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Dimensions of program quality and returns to short-cycle technical education

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ABSTRACT

This letter examines whether an external, multidimensional, high-stakes measure of program quality predicts heterogeneity in the returns to short-cycle tertiary technical education. We use student-level administrative data matched to official program-quality scores and estimate individual fixed-effects models with individual-specific linear time trends. We find that employment, earnings, and skill-match returns to the diploma are lower in low-rated programs. Delving into the different dimensions of the composite quality indicator, we find that program attractiveness and firms' involvement in traineeships provide the strongest signals, with the traineeship gradient persisting also once controlling for program attractiveness.

1. Introduction

Institutional quality is one of the determinants of the labour market returns of higher education programs, but evidence remains scarce for open-access, short-cycle institutions (Lovenheim and Smith, 2023). This relationship is policy relevant because short-cycle technical tertiary education is largely publicly funded and increasingly financed through external assessments of programs' quality: whether they track labour market returns, at the level of the individual program rather than the institution, determines whether they actually reward the provision that benefits students most. Standard measures used in the four-year college literature, such as admission rates and entrants' test scores, are either unavailable or display little variation in this sector. The few existing studies reach mixed conclusions. Stange (2012) finds that input-based measures, such as expenditure per student, do not affect educational attainment, whereas Smith and Stange (2016) find that higher average peer achievement predicts greater degree attainment, although their estimates rely on strong selection-on-observables assumptions.

Italy offers a unique setting to study this issue. Since 2015, an external national agency (INDIRE) has annually assessed all tertiary technical education programs offered by the "Higher Technical Institutes" (Istituti Tecnici Superiori, ITS) using a composite indicator that covers attractiveness, employability, traineeships, firms' involvement in teaching, and inter-regional networks. Scores are on a 100-point scale, rankings are public, and 30% of national funds are reserved for "excellent" programs. Unlike conventional proxies, the INDIRE evaluation includes process-based dimensions that are directly related to how training is delivered. This letter asks whether these public evaluations are informative about heterogeneity in labour market returns to a tertiary technical degree, and, crucially, which dimensions of quality are more relevant.

We combine individual-level records for all ITS students in Lombardy, the largest Italian region with the highest number of programs, with program-level quality scores, and estimate returns to the ITS diploma by program quality. We investigate which of the sub-dimensions are most informative about labour market outcomes. We find that completing a highly rated program is associated with significantly better employment outcomes. The informational content of the evaluation, however, differs across its components, with the largest gradient displayed by program attractiveness and firms' traineeships.

This letter complements Comi and Origo (2025), whose aggregate course-year data on employment rates cannot separate differences in student composition from differences in returns, and builds on Comi et al. (2026), which estimates average and gender-specific returns to

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the ITS diploma. We exploit individual-level records to estimate returns across three margins, employment, earnings, and skill match, and to unbundle the composite score into sub-indicators that providers and funders can act upon. We contribute to the literature (Jepsen et al., 2014; Carruthers and Sanford, 2018; Stevens et al., 2019; Grosz, 2020) by showing that returns of postsecondary programs vary sharply with external measures of program quality, highlighting that students' selectivity may be a limited proxy for quality in educational contexts characterized by high firms' involvement.

2. Context and data

The Italian short-cycle technical tertiary education track was created in 2011. Programs last two or three years and train highly skilled technicians; they are run by foundations whose members include local public administrations and private firms. 30% of public funds are allocated based on a composite quality indicator for courses rated excellent (at least 70/100). INDIRE computes the score as a weighted average of five sub-indicators: attractiveness (25%), employability (40%), traineeships (15%), firms' involvement in teaching (10%), and inter-regional networks (10%). The score, published with a two-year lag after program completion, ranges from 35 to 92 in our observation period (2011-2017), with a median of 71.

Our data merge the universe of students enrolled in an ITS program in Lombardy between 2011 and 2017 (around 2,000 students, with 111,057 student-month observations) with employment records covering all hiring events in the region through 2021. Program-level final scores are available for the whole period; their sub-indicators up to 2017. Scores are matched to students through the unique program identifier, so that each student is assigned the score of the specific program edition he or she attended.

