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Gendered labour market outcomes among South African technical and vocational education and training (TVET) completers

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ABSTRACT

South Africa's post-school education and training (PSET) system plays an important role in addressing historical inequalities and preparing youth for the labour market. Technical and vocational education and training (TVET) colleges have seen rising female enrolment, including in traditionally male-dominated fields like Engineering. This study examines whether women's increased participation in TVET programmes translates into equal labour market opportunities. Using administrative enrolment data and a tracer study of TVET completers, findings show that female completers face significantly higher unemployment rates than men, unrelated to the over-representation in Business Studies or services programmes. Additionally, women earn 22% less than men, even after accounting for study choices and qualification levels. While challenges remain in ensuring gender parity, the increasing presence of women in male-dominated fields signals progress. Efforts must focus on translating these gains into equitable employment outcomes.

KEYWORDS

Women in the TVET sector; gender differences; gendered inequalities; role of PSET system; equal opportunities; gender parity

Introduction

Globally, the technical and vocational education and training (TVET) sector plays a vital role in socio-economic development through the promotion of intermediate skills (Kraak, 2018; DHET, 2019). However, while TVET holds the potential to empower young Africans, the 'transformation of oppressive gender dynamics' is also required for advancing the Sustainable Development Goals (SDGs) and achieving Agenda 2063 in Africa, which calls for equality of all persons in work and education (Bray-Collins, Andrade & Wanjiru, 2022:152). Both in South Africa and globally, a gender bias in TVET course choices has been documented, with an over-representation of women enrolled in low-paying service or care sector courses, such as secretarial work and childcare, and under-represented in traditional 'technical' trades such as the electrical trade, mechanical engineering and construction (ILO, 2020). Furthermore, women are less likely to have opportunities for internships with master-craftspeople, while men have better prospects of obtaining apprenticeships with experienced mentors as opposed to women who are more likely to acquire skills through unstructured, informal learning (ILO, 2020; Nordman & Pasquier-Doumer, 2012). Recent policy shifts have, however, resulted in an increase in the enrolment of women in TVET globally, particularly in traditionally male-dominated courses (UNESCO, 2020). These gains notwithstanding, there is evidence that TVET institutions may reproduce gender inequality unless long-standing biases towards perceptions of women's work are addressed (Bray-Collins et al., 2022).

Using the largest destination study of TVET completers in South Africa, this article aims to identify whether the recent increases in TVET enrolment among women have coincided with the equal probability of employment for women and men and equality in gender earnings. Particular attention is paid to whether women's labour market disadvantages are evident among a subgroup which completed a qualification in the typically male-dominated engineering vocational subfield. The remainder of the paper is structured as follows. Section 2 begins by outlining the literature related to women's participation in the TVET sector both globally and in the South African context. Section 3 describes the relatively novel dataset that we analyse in the empirical section of the article and offers a description of the sample. In Section 4, we present the results in two parts. We begin with a descriptive analysis of gendered differences in employment and earnings among a recent cohort of TVET completers. We then estimate a series of regressions to identify whether and how the choice of study field, location and level of qualification explain the persistence of gender gaps in the probability of employment and earnings. Finally, we conclude with some reflections on gendered inequalities in the TVET sector and identify recommendations for the direction of future research.

Women in the TVET sector

Gender inequalities in the TVET sector

Gender inequalities in the TVET sector are driven by both external and internal factors. Bray-Collins et al. (2022), in an extensive literature review on gender inequality in African

TVET programmes, observed that external drivers are often influenced by sociocultural, socio-economic and sociopolitical relationships which result in gender inequality. For example, even when women enter the labour market, the burden of care and domestic responsibilities often restricts equal participation (Posel et al., 2024). Internal factors which disadvantage women in the TVET sector are often shaped by perceptions of gendered roles in the labour market and include educational choices and gender barriers in TVET colleges. In particular, educational choices often result in women being over-represented in the care and service sector professions and under-represented in 'technical' and industrial fields. This is particularly evident in programmes related to science, technology, engineering and mathematics (STEM) careers, which are becoming more important for progress in the 21st century (UNESCO, 2020). While university degrees are required for some STEM careers, the TVET sector also offers STEM-related qualifications. However, there is empirical evidence that young women in TVET institutions are less likely to select programmes which prepare them for STEM careers (e.g. engineering[1]) (UNESCO, 2020; Bray-Collins et al., 2022).

