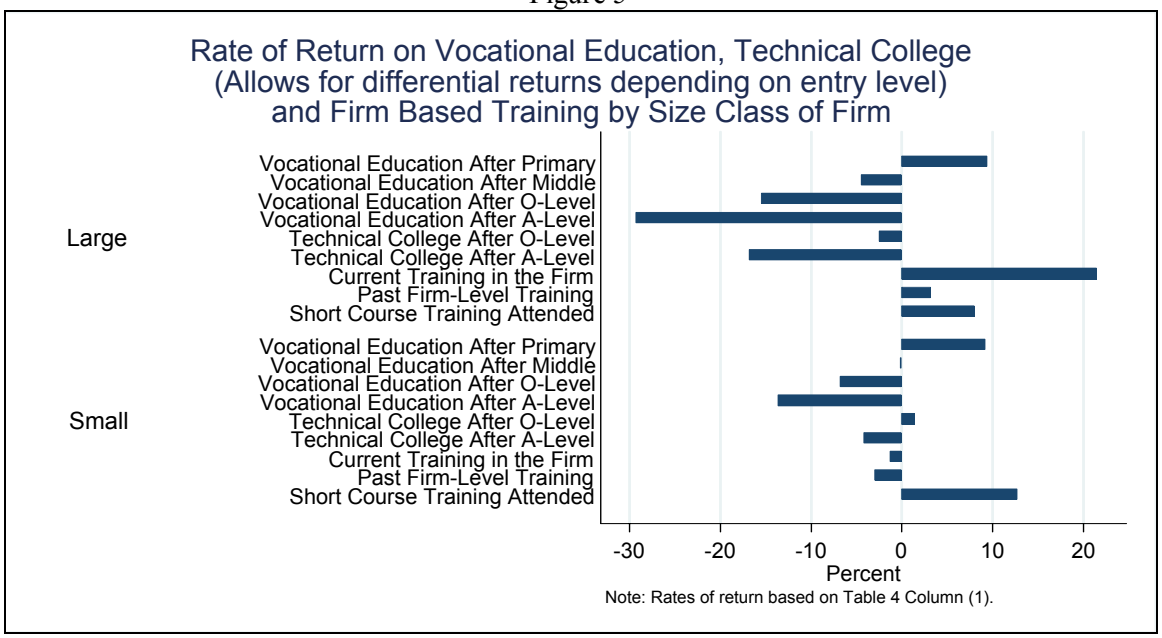


Figure 5



Note: A large firm is defined as one with 100 employees, a small firm as one with 10 employees.

levels, particularly those at O and A-level than on vocational education. The effect is to greatly reduce the return on either vocational education after O-level or technical college after A-Level. This is true across both small and large firms. These findings are in essence a confirmation of the argument that Foster (1965a,b) makes against vocational training. By teaching narrowly defined skills rather than the ability to solve problems such training fails to develop general skills which firms with any degree of technical sophistication find most useful. The fact that the returns to

academic education rise much faster with firm size than those for vocational education is consistent with this view.

However the results present us with a problem. Why if the returns are negative go at all? The effect cannot be causal. A possible source of the problem lies in the unobservables in the regressions which underlie Figures 4 and 5. We consider this problem in the next section.

7 Firm Fixed Effects and Worker Quality

We can use the results reported in Table 4 Column (2) to ask if allowing for firm fixed effects does allow us to identify a possibly positive effect of vocational and technical college on earnings at all educational entry levels. The results are reported in Figure 6 which presents a similar calculation to that in Figure 5 but with controls for fixed effects.