3. Empirical strategy

Following the fixed-effects approach standard in this literature (Jepsen et al., 2014; Stevens et al., 2019), we estimate:

$$Y_{it} = \delta(ITSdiploma_{it}) + \delta_L(ITSdiploma_{it} \times Low) + \lambda Enroll_{it} + \rho Post_{it} + \theta U_{i,t-1} + \alpha_i + \gamma_t + \omega_i t + \varepsilon_{it} \quad (1)$$

where Y_{it} is either an indicator for individual i being employed at least ten consecutive days in month t, gross monthly earnings, or an indicator of occupational skill match[1]. $ITSdiploma_{it}$ indicates whether individual i has earned the diploma by month t; $Enroll_{it}$ and $Post_{it}$ are indicators for the enrollment and post-enrollment periods, respectively; $U_{i,t-1}$ is the lagged provincial youth unemployment rate; and α_i, γ_t and $\omega_i t$ are individual effects, month effects, and individual linear trends.[2] *Low* equals one for programs in the bottom quartile of a re-weighted score that excludes the employability component[3]. As an alternative measure, we use an indicator for programs' closure during the observation period[4]. In the sub-indicator analysis, *Low* is defined analogously for each component. The comparison group consists of students who enrolled but did not complete the degree; standard errors are clustered at the individual level.

[1] Earnings are set to zero in months without employment. The skill-match indicator equals one when the worker's three-digit ISCO occupation belongs to the set of occupations associated by national regulation with the ITS qualification, and zero otherwise, including months without employment. The three outcomes are defined over the same set of individual-month observations.

[2] See Comi et al. (2026) for details on the empirical strategy.

[3] We exclude the employability sub-indicator since it is mechanically correlated with the outcomes of interest. Results for this component are reported in Table 3, column (5).

[4] Around 30% of programs close during the observation period.

Table 1
Descriptive statistics.

	(1) Graduates	(2) Non-completers	(3) $\hat{\beta}$
Female	0.315	0.349	-0.025
	(0.464)	(0.477)	(0.029)
Age	23.202	23.349	0.105
	(2.693)	(3.242)	(0.223)
High-school diploma	0.974	0.958	0.009
	(0.158)	(0.200)	(0.014)
Employed before enrollment	0.327	0.391	0.012
	(0.469)	(0.489)	(0.035)
Earnings before enrollment	205.995	369.292	-105.6**
	(480.198)	(616.944)	(42.01)
Observations	1,631	335	1,966

Notes: Characteristics are measured in the month before enrollment. Columns (1)–(2): means (standard deviations); column (3): differences conditional on program and enrollment-year fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2
Returns to ITS diploma by public quality evaluation.

	(1) Employed	(2) Earnings	(3) Skill match
Panel A – Quality rating			
ITS diploma	0.207***	343.942***	0.102***
	(0.025)	(36.892)	(0.017)
ITS diploma x Low	-0.067**	-99.653**	-0.043**
	(0.027)	(44.086)	(0.020)
Panel B – Program closure			
ITS diploma	0.223***	374.156***	0.107***
	(0.025)	(37.510)	(0.018)
ITS diploma x Closed	-0.102***	-170.583***	-0.048**
	(0.025)	(38.316)	(0.018)
Observations	111,057	111,057	111,057

Notes: *Low* denotes the bottom quartile of the score, excluding employability; *Closed* denotes discontinued programs. Standard errors are clustered at the individual level.
*** $p < 0.01$,
** $p < 0.05$, * $p < 0.1$

Table 1 shows that graduates and non-completers are similar in gender, age and upper-secondary schooling; non-completers display slightly higher earnings before enrollment. Individual effects and trends account for time-invariant individual heterogeneity and differences in linear outcome trends. We interpret δ_L as measuring the extent to which the public evaluation distinguishes programs associated with different returns to diploma completion, rather than a pure causal effect of quality. We examine the remaining concerns about student sorting below.