Comparisons are often difficult to make across different contexts, but one stylised fact is that employment in STEM careers is biased towards males and more likely to result in more secure, formal sector jobs which are better remunerated (UNESCO, 2020). In a recent study by the World Bank (2019) it was found that women who gained employment in STEM sectors earned approximately three times more than women who remained in female-dominated sectors. Although gender parity in STEM graduates has been achieved in many countries, including South Africa, women's remuneration in such male-dominated occupations still tends to be less than men (Bray-Collins et al., 2022). An additional source of gender inequality is found in the gap between female enrolment in STEM-related TVET programmes and employment in STEM-related occupations (UNESCO, 2020). This phenomenon is often termed the 'leaky pipeline' and is characterised by women dropping out between training and labour market entry.

In terms of the gendered barriers in TVET colleges, a root cause is often ascribed to the lack of gender-awareness which potentially creates barriers for women to succeed (Bray-Collins et al., 2022). This is often exacerbated by gender bias in curriculum content, available facilities, the availability of female role models/mentors, and selection into apprenticeships (Bray-Collins et al., 2022). More broadly, Bray-Collins et al. (2022) have suggested that TVET policies and strategies for implementation do not sufficiently address gender inequalities in the African TVET context. Thus, while progress has been made in the TVET sector, more is needed to ensure gendered equality in study choices, qualification completion and labour market outcomes (UNESCO, 2020; Bray-Collins et al., 2022).

1 UNESCO (2020) defines STEM study programmes in TVET as those which are focused on: Natural Sciences, Mathematics and Statistics; Engineering, Manufacturing and Construction; Communication and Information Technologies; and Agriculture, Forestry, Fisheries And Veterinary.

Gender and the TVET sector in South Africa

Education in South Africa has long been seen as a means of promoting equality in a society that is plagued by high levels of inequality (Khuluvhe & Negogogo, 2021). An inequality trap has been identified which, in part, operates through the quality of schooling provided to children from different socio-economic backgrounds (Friderichs, Keeton & Rogan, 2023). Given the high returns to post-secondary education, the post-schooling education and training (PSET)[2] sector has been identified as a potential way of breaking the cycle of poverty (Branson & Kahn, 2016). Part of the challenge is, however, poor matric outcomes limiting access to post-school education (Branson & Kahn, 2016). Even of those who do pass matric, only a fraction (30%) pursues any form of post-secondary education or training.

In the 2013 White Paper, DHET (2013) aimed to expand the capacity of the PSET sector, part of which has seen a rapid expansion of the TVET sector in South Africa. TVET college enrolment figures increased rapidly between 2010 and 2019 from 358 393 to 673 490, respectively (DHET, 2020). However, this is still well short of the 2,5 million enrolment target for 2030 (DHET, 2023a). The rapid increase in enrolment since 2010 has largely been facilitated through the National Student Financial Aid Scheme (NSFAS), which supports students from households with an income below a certain threshold to enter post-schooling education. The funding covers tuition fees and makes allowances for transport and accommodation costs. The value of the TVET sector is that the programmes are focused on the needs of industry and therefore specifically focused on labour market skills and employability. However, despite the expectations of the TVET sector, authors including Rawkins (2018), Papier (2021), Scheepers & Gebhardt (2021) show that the full potential of the sector is not being reached given poor performance in throughput rates, employability and skills development. In South Africa, labour market outcomes for university graduates are better than those for TVET completers, with unemployment rates in 2017 being 7% and 33%, respectively (StatsSA, 2018; Sibiya, Nyembezi & Bogopa, 2021).

Accordingly, it has been difficult to position TVET colleges as post-school institutions of 'first choice'. Branson and Khan (2016), in a study of the factors influencing post-secondary education, found that students in the highest income group have low levels of enrolment in TVET colleges when their test scores are high. This suggests that, when there are no financial or academic constraints, students will not choose to enrol in a TVET college but rather attend a university. Low-income households with individuals with high test scores are also more likely to enter universities. These students with limited academic constraints thus appear to choose to attend universities when offered NSFAS support or other sources of funding.

2 The PSET sector consists of both private and public service providers. The public providers include TVET colleges, higher education institutions (universities) and community education and training (CET) colleges (Terblanche & Bitzer, 2018).

Since the end of apartheid, inequality research has focused predominantly on racial inequalities (Van der Berg & Louw, 2004). However, considering the increases in inequality within racial groups (Van der Berg, 2014), and that income inequality in South Africa is generated largely in the labour market (Hundenborn, Leibbrandt & Woolard, 2016), recent research has focused on inequality in educational opportunities and on gender inequalities in the labour market (Spaull, 2015; Posel et al., 2024). Historically, women have attained lower levels of post-school education, however, this is no longer the case in South Africa where women actually have higher levels of education on average, particularly among the younger age cohort (Posel et al., 2024). Nonetheless, women continue to earn less than men and have generally poorer employment outcomes (StatsSA, 2018) – particularly after aiming for educational attainment (Magadla, Leibbrandt & Mlatsheni, 2019).