Figure 6

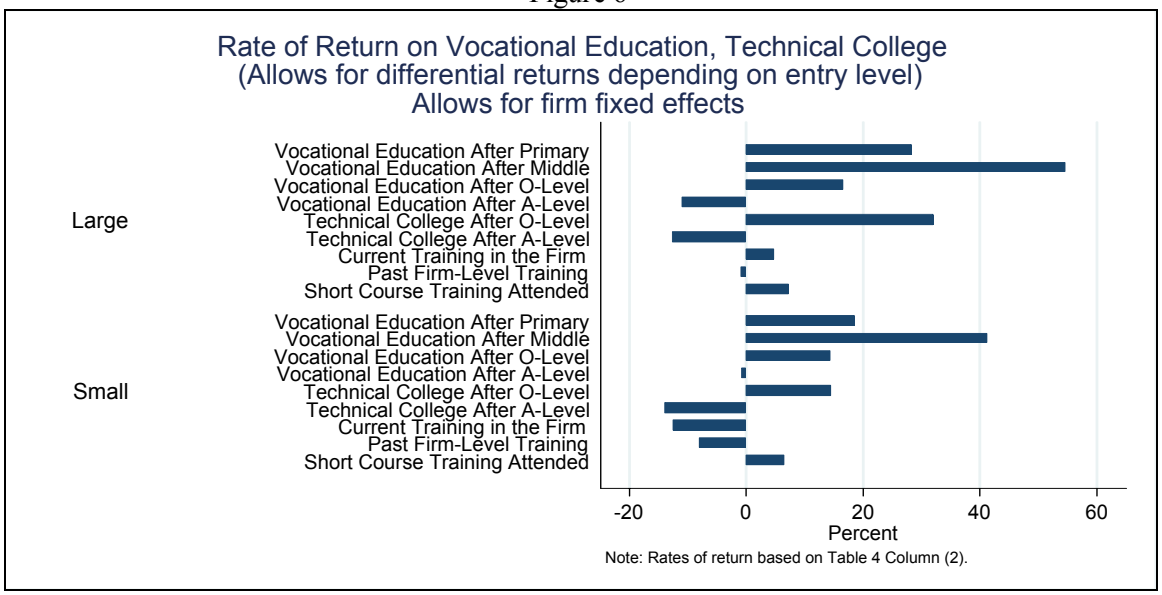
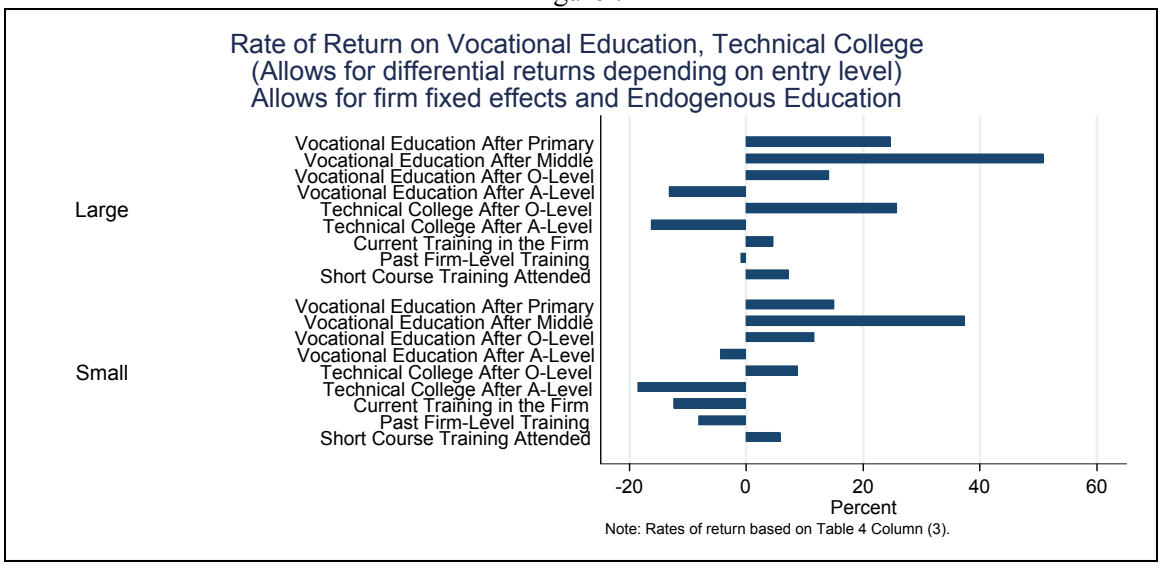


Figure 7



It is clear that that firm fixed effects are a very important factor in explaining the net negative return from vocational training. It is now the case that for vocational school after O-Level the returns among both small and large firms are positive and in the case of large firms close to 20 per cent. It remains true that the returns from technical college after A-Level remains negative in large firms although it is far lower than in the case where there are no controls for firm fixed effects.

The implication of these results is clear. Low wage firms tend to employ those with some form of vocational or technical education - there is a strong negative correlation between the unobservables determining wages and those with technical qualifications. While this result follows from the firm-fixed effect, it may well reflect the unobserved quality of the workers. If firms which employ those with technical qualifications end up with a low-quality workforce then the firm fixed effect is simply picking up this quality dimension of the worker. If this interpretation is correct then in assessing the return from vocational or technical schooling it is necessary to control for the firm fixed effect. Conditional on the worker quality we see that for the large majority of those attending vocational or technical school the returns are positive and substantial. For those who attend vocational school after primary, 67 per cent of our sample, the return is just below 20 per cent for those in small firms and nearly 30 per cent for those in large firms. For those who attend technical college after O-level, 80 per cent of our sample, the increment in earnings is 15 per cent in small firms and 30 per cent in large ones.

