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Earnings Differentials in the Greek Private Sector: The Case of Lower and Upper Secondary General and Vocational Education Graduates

[1] Velaora Argyro, [2] Tsamadias Constantinos, [3] Stamoulis George

[1] PhD Candidate, Department of Electrical and Computer Engineering, University of Thessaly, Sekeri - Cheiden Str, Pedion Areos, ECE Building, 383 34 Volos, Greece

[2] Emeritus Professor, Department of Economics and Sustainable Development, School of Environment, Geography and Applied Economics, Harokopio University, El. Venizelou 70, Athens, Greece

[3] Professor, Department of Electrical and Computer Engineering, University of Thessaly, Sekeri - Cheiden Str, Pedion Areos, ECE Building, 383 34 Volos, Greece

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Corresponding Author: **Velaora Argyro**

Abstract

This study examines the gross annual earnings of secondary education graduates in Greece, utilizing data obtained from a primary statistical survey carried out in the private sector. The analysis is conducted based on the level of secondary education (lower and upper), type of upper secondary education (General or Vocational Lyceum), gender, years of work experience and age. The results reveal earnings differentials in favor of upper secondary graduates both overall and by gender, thus reinforcing human capital theory. Furthermore, graduates of General Lyceums exhibit higher earnings compared with graduates of Vocational Lyceums. The analysis also highlights the persistence of gender-based wage disparities, with male graduates earning more than female graduates even at equivalent levels of educational attainment.

Keywords: Secondary Education, General, Vocational Education, Annual Earnings

1. Introduction

Since the 1950s, education has been firmly established in the economic literature as an investment in human capital (Schultz, 1961, 1963, 1971; Mincer, 1962, 1974, 1988, 1994; Becker, 1964, 1995) [41, 42, 43, 26, 27, 28, 29, 3, 4, 5]. Empirical studies across countries and over time have shown that individuals with higher educational levels tend to earn higher wages, face lower unemployment, and are more likely to occupy prestigious and stable positions compared with those possessing lower levels of education (Card, 1999) [7].

In Greece, the structure of the educational system consists of two main stages: compulsory education, which includes primary and lower secondary education, and non-compulsory education, which includes upper secondary and tertiary education. After completing lower secondary education (Gymnasium), students must choose between attending a General Lyceum (GEL) or a Vocational Lyceum (EPAL) [1]. EPAL aims to equip students with skills relevant to specific professions or sectors (Cedefop, 2017) [8]. This educational choice is often shaped consciously or unconsciously by a combination of social norms, prevailing cultural attitudes, and qualitative and quantitative factors such as family background, social expectations, educational

[1] In the Vocational Lyceum (EPAL) two cycles of studies are offered:

a. The secondary education cycle, which combines general education subjects with theoretical instruction and practical laboratory training.
b. The postsecondary course, 'apprenticeship class', which is optional. This cycle includes a dual learning approach that integrates on-the-job training with specialized laboratory instruction, conducted either in EPAL's own facilities or in affiliated laboratory centers.

aspirations, and economic conditions. In Greece, upper secondary education is predominantly geared towards general knowledge and skills. In recent years, the apprenticeship sector has been strengthened.

This study aims to investigate the earnings of secondary education graduates from Gymnasium and Lyceum (GEL and EPAL) employed in the Greek private sector, through the following research questions:

- Do graduates of lower and upper secondary education exhibit differences in their earnings from paid employment?
- What do the earnings of graduates from General and Vocational Lyceums indicate about the different types of upper secondary education?
- What are the annual earnings of secondary education (Gymnasium and Lyceum-GEL/EPAL) graduates by gender?
- How do annual earnings vary by years of work experience, type of upper secondary education, and gender?

This study contributes to the international literature by providing new empirical evidence on the earnings of secondary education graduates in Greece. It also fills a gap in national research by disaggregating earnings data by gender, educational level, and years of work experience in the private sector, a context that remains relatively underexplored in the field of the economics of education.

The organization of this paper is as follows: **In Section 2**, the literature review is presented. **In Section 3**, the methodology and models are described. **In Section 4**, the empirical research is presented, the data sources are listed, the mean gross annual earnings of secondary education (Gymnasium and Lyceum-GEL/EPAL) graduates are calculated. Comparisons are made by level and type of education, as well as by gender, work experience, and age. Finally, **in Section 5**, concluding remarks and policy recommendations are provided.

2. Literature review

The relationship between educational level and labor market outcomes has long been a focal point in labor economics and public policy (Hanushek *et al*., 2017; Psacharopoulos and Patrinos, 2018) [16, 40]. According to the theory of human capital, education is the main institutional mechanism of the production, accumulation and diffusion of human capital and is an investment (Schultz, 1961; Becker, 1964; Mincer, 1974, etc.) [41, 3, 4, 27] forming the basis of numerous national and international reforms targeting economic growth through skill enhancement.