Research on gender inequality in the early part of the post-apartheid period found that the gender remuneration gap was driven by differences in earnings at the lower end of the income distribution and thus ascribed to as the 'sticky floor effect' (Posel et al., 2024). However, over the post-apartheid period, minimum wage legislation contributed to a reduction in the gender gap at the lower end (Posel et al., 2024). At the same time, the unexplained part of the gender gap, often ascribed to labour market discrimination, is greater at the upper end of the income distribution – typically referred to as the 'glass ceiling' effect (Posel et al., 2024). The fields of study in which women enrol, particularly at the post-secondary education level, is in part identified as the reason for gender inequalities resulting in employment and occupational inequalities.

Mirroring trends in the higher education sector (Van Broekhuizen & Spaull, 2017), there have been large increases in TVET enrolment among women over the past decade. In 2014, women made up 50.9% of total TVET enrolment, 50.8% of Nated (National Accredited Technical Education Diploma) enrolment and 58.4 percent of NCV (National Certificate (Vocational)) enrolment (DHET, 2016). By 2021, this had increased to 63% of total enrolment, 61.2% of Nated enrolment and 69.3% of NC(V) enrolment (DHET, 2023b; UNESCO, 2020). Similarly, Khuluvhe and Negogogo (2021) found that the gender parity index[3] (GPI) in the TVET sector had increased from 0.9 in 2010 to 1.4 in 2019. This means that, while there were more men than women enrolled in TVET programmes in 2010, by 2019 40% more women were enrolled. This change in the TVET sector, GPI was driven mostly by the black African population group, which experienced an increase in the index from 1:1.5 in 2010 and 2019, respectively. The GPI for white and Indian/Asian race groups was the lowest at 0.4 or less for both race groups over the study period. While the research by Khuluvhe and Negogogo (2021) did not study the GPI for STEM-related subjects compared with non-STEM programmes in the TVET sector, there are some recent enrolment figures available. The most recent DHET report (2023b) on the TVET sector suggests, for example, that women accounted for nearly 50% of N6 Engineering Studies enrolments and that

3 The GPI is the ratio of female to male participation, with a GPI of 1 indicating a 1:1 ratio and thus equitable gender participation. A GPI of greater than 1 indicates higher female participation, whereas a GPI of less than 1 indicates higher male participation (Khuluvhe & Negogogo, 2021).

there were more women than men enrolled in the NC(V) (Levels 2–4) Civil and Electrical Engineering programmes in the 2021 academic year.

Method

Data

The data analysed in this article come from the largest (n=18 579) tracer study of South African TVET completers. TVET completers from all 50 public TVET colleges who qualified in 2018 were interviewed in 2023, that is, nearly five years after completing a TVET qualification. Since many TVET completers participate in a work-based learning (WBL) programme, the study was designed to allow enough time for the 2018 completers to undertake a WBL programme and then find employment related to their qualification. This period does, of course, include the pandemic-affected years during which the labour market experienced severe disruptions.

TVET completers were identified from DHET's enrolment database (TVET management information system –TVETMIS) and a 2018 database containing examination results. The sample was restricted to NC(V) (Level 4) and N4–6 completers in the fields of Engineering, Business, Services and Production. Two different sampling strategies were used to identify respondents. For the Business/Commerce and Engineering completers, a random probability sample stratified by qualification, gender and province was selected. This approach ensured that the gender differences in study choices were reflected in the final sample and that completers from all provinces were represented proportionately. However, as requested by the DHET, all completers of qualifications in the services vocational field were contacted for an interview. Consequently, a larger share of completers in the Services and Production qualifications, relative to their population size, was included in the study and the survey margin of error is smaller for this group. The results for completers from Business and Engineering Studies are, therefore, not directly comparable with the results for completers from the Services and Production qualifications.

Table 1 shows the final sample for the tracer study of 18,579 TVET completers (14% of the total sample frame) disaggregated by gender and qualification. Women make up the vast majority of completers in the Business Studies, and Services and Production vocational fields (75% and 82%, respectively) while making up about half of all completed Engineering qualifications. Taken together, the estimates in the table demonstrate the remarkably gendered composition of TVET qualifications and are evidence that women are now equally represented among the Engineering qualifications, which, historically, had been male-dominated.

Data collection was conducted by a professional fieldwork company with experience in conducting social science research in general, and tracer study telephone interviews in particular. Since telephone numbers were the only reliable contact information provided in the TVETMIS database, telephonic surveys were used to collect data for this tracer study. Interviews lasted, on average, just under ten minutes and the responses were captured with the aid of computer-assisted telephone interviewing (CATI) software.