This interpretation hinges on interpreting the firm fixed effect as capturing an important dimension of worker quality. This is a separate issue from the standard concern with earnings functions that the education variable is biased by its correlation with unobserved ability. To assess the importance of this factor in biasing our estimates we present an estimation which attempts to control for the endogeneity of education by a similar method to that used in Söderbom (et al) (2006). The results are reported in Table 4 Column (3) and the implications presented in figure 7. There is no change at all in the pattern we observe in Figure 6.

The firm fixed effects are of equal importance for the results regarding firm-level training. Our results strongly suggest that the positive correlation between earnings and current and past training is due to the fact that firms which train pay more. It is only for those attending a short training course that there is any evidence that attending this course is associated with a rise in earnings. Clearly in this case there is the possibility that it is some unobserved factor, the ability of the individual worker, which leads her to be sent on a course and then to receive an increase in earnings. The results for current training are striking in that if it had been the case that earnings rose with training, within the firm, there would have been the issue as to whether this was due to some unobservable of the worker. However we cannot find such an effect.

It is possible to advance an interpretation that the firm fixed effect has captured the quality of the workforce from the training. If that is so the training benefits all the workers in the firm not simply the person trained who sees no return from the training except through the firm effect. Given that firms do train some mechanism along these lines seems the most likely explanation for our inability to find an effect from training within the firm.

8 The Mincerian Returns from Academic and Vocational Education

We now return to the more general issue as to how the return on academic education compares with that on vocational. This issue is generally discussed in the literature using the Mincerian definition of the return to such education. This is the annual increment in earnings expressed as a percentage change and measures, subject to certain assumptions, the rate of return on education in a form commensurate with other forms of investment. The calculation assumes that the foregone opportunity cost of any level of education is the wage that would have been earned at the previous level. Thus in deriving the Mincerian return on primary education we are implicitly assuming that the wage cost of attending primary school is the wage that an individual without primary education would have obtained. The calculation as reported here abstracts from other costs in the form of the costs of schooling. As these are known to differ substantially between academic and vocational training this is an important issue to which we will return.

In converting our rates of return, which are measures of increments in earnings, into Mincerian returns we need to make an assumption as to how long it takes to complete any level of education. In presenting our summary statistics in Table 2 above we have reported the median years of education which will be used in this Mincerian calculation. We assume that completing vocation school takes two years and completing technical college three years. With these assumptions we can calculate the *average* Mincerian returns to differing levels of education. In Figure 8 we show the results with no allowance for fixed effects and in Figure 9 we allow for fixed effects. Recall that the interpretation we can advance for the Mincerian returns reported in Figure 9 is that it is the average return to an additional year of education *conditional on being in the firm*. As for the previous figures we show the results separately for large and small firms.

In assessing the return to academic as compared with vocational training the results presented in Figures 8 and 9 allow us to consider both the effects of firm size and the implications of conditioning on the firm fixed effect (Table 5 summarises the results for key stages of the academic and vocational paths). One common factor across Figures 8 and 9 (and Table 5) is that the average Mincerian return to an academic education rises with the level of that education, most steeply at the tertiary level (see Bennell (1996c) for the view that the pattern of returns presented by Psacharopoulos (1994) does not apply in Africa). Such rising average rates imply that the marginal return is also increasing in the level of education. These findings show

that it is rather misleading to ask how "the" return from academic education compares with "the" return from vocational. There is not one return for either the academic or the vocational path, it depends on which level of either type of education is being considered.