Empirical studies have provided robust evidence of a positive correlation between education and labor income (Mincer, 1958, 1974; OECD, 1998; Harmon *et al*., 2001; de la Fuente, 2003; Bassanini *et al*., 2005; etc.) [25, 27, 30, 18, 10, 2]. Mincer (1958, 1974) [25, 27] laid the groundwork for analyzing earnings as a function of educational attainment and work experience. His earnings equation revealed a strong and consistent relationship between years of schooling and labor income-an empirical finding that has been replicated across a wide range of countries and time periods. Blaug (1972) [6] emphasized the robustness of this relationship, noting that the positive correlation between education and earnings is among the most consistent findings in modern social science.

From an economic standpoint, individuals are assumed to behave rationally by investing in educational paths expected to yield higher economic returns-namely, higher earnings, greater job security, and enhanced social status. Governments, in turn, prioritize investment in educational tiers or fields demonstrating the highest rates of return (Psacharopoulos, 1981, 1994; OECD, 2014; Tsamadias, 2020) [38, 39, 31, 46].

Although much empirical literature has traditionally emphasized the private and social returns to tertiary education, increasing attention is being paid to the role of secondary education-especially in countries where participation in higher education is not universal or where youth unemployment is persistently high (OECD, 2020; World Bank, 2021) [33, 50]. In such contexts, understanding the labor market outcomes of individuals completing lower secondary (Gymnasium) and upper secondary education (General or Vocational Lyceum) becomes critical for the design of equitable and efficient education systems.

While most studies confirm that education improves earnings, differentials by type of secondary education (general, vocational) and gender remain underexplored, particularly in Southern European countries. Vocational education, for example, often leads to faster labor market entry but may limit upward wage mobility in the long term (Hanushek, *et al*., 2011; Lavrijsen and Nicaise, 2017) [17, 23]. Gender-based earnings gaps also persist despite converging educational attainment levels, suggesting the need for more nuanced analyses (OECD, 2017, 2021) [32, 34].

The relationship between education and earnings is particularly strong in countries such as Germany and Switzerland with a clear distinction between general and vocational education. Nonetheless, the extent to which general and vocational education provide comparable economic returns continues to be a topic of sustained scholarly inquiry (Kriesi and Sander, 2024) [22].

Several empirical investigations, including those conducted by Psacharopoulos (1994) [39], Tangtipongkul (2015) [44], Vincent and Cornel (2019) [49], and Patrinos and Psacharopoulos (2020) [36], indicate that general upper secondary education is associated with greater earnings advantages compared with vocational education. On the other hand, studies by Moenjak and Worswick (2003) [24], Almeida *et al*. (2015) [1], Yang (2017) [51], Guo and Wang (2020) [15], Vandenberg and Laranjo (2021) [48], Patrinos *et al*. (2021) [37], and Chen and Pastore (2024) [9], have produced contrasting results, indicating higher returns in vocational education than in general education.

According to Eurostat (2023) [13], in 2023 the highest average full-time adjusted salary per employee (in euros) was recorded in Luxembourg, at €81,064, followed by Denmark (€67,604), Ireland (€58,679), Austria (€54,508), and Germany (€50,998). On the other hand, the lowest figures were observed in Bulgaria (€13,503), Hungary (€16,895), and Greece (€17,013). The average across the 27 European Union countries was €37,863.

Nonetheless, education level clearly influences earnings distribution. In 2022, 27.5% of EU employees with a low level of education were classified as low-wage earners. This share decreased to 17.5% among those with a medium level of education, and fell significantly to just 4.8% among employees with a high level of education (Eurostat, 2024) [14].

Among graduates aged 16-34 from GEL and EPAL in Greece no pronounced differences in earnings are observed. In contrast, earnings gaps are particularly wide in countries such as Austria, Finland, Sweden, and Denmark, favoring vocational upper secondary graduates, while in Luxembourg the advantage is held by graduates of general upper secondary education (European Commission, 2020) [11].

In Greece, where structural challenges such as skills mismatches and youth unemployment prevail (Karamessini, 2008; European Commission, 2022) [21, 12], examining the wage outcomes of secondary education becomes especially important. Upper secondary graduates often face divergent trajectories depending on the type of institution attended (general versus vocational), as well as on gender, given well-documented disparities in occupational outcomes and wage levels (Paleocrassas *et al*., 2002; Heinesen and Lange, 2024) [35, 19].

3. Methodology

This study uses a multi-step quantitative analysis to examine earnings differentials among secondary education graduates in the Greek private sector. The data were collected through a primary statistical survey and analyzed using both descriptive and econometric techniques.