TABLE 1: Sample sizes by qualification type, vocational field and gender (n= 18 579)

	NC(V)	N4	N5	N6	Total
	Engineering Studies				
Women	805 (50.8)	127 (46.0)	168 (53.2)	553 (51.2)	1 653 (50.7)
Men	779 (49.2)	149 (54.0)	148 (46.8)	528 (48.8)	1 604 (49.3)
Total	**1 584**	**276**	**316**	**1 081**	**3 257**
	Business Studies				
Women	535 (82.8)	1 502 (75.5)	1 314 (73.6)	5 223 (74.7)	8 574 (75.1)
Men	111 (17.2)	488 (24.5)	471 (26.4)	1 774 (25.3)	2 844 (24.9)
Total	**646**	**1 990**	**1 785**	**6 997**	**11 418**
	Services and Production				
Women	505 (74.7)	323 (81.8)	344 (82.1)	1 998 (84.1)	3 170 (82.0)
Men	171 (25.3)	72 (18.2)	75 (17.9)	379 (15.9)	697 (18.0)
Total	**676**	**395**	**419**	**2 377**	**3 867**

Source: Own calculations from the TVET tracer study.

Notes: Percentages (column totals) in parentheses. There were 37 missing values for gender in the original TVETMIS database.

There are two main limitations associated with the study. First, since all interviews were conducted telephonically (and most of these with the aid of mobile phones), the interviews were very short. This meant that, among other things, information on past education (i.e. schooling history) was not captured through the survey. This is a particular problem because the department's administrative database (TVETMIS) also does not contain this information. The result is that it is not possible to identify whether schooling background impacts on employment outcomes. To the extent that schooling backgrounds are correlated with employment outcomes, the differences in the probability of employment/unemployment by gender, qualification stream and province would be overstated.

Second, and perhaps the main limitation, as with all tracer studies, is that selection bias may influence the results (e.g. the analysis of employment outcomes) and it is not possible to identify the direction of this bias (Branson & Leibbrandt, 2013). While the sampling strategy ensured proportionate sampling by qualification type, vocational field, gender and province, it is possible that there are non-observable differences which could be correlated with the outcomes of interest (e.g. employment status and earnings).

Results

Descriptive statistics

Labour market status, absorption and unemployment rates for women and men by level of qualification and vocational field are presented in Table 2. It is evident that men have higher levels of absorption and lower levels of unemployment for all levels of qualification and across vocational fields. Apart from completers in the NC(V) L4 Services and Production qualification, women, regardless of level of qualification and vocational field, have an unemployment rate of 60%. On the other hand, male completers experience an unemployment rate of below 60% for all levels of qualification and all vocational fields, except for NCV(4) Level 4 Business Studies completers.

There are, moreover, some potentially important differences between employment outcomes by level of qualification and/or vocational field. For example, completers from the Engineering field of study are more likely to be involved in internships (WBL) compared with the other two vocational fields. Also evident is that the largest gender difference in unemployment is for the Engineering N5 Level qualification, with male and female unemployment rates being 42.25 per cent and 61.49 per cent respectively – an approximate 20 percentage-point difference. Self-employment is, furthermore, greatest amongst completers from the Services and Production programmes. Completers of the NC(V) L4 Business Studies qualification have the highest unemployment rates for both women and men – 73.67% and 67.62%, respectively.

TABLE 2: Labour market status by qualification level, vocational field and gender (n= 18 579)

	NC(V)		N4		N5		N6		Total	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
	Engineering Studies									
Labour market status (%)	n=1 584		n=276		n=316		n=1 081		n=3 257	
Employed	14.18 (1.2)	24.65 (1.5)	18.11 (3.4)	22.82 (3.4)	17.26 (2.9)	35.14 (3.9)	17.00 (1.6)	22.35 (1.8)	15.74 (0.9)	24.69 (1.1)
WBL	16.29 (1.3)	14.51 (1.3)	11.81 (2.9)	14.77 (2.9)	12.50 (2.6)	16.89 (3.1)	16.46 (1.6)	17.05 (1.6)	15.62 (0.9)	15.59 (0.9)
Not working	59.45 (1.7)	51.86 (1.8)	59.06 (4.4)	53.02 (4.1)	54.76 (3.9)	41.22 (4.1)	57.50 (2.1)	51.33 (2.2)	58.29 (1.2)	50.81 (1.2)
Self-employed	1.12 (0.4)	3.59 (0.7)	2.36 (1.4)	2.68 (1.3)	4.17 (1.5)	3.38 (1.5)	0.90 (0.4)	3.60 (0.8)	1.45 (0.3)	3.49 (0.5)
Studying	8.96 (1.0)	5.39 (0.8)	8.66 (2.5)	6.71 (2.1)	11.31 (2.5)	3.38 (1.5)	8.14 (1.2)	5.68 (1.0)	8.90 (0.7)	5.42 (0.6)