Figure 8

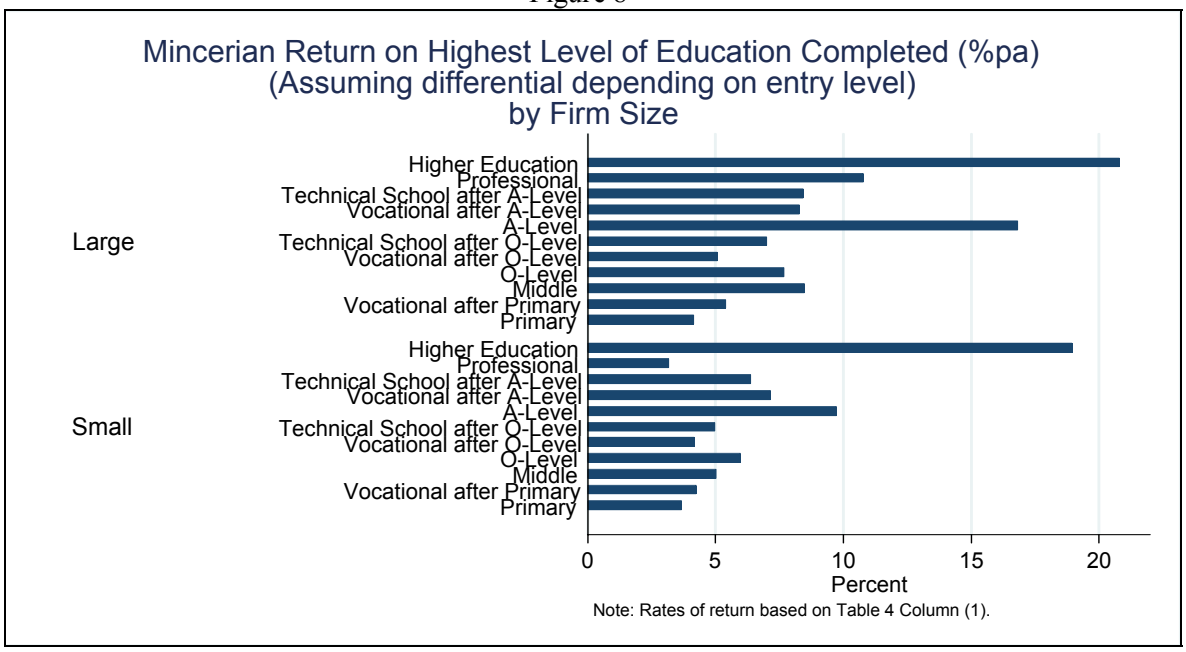
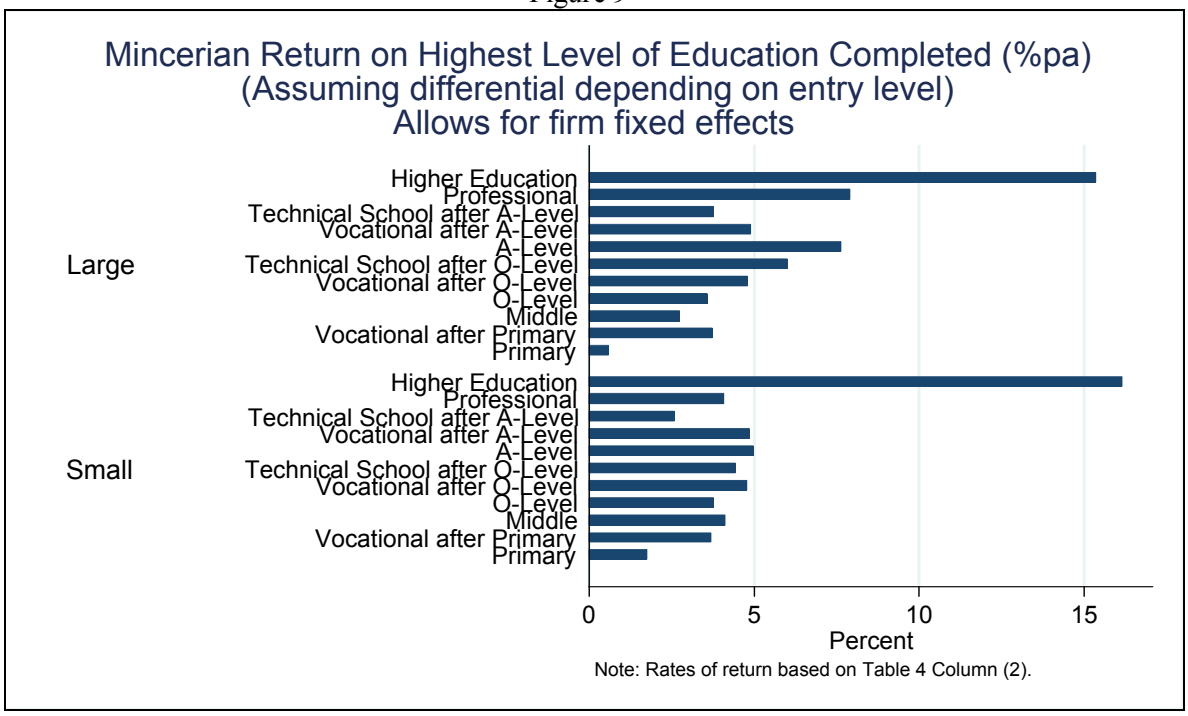