Initially, descriptive statistics (means, standard deviations) were calculated to summarize the distribution of earnings across different educational levels and gender. Earnings disparities were illustrated through tables and graphical representations, stratified by educational level, gender, and work experience. To assess statistically significant differences in mean earnings between subgroups, independent samples t-tests were conducted.

The analysis included a series of comparisons aimed at examining earnings disparities across educational levels. Specifically, comparisons were conducted between Gymnasium and Lyceum graduates (total sample and by gender). Additional comparisons were made between Gymnasium and GEL graduates, as well as between Gymnasium and EPAL graduates (total sample and by gender). Finally, the earnings of GEL graduates were compared with those of EPAL graduates (total sample and by gender).

Thereafter, the estimation of age-earnings function by level of education was conducted. The age-earnings function of graduates at education levels h and h-1 is estimated according to formula (1) (Psacharopoulos, 1981; Tsamadias, 2002, 2020) [38, 45, 46]:

$$W_i = a \cdot A_i^2 + b \cdot A_i + c + u_i \quad (1)$$

where W_i is the annual gross earnings (before taxes) of the individual I from hired labour. A_i is the age of individual i, a and b are the regression coefficients, c is a constant and u_i is the disturbance term. In function (1), the square of the variable A_i is inserted to adapt the model to the parabolic shape of the age-earnings profiles. The Ordinary Least Squares (OLS) method is employed, and model performance is evaluated based on standard statistical criteria and consistency with economic theory.

4. Empirical research

4.1 Sampling and sample

The data for this study were obtained through a primary statistical survey conducted within the private sector of the economy, where productivity differences are more distinctly observable. A stratified sampling method with proportional allocation was employed across the populations of upper secondary and lower education graduates (control group) who were employed full-time in the private sector and within the three main production sectors (primary, secondary, and tertiary) of the Greek economy in 2020. The choice of stratified sampling was based on its capacity to enhance the accuracy of statistical estimates (Zairis, 1991) [52].

The sample included individuals who had completed either lower or upper secondary education without pursuing any form of further education or training. Their annual earnings excluded extraordinary payments or additional compensation (e.g., overtime pay), as well as income from supplementary training activities (such as seminars, specialization courses, or vocational programs).

Individuals with secondary education who were self-employed or working as freelancers were not included in the study, as it is not feasible to distinguish labor income from income derived from other production factors (e.g., natural resources, capital, and entrepreneurial activity). Similarly, secondary education graduates working part-time were excluded from the analysis.

For the purposes of the survey, the sample was divided into two subpopulations: graduates of lower secondary education (gymnasium) and graduates of upper secondary education (lyceum), all of whom were employed full-time in the private sector in Greece. The upper secondary education group was further subdivided into two categories: the first included graduates of general upper secondary schools (GEL), while the second included graduates of vocational upper secondary schools (EPAL).

In the initial stage of the study's design and planning, a pilot sample of 170 observations was selected.

The total size of sample n_0 is determined by the type (2):

$$n_o = \frac{\sum W_h \cdot S_h^2}{\bar{Y}^2 \cdot CV^2(\bar{y})} \quad (2)$$

where $W_h = \frac{N_h}{N}$ denotes the weight of stratum h in the population, N_h is the size of the h stratum, N is the overall population size, S_h^2 is the variance of stratum h, CV is the coefficient of variation and is set at 0.01 (1%), and $\bar{Y}$ is the real average earnings (from the pilot sample) (Tsamadias and Chanis, 2012) [47].

The average earnings were estimated at 14,889€ per year from the pilot sample.

Table 1 presents the structure of the population and sample by educational level, type in upper secondary education and gender in the private sector of the Greek economy.

Table 1: Population and sample by educational level, type of upper secondary education and gender in the private sector of the Greek economy (2020)

Educational level	Private Sector				
	Population		Sample		
	N	%	N	Male	Female
Gymnasium Graduates	129,939	18.23	347	176	171
Lyceum Graduates	583,143	81.77	1,554	870	684
Total	713,082	100	1,901	1,046	855
Educational level	**Population**		**Sample**		
	N	**%**	**N**	**Male**	**Female**
GEL Graduates	437,940	75.1	1,167	631	536
EPAL Graduates	145,203	24.9	387	239	148
Total Lyceum Graduates	583,143	100	1,554	870	684

Source: Population data were taken from the Hellenic Statistical Authority (2020) [20], and sample data were derived from the authors' research

4.2 Results and discussion

This section provides a detailed analysis of average annual earnings from paid employment. Specifically, earnings are analyzed by level of educational attainment, level of educational attainment and gender, level of educational attainment and years of work experience, and level of educational attainment, years of work experience and gender.

Table 2 presents the mean gross annual earnings of secondary education graduates by educational level and gender in Greece.