	NC(V)		N4		N5		N6		Total	
TOTAL	100	100	100	100	100	100	100	100	100	100
Absorption rate	**34.75**	**45.49**	**35.34**	**43.48**	**38.51**	**57.75**	**37.70**	**45.67**	**36.16**	**46.52**
Unemployment rate	**65.25**	**54.51**	**64.66**	**56.52**	**61.49**	**42.25**	**62.30**	**54.33**	**63.84**	**53.48**
	Business Studies									
Labour market status (%)	n=646		n=1 990		n=1 785		n=6 997		n=11 418	
Employed	13.83 (1.5)	19.82 (3.8)	20.59 (1.0)	29.92 (2.1)	20.72 (1.1)	30.36 (2.1)	21.30 (0.6)	30.06 (1.1)	20.62 (0.4)	29.69 (0.9)
WBL	9.53 (1.3)	9.01 (2.7)	10.46 (0.8)	9.22 (1.3)	6.85 (0.7)	8.28 (1.3)	10.73 (0.4)	9.42 (0.7)	10.01 (0.3)	9.18 (0.5)
Not working	69.53 (2.0)	63.96 (4.6)	61.83 (1.3)	52.66 (2.3)	63.29 (1.3)	51.38 (2.3)	61.87 (0.7)	53.41 (1.2)	62.56 (0.5)	53.36 (0.9)
Self-employed	1.31 (0.5)	1.80 (1.3)	1.40 (0.3)	3.48 (0.8)	1.68 (0.4)	4.25 (0.9)	1.13 (0.1)	2.54 (0.4)	1.27 (0.1)	2.95 (0.3)
Studying	5.79 (1.0)	5.41 (2.2)	5.73 (0.6)	4.71 (1.0)	7.46 (0.7)	5.73 (1.1)	4.98 (0.3)	4.57 (0.5)	5.54 (0.2)	4.82 (0.4)
TOTAL	100	100	100	100	100	100	100	100	100	100
Absorption rate	**26.29**	**32.38**	**34.61**	**45.02**	**31.92**	**45.91**	**35.25**	**44.42**	**34.08**	**44.30**
Unemployment rate	**73.71**	**67.62**	**65.39**	**54.98**	**68.00**	**54.09**	**64.73**	**55.40**	**65.90**	**55.59**
	Services and Production									
Labour market status (%)	n=676		n=395		n=419		n=2 377		n=3 867	
Employed	29.11 (2.0)	36.84 (3.7)	19.81 (2.2)	31.94 (5.5)	27.91 (2.4)	40.00 (5.7)	27.14 (1.0)	34.56 (2.4)	26.79 (0.8)	35.44 (1.8)
WBL	7.52 (1.2)	5.26 (1.7)	6.19 (1.3)	5.56 (2.7)	3.78 (1.0)	4.00 (2.3)	4.61 (0.5)	6.33 (1.3)	5.14 (0.4)	5.74 (0.9)
Not working	52.48 (2.2)	43.27 (3.8)	59.13 (2.4)	47.22 (5.9)	59.59 (2.6)	48.00 (5.8)	55.53 (1.1)	49.60 (2.6)	55.85 (0.9)	47.63 (1.9)
Self-employed	4.36 (0.9)	8.19 (2.1)	3.41 (1.0)	4.17 (2.4)	4.07 (1.1)	2.67 (1.9)	3.96 (0.4)	5.80 (1.2)	3.98 (0.3)	5.88 (0.9)
Studying	6.53 (1.1)	6.43 (1.9)	11.46 (1.8)	11.11 (3.7)	4.65 (1.1)	5.33 (2.6)	8.76 (0.6)	3.69 (1.0)	8.24 (0.5)	5.31 (0.8)
TOTAL	100	100	100	100	100	100	100	100	100	100
Absorption rate	**44.42**	**54.09**	**33.69**	**46.88**	**37.96**	**49.30**	**39.33**	**48.63**	**34.40**	**45.10**
Unemployment rate	**55.36**	**45.91**	**65.60**	**53.13**	**61.42**	**50.70**	**60.45**	**51.37**	**65.57**	**54.83**

Source: Own calculations from the TVET tracer study.

Notes: Standard errors (SE) in parentheses. There were 37 missing values for gender in the original TVETMIS database.