Figure 9



A second common factor across the results is the decrease in the return to education once we allow for the firm fixed effect. If the interpretation of this result advanced above is accepted, namely that this firm fixed effect captures a substantial element of unobserved worker quality, then the return to vocational education, *at the level at which it occurs*, exceeds that on academic

education. For most workers it is the returns to education in small firms that is most relevant and for these the return to vocational education after primary is 3.7 per cent per annum as compared

TABLE 5
Mincerian Rates of Return to Academic and Vocational Education

	No fixed Effects	Fixed Effects
Small firms		
University	19.0	16.2
A-Level	9.7	5.0
O-Level	6.0	3.8
Primary	3.7	1.8
Vocational after Primary	4.3	3.7
Technical College after O-Level	5.0	4.5
Large firms		
University	20.8	15.4
A-Level	16.9	7.6
O-Level	7.7	3.6
Primary	4.2	1.0
Vocational after Primary	5.4	3.7
Technical College after O-Level	7.0	6.0

Source: Table 4, Columns (1) and (2).

with 1.8 per cent per annum for primary. As we would now anticipate given the rising return with level of education the return to technical college after O-level is higher at 4.5 per cent per annum. This exceeds the return from O-Level which is 3.8 per cent per annum.

Do these results imply that vocational education should be encouraged relative to academic? Clearly that inference cannot be dawn from these results for, at least, two reasons. The first, to which we have already referred, is that the costs of supplying vocational and academic education differ and we have abstracted from those costs in this discussion. The second, and more fundamental, reason is that the pattern of rising returns with the level of education suggests that the issue is not primarily between the academic and vocational paths but the appropriate rate of investment at different levels for either path.

9 Summary and Conclusions

In this paper we have sought to address several related questions as to the returns on vocational relative to academic education. We began by noting how little consensus there was in the literature as to the relative returns on these two forms of education. As we have produced estimates on the return to vocational education that range from +40 to -40 per cent a skeptic might wish to argue that we have done little to advance any consensus or clarity. We would

disagree. The return to any form of activity depends on its opportunity cost and in assessing the return to vocational schooling it is essential that the opportunity cost be clearly identified.

We have shown the importance of three factors that affect the opportunity costs of vocational training. The first is the necessity of identifying the point at which the student enters the vocational stream given the structure of the Tanzanian education system where entry can occur at different points along the educational ladder. The second factor is the importance of the size of the firm in which the worker is employed and the third, and most important for making the investment in vocational education a rational choice for the student and training for the firm, is the importance of unobserved firm fixed effects.

Students enter vocational and technical college at different points along the educational path. In Tanzania the two most common paths are to enter vocational school after primary (66% of those attending vocational school in the sample) and to enter technical college after O-level (80% of those attending technical college in the sample). In assessing the return to going to either vocational or technical school it is necessary to know the return from completing primary or O-Level. We have shown that these returns depend on the size of the firm in which the worker is employed. Given that the return to the academic stream rise more rapidly with firm size than the returns to the vocational stream we find that the returns to going to vocational at any level higher than primary are negative, while the returns to going to technical college after O-level are either negligible, for small firms, or negative for large ones.

The finding that firm size has a much bigger impact on academic educational levels, particularly those at O and A-level than on vocational education can be regarded as a confirmation of the argument that Foster (1965a,b) makes against vocational training. By teaching narrowly defined skills rather than the ability to solve problems such training fails to develop general skills which firms with any degree of technical sophistication find most useful. The fact that the returns to academic education rise much faster with firm size than those for vocational education is consistent with this view. However it does not follow that the return to vocational school or technical college is lower than that for those with primary school or O-levels.

We have advanced the argument that the firm fixed effect can be interpreted as capturing an element of unobserved worker quality. If this interpretation is accepted we have shown that the return to vocational education or technical college, at the point where it occurs for the majority of students, exceeds the return to academic education. However this result needs to be seen in the context of rising returns to education with the level of education. The reward from being successful in the academic stream, in particular getting to A-Level and beyond, far exceed the return to any form of vocational or technical school. The preference of African students, and their parents, for an academic education over a vocational one is readily understood.

Finally we have also shown the importance of firm fixed effects for assessing the impact of training on earnings. We find that the substantial increment in earnings associated with currently being trained, 25 per cent in Table 3 Column (1), disappears once we control for firm fixed effects. One interpretation of this result is that the training effect gets incorporated in the firm fixed effect which captures an increase in the quality of the workforce. This benefits all those working in the firm but not differentially those being trained.

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