4. Results

Table 2 shows that the estimated returns to ITS diploma completion are significantly lower in low-rated programs: by 6.7 percentage points for employment, €99.7 for earnings, and 4.3 percentage points for skill match. Panel B shows an analogous gradient using program closure as an alternative marker of underperformance.

Table 3 unbundles the composite score into its sub-indicators. Programs rated low on attractiveness (column 1) display significantly lower returns across all three outcomes. Weak firms' involvement in teaching (column 2) is associated with a significant employment penalty and a weakly significant skill-match penalty, while the earnings difference is not statistically significant. Weak traineeship activity (column 3) shows a 5.7 p.p. employment penalty, a significant earnings penalty of €89, and the largest skill-match penalty at 8.6 p.p. By contrast, the inter-regional network component (column 4) shows no significant low-quality penalty. Column (5) reports results for the employability sub-indicator,

Table 3
Returns to ITS diploma by quality sub-indicators.

	(1) Attractiveness	(2) Teaching	(3) Traineeships	(4) Network	(5) Employability
Panel A: Employed					
ITS diploma	0.212***	0.205***	0.205***	0.185***	0.207***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
ITS diploma x Low	-0.094***	-0.057**	-0.057**	0.026	-0.071**
	(0.026)	(0.026)	(0.028)	(0.026)	(0.028)
Panel B: Earnings					
ITS diploma	357.562***	335.122***	342.452***	307.026***	355.933***
	(36.971)	(37.000)	(37.065)	(37.131)	(36.867)
ITS diploma x Low	-163.683***	-59.728	-89.268**	56.064	-161.760***
	(42.393)	(42.674)	(41.230)	(40.170)	(43.064)
Panel C: Skill Match					
ITS diploma	0.105***	0.100***	0.112***	0.097***	0.097***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
ITS diploma x Low	-0.061***	-0.035*	-0.086***	-0.021	-0.024
	(0.019)	(0.019)	(0.018)	(0.019)	(0.021)
Observations	111,057	111,057	111,057	111,057	111,057

Notes: Models are estimated separately by sub-indicator. See Table 2.

which we exclude from the composite score in Table 2. This outcome-based component predicts employment and earnings returns but is uninformative about skill match. Overall, attractiveness and traineeship are the only components with significant gradients on all three outcomes.

A natural concern is that these gradients reflect student sorting rather than program quality. Attractiveness is the component most exposed to this concern, as it directly captures demand for the program. In Table A.1, we re-estimate the sub-indicator models on the subsample of programs defined as high quality with respect to attractiveness. Once we condition on attractiveness, the teaching gradient is no longer statistically significant, suggesting that part of its informational content in the full sample reflects sorting on attractiveness. The traineeship penalty, by contrast, remains significant across all three outcomes and increases in magnitude, while the network component, uninformative in the full sample, becomes significant for skill match alone. The employability gradient persists for employment and earnings. Firms' involvement in traineeships, arguably the dimension most directly under the control of program providers, is thus the only margin that carries return-relevant information on all three outcomes beyond sorting.

5. Conclusion

We find that public multidimensional evaluations of short-cycle technical programs are informative: the estimated effects of diploma completion on employment, earnings, and occupational skill match are significantly larger in highly rated than in low-rated programs. Unbundling the score shows that program attractiveness and firms' involvement in traineeships carry the most return-relevant information, and, unlike the teaching indicator, the traineeship gradient persists after restricting the analysis to highly attractive programs. These results suggest that quality assessment should not rely exclusively on student selectivity or institutional inputs. Process indicators that providers can act upon, such as firms' involvement in traineeships, contain information about heterogeneity in individual labour market returns even among similarly attractive programs. Such indicators can therefore complement outcome-based measures in the design of performance-based funding, helping policymakers identify underperforming programs while rewarding excellence.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.econlet.2026.113355.

Data availability

The authors do not have permission to share data.

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