Table 3 extends the analysis by considering gender differences in reported monthly earnings by level of qualification and vocational field. Men earn higher wages than women for every level of qualification and vocational field except among the N4 Engineering Studies completers. The sample sizes for the male and female earnings for the N4 Engineering Studies are, however, very small with 25 women and 33 men. Men with the highest monthly average earnings are those that completed a qualification in the Engineering vocational field (R8 423.39), while women's earnings in the same field (R6 049.65) were not significantly different from their average earnings in the field of Business Studies (R6 140.63). Women who completed a qualification in the Services and Production field earned, on average, the least (R5 460.06 per month). Excluding the qualifications which have 100 or fewer observations in each vocational field, the level of qualification with the lowest male average earnings is still greater than the highest female average earnings. Taken together, these descriptive findings suggest that there is a large gender earnings gap across all the qualification types and three fields of study. The other key insight from these summary statistics is that women's earnings do not appear to be higher for those who completed an Engineering-related qualification. In other words, Table 3 offers some preliminary evidence that, among a recent cohort of TVET completers, women do not appear to have attained an earnings premium by completing a qualification in a traditionally male-dominated field of study.

TABLE 3: Mean monthly earnings by qualification level, vocational field and gender (n=4 520)

	NC(V)		N4		N5		N6		Total	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
	Engineering Studies									
Women	5 372.58	428.73	8 404.04+	2 378.09	6 264.41+	1 231.95	6 212.76	393.12	6 049.65	327.22
Men	8 274.97	615.34	6 536.97+	940.80	8 981.82+	1 872.72	8 829.03	851.36	8 423.39	472.70
	Business Studies									
Women	5 144.51	432.89	5 531.82	244.44	6 361.26	340.58	6 347.64	164.21	6 140.63	124.23
Men	5 623.96	774.79	7 527.65	630.91	6 802.40	582.12	7 818.42	346.97	7 524.05	264.32
	Services and Production									
Women	5 687.16	387.79	4 833.33+	681.10	5 865.29	658.12	5 393.17	174.25	5 460.06	159.91
Men	8 141.72	966.85	4 832.00+	491.82	8 667.86	2 140.49	7 151.01	401.86	7 360.35	411.25

Source: Own calculations from the TVET tracer study.

Notes: There were 37 missing values for gender in the original TVETMIS database. Sample size: NC(V) L4 Eng.: female n=130, male n=167; NC(V) L4 Bus.: female n=130, male n=167; NC(V) L4 Services and

Production: female n=183, male n=71; N4 Eng.: female n=25, male n=33; N4 Bus.: female n=354, male n=154; N4 Services and Production: female n=75, male n=25; N5 Eng.: female n=34, male n=44; N5 Bus.: female n=241, male n=125; N5 Services and Production: female n=102, male n=28; N6 Eng.: female n=134, male n=154; N6 Bus.: female n=1 174; male n=453; N6 Services and Production: female n=559, male n=138. +100 or less observations for the level of qualification.

Regression analysis: Explaining gender difference in employment and earnings

Having shown that there are large gender differences in employment outcomes and earnings levels among TVET completers, this section now examines whether demographic characteristics and study choices can explain these gender disadvantages in the labour market. Table 4 shows the results of a linear probability model where the dependent variable is a binary outcome denoting whether a respondent is employed (including the self-employed and those in a WBL programme). In the first specification (I), the only independent variable is gender, and the results show that, on average, women who completed a TVET qualification are approximately 10 percentage points less likely than men to be employed. After including controls for age and province of origin (II), the female disadvantage increases slightly. The third specification (III) includes choice of study field and level of qualification as independent variables and is particularly interesting since it might have been expected that these two variables would explain at least part of the gender disadvantage in employment. However, the results suggest that, while employment probabilities are slightly lower among the completers of Business qualifications (relative to Services and Production qualifications), the completers of engineering-related qualifications are not significantly more likely to be employed. Similarly, there is no evidence that the type (or level) of qualification is associated with employment outcomes. The most important finding from the table, however, is that, even though women are over-represented among the Business qualifications, the female disadvantage in employment is almost unchanged between specifications II and III. In other words, the lower probability among women who have completed a TVET qualification does not appear to be 'due' to different study choices. The final specification (IV) considers this finding more closely by restricting the sample to the completers of engineering-related qualifications. The results are surprisingly consistent and suggest that, on average, women who have completed an Engineering qualification are about 11 percentage points less likely to be employed than their male counterparts.

TABLE 4: Employment probabilities among TVET completers (estimation by linear probability)

	I	II	III	IV (Engineering only)
Female	–.102*** (.008)	–.116*** (.008)	–.114*** (.008)	–.113*** (.017)
Age		.003*** (.001)	.002*** (.001)	–.005* (.003)
Province	No	Yes	Yes	Yes

	I	II	III	IV (Engineering only)
Vocational field				
Business			−.022** (.009)	
Engineering			.007 (.012)	
Qualification type				
N4			−.002 (.013)	−.027 (.031)
N5			.001 (.014)	.065** (.029)
N6			.013 (.011)	.016 (.019)
Intercept	.431*** (.007)	.582*** (.022)	.586*** (.025)	.721*** (.073)
F Statistic	168.95 (p=0.000)	71.07 (p=0.000)	48.35 (p=0.000)	8.57 (p=0.000)
R Squared	.009	.036	.037	.029
N	**18 535**	**18 535**	**18 535**	**3 256**

Source: Own calculations from the TVET tracer study.

*Notes: Standard errors in parentheses. Reference categories include: male, Services and Production, and NC(V). Level of significance denoted by: *** Significant at the 99% confidence level. ** Significant at the 95% confidence level. * Significant at the 90% confidence level. For the first specification (I), the independent variable is gender; the second specification (II) includes gender, age and province of origin; the third specification (III) includes variables from II as well as choice of study field and level of qualification; the fourth specification (IV) includes the same variables as II as well as level of qualification, and, furthermore, is restricted to the Engineering field.*

Table 5 extends the analysis by examining the gender earnings gap among TVET completers. The raw earnings gap (I) is approximately 20% (18.2 per cent to be precise) and increases further to about 24% when controls for age and province are added. There is a relatively large earnings premium for Business (15%) and Engineering (22%) completers compared with those who obtained a qualification in Services- and Production-related fields. However, controlling for the field of study does not change the magnitude of the gender earnings gap appreciably. Even after conditioning on study choices and the level of qualification, women earn approximately 22% less than men. Perhaps most surprising (yet consistent with the descriptive statistics) is the finding in the final specification (IV) that women earn even less than men among the subpopulation that completed an Engineering-related qualification. Among the completers in this field, where women and men are evenly represented, women earn, on average, about 24% less than men (after adjusting the partial elasticity of −0.279). Among recent TVET completers, the somewhat startling finding is, therefore, that women face a significant disadvantage in finding employment and, when they do find employment,

they earn significantly less than men. The key contribution of the analysis is that, contrary to several a priori expectations, these gender disadvantages in the labour market do not appear to be explained by study choices or the historical under-representation of women in the more technical STEM subjects. Even among the cohort of students that attained an Engineering qualification, women experience several key disadvantages in the labour market.

TABLE 5: The female earnings penalty among TVET completers (conditional on employment)

	I	II	III	IV (Engineering only)
Female	–.201*** (.023)	–.246*** (.022)	–.224*** (.023)	–.279*** (.052)
Ag		.029*** (.002)	.030*** (.002)	.038*** (.008)
Province	No	Yes	Yes	Yes
Vocational field				
Business			.157*** (.025)	
Engineering			.229*** (.034)	
Qualification type				
N4			–.029 (.041)	.035 (.101)
N5			.022 (.041)	–.047 (.089)
N6			.065** (.032)	.100* (.058)
Intercept	8.69*** (.019)	8.29*** (.060)	8.11*** (.068)	8.16*** (.225)
F-statistic	71.40 (p=0.000)	41.28 (p=0.000)	32.40 (p=0.000)	6.47 (p=0.000)
R Squared	.017	.082	.097	.107
N	**4,509**	**4,509**	**4,509**	**712**

Source: Own calculations from the TVET tracer study.

*Notes: The dependent variable is the log of monthly earnings. Standard errors in parentheses. Reference categories include: male, Services and Production, and NC(V). Level of significance denoted by: *** Significant at the 99% confidence level. ** Significant at the 95% confidence level. * Significant at the 90% confidence level. For the first specification (I), the independent variable is gender; the second specification (II) includes gender, age and province of origin; the third specification (III) includes variables from II as well as choice of study field and level of qualification; the fourth specification (IV) includes the same variables as II as well as level of qualification, and, furthermore, is restricted to the Engineering field.*

These findings require at least some further exploration. Using the data collected from the 2018 TVET completers, it is possible to examine at least two explanations for these persistent gender disadvantages – particularly among the completers of Engineering qualifications. The first possibility is that, within the broad category of Engineering, women attained different qualifications than men. However, the data suggest that there are only very small differences in the type of qualification (NC(V), N4[4], N5 or N6) attained by women and men. Moreover, 93% of men and 91% of women qualified in the subfield of 'Engineering and related studies'. Similar (and very small) percentages of men and women qualified in 'Civil Engineering' or 'Electrical Infrastructure'. Therefore, there is very little evidence that the large female disadvantages in employment and earnings can be explained by the type or level of qualification attained within the Engineering field.

The other possibility which can be explored – at least in part – with the tracer study data is whether men are more likely to work in the Engineering field after completing an Engineering qualification. The data only allow a self-reported assessment of this possibility, as the questionnaire asked respondents whether they are currently working in a field that is related to what they studied at a TVET college. Since this question was only asked of those who were in employment, it is only possible to examine whether a lower likelihood of being in an Engineering-related occupation might explain the gender earnings gap. Among Engineering completers, about a third (33.7%) of women reported that their 'work is related to what [they] studied at the college'. In contrast, 44% of men who completed an Engineering qualification reported that their employment was related to what they studied. This finding suggests that at least part of the gender earnings gap may be explained by women failing to 'break into' the Engineering field after qualifying. Further support for this conclusion can be found when specification IV from Table 5 is re-estimated on the subsample of Engineering completers who report that their current employment is either related or 'somewhat' related to what they studied. When this proxy, working in an Engineering-related job is used, the female earnings penalty is only about 7%t (not shown in the table). In other words, when women are able to find employment in the traditionally male-dominated field of Engineering, then their earnings' disadvantage decreases substantially. The key bottleneck, therefore, appears to be in the transition from TVET college into the labour market.

Discussion and conclusion

The South African PSET system plays a crucial role in addressing the inequalities inherited from the apartheid and colonial eras and in preparing young people to be successful in the labour market. Accordingly, the South African government has set ambitious targets for access to post-school education and the TVET sector is expected to see the largest increase in enrolments over the coming years (see Rogan, 2019). However, the sector has been beset by a number of problems over the past two decades and the employment outcomes of TVET

4 The sample sizes for the male and female earnings for the N4 Engineering studies are, however, very small with 25 women and 33 men.

completers have been somewhat disappointing (Papier et al., 2019). In addition, vocational education has been characterised by large gender differences in study choices and career paths, both in South Africa and further afield. As outlined earlier, these stark gendered patterns, particularly in enrolment and study choice, have prompted some commentators to describe the sector as a site which reproduces gendered inequalities.

Recent changes in the gendered characteristics of TVET enrolment have, however, signalled the arrival of important changes to the sector. Perhaps driven by some of the same factors which have seen a dramatic increase in women's enrolment in higher education, both globally and in South Africa, there is clear evidence that women are enrolling in TVET colleges at a greater rate than men, and, in particular, women are no longer under-represented in traditionally male-dominated fields of study such as Engineering and Construction. Against the backdrop of largely disappointing labour market outcomes and the reversal of long-standing gender differences in enrolment patterns, there are important questions about whether these changes have coincided with gender parity in employment outcomes. In other words, has women's increased enrolment in South African TVET programmes translated into equal opportunities in the labour market? In particular, are gendered employment outcomes more equal within a more 'technical' field such as Engineering?

To answer these questions, we analysed a novel dataset based on administrative enrolment data and a tracer study of recent TVET completers from three vocational fields. The results reveal several important insights which require further investigation. First, there is evidence that women face large and significant disadvantages in finding employment after completing a TVET qualification. Somewhat counter to a priori expectations, our findings do not suggest that the higher risk of unemployment for women is due to their over-representation in qualifications related to Business Studies or Services. Even among the completers with qualifications that fall within the more 'technical' field, women are less likely to be employed and are more likely to be unemployed (e.g. the difference cannot be explained by the slightly higher share of women who are studying). There is also very limited evidence to suggest that women are studying different types of qualifications than men (e.g. NC(V) vs N6). Women are clearly more likely to have achieved a qualification in the Business or Services fields but the share across qualification types is relatively consistent.

Second, there are large and significant differences in earnings between women and men who have completed a TVET qualification. Here there might have been an expectation that the gender gap would be smaller among women who qualified with an Engineering qualification but, if anything, the gap is even wider among Engineering completers. Moreover, there is descriptive evidence that men with an Engineering-related qualification earn more than other completers (although this result is not statistically significant), while average earnings for women are relatively similar across different fields of study. While these findings require further examination, one tentative conclusion is that at least part of the large gender gap in earnings among Engineering completers is due to the lower likelihood of women finding employment related to what they studied. In other words, men who completed an Engineering

qualification are more likely to have found employment in the Engineering field relative to their female counterparts. To the extent that this is the key obstacle to achieving gender parity in employment outcomes, much more research should be devoted to career trajectories and opportunities, WBL linkages and employer perceptions.

There are clearly a number of challenges in the TVET sector, yet it is encouraging that women have been enrolling in greater numbers and that they are also qualifying in fields that have been male-dominated in the past. The key challenge is to translate these gains into gender parity in employment opportunities and earnings. The potential for an increasing need for industry-related intermediate skills that are acquired through the TVET sector (Kraak, 2018), provides an opportunity to ensure that any transformation of the TVET skills system is inclusive of both women and men.

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