Table 2: Mean gross annual earnings of secondary education graduates by educational level and gender (in euros, 2020)

Educational Level	Mean gross annual earnings (W)								
	Total			Male			Female		
	N	Mean	S	N	Mean	S	N	Mean	S
Gymnasium	347	12,624	3,225	176	13,321	3,134	171	11,904	3,167
Lyceum	1,554	14,224	3,266	870	14,506	3,397	684	13,865	3,056
Total	1,901	13,932	3,316	1,046	14,307	3,382	855	13,473	3,176

Notes: a. Significant at the 5% level.
b. S denotes standard deviation.
Source: Authors' calculations

Table 2 presents evidence of wage disparities based on both educational level and gender. Firstly, the data confirm a positive correlation between educational level and earnings. Graduates of upper secondary education (Lyceum) receive statistically significantly higher average earnings than graduates of lower secondary education (Gymnasium), at the 5% significance level. Specifically, Lyceum graduates earn, on average, approximately 12.7% more annually than those who have completed only lower secondary education.

Second, there is a statistically significant difference at the 5% level in mean gross annual earnings between male graduates of lower and upper secondary education, with Lyceum male graduates earning 8.9% more than male Gymnasium graduates. In addition, a statistically significant difference at the 5% level is also observed among women, with female Lyceum graduates earning 16.5% more than female Gymnasium graduates.

Among Gymnasium graduates, men earn €13,321 annually, while women earn €11,904-a difference of approximately 11.9%**.** The gap persists, albeit to a lesser extent, among Lyceum graduates, with men earning €14,506 compared to €13,865 for women (a 4.6% difference). Overall, the mean earnings for men across the sample stand at €14,307, while for women the figure is €13,473, indicating a total gender pay gap of 6.2%.

Table 3 presents the mean annual gross earnings of graduates from GEL and EPAL Lyceums employed full-time in the Greek private sector, disaggregated by gender.

Table 3: Mean gross annual earnings of general and vocational lyceum graduates total and by gender (in euros, 2020)

Educational Level	Mean gross annual earnings (W)								
	Total			Male			Female		
	N	Mean	S	N	Mean	S	N	Mean	S
GEL	1,167	14,369	3,239	631	14,668	3,367	536	14,017	3,048
EPAL	387	13,787	3,312	239	14,080	3,447	148	13,314	3,034
Total (Lyceum)	1,554	14,224	3,266	870	14,506	3,397	684	13,865	3,056

Notes: a. Significant at the 5% level.
b. S denotes standard deviation.
Source: Authors' calculations

In Table 3 analysis reveals a statistically significant difference in average earnings between graduates of GEL and EPAL, with GEL graduates earning approximately 4.2% more. When stratified by gender, male GEL graduates earn 4.2% more than male EPAL graduates. Similarly, female GEL graduates earn 5.3% more than EPAL graduates, with the difference being statistically significant in both cases.

The data reveal a consistent pattern of higher male earnings across both educational tracks. Among GEL graduates, men earn an average of €14,668, while women earn €14,017-resulting in a gender gap of 4.6%. The disparity is more pronounced among EPAL graduates, with male earnings averaging €14,080 compared with €13,314 for females, yielding a gender gap of 5.8%.

Fig 1 shows the mean gross annual earnings by years of work experience in secondary education.

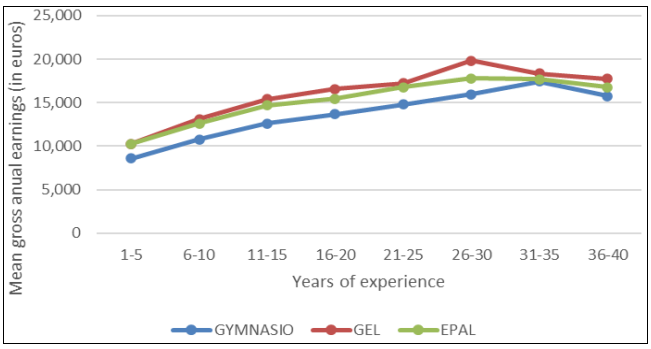

Fig 1: Mean gross annual earnings by years of work experience in secondary education in Greece

Fig 1 shows that GEL graduates consistently earn more than EPAL and Gymnasium graduates in all classes of work experience. Earnings for GEL and EPAL graduates tend to peak between 26-30 years of experience, whereas earnings for Gymnasium graduates reach their highest levels between 31-35 years, followed by a slight decline across all groups. These findings underscore the long-term labor market benefits associated with higher levels and types of secondary education.

There is a statistically significant difference in the average gross annual earnings between Gymnasium graduates and both GEL and EPAL graduates. Specifically, graduates of GEL earn, on average, 13.8%, more than Gymnasium graduates, while graduates of EPAL also enjoy a significant

earnings advantage of 9.2% over Gymnasium graduates.
Fig 2 shows the mean gross annual earnings of male graduates by years of work experience in secondary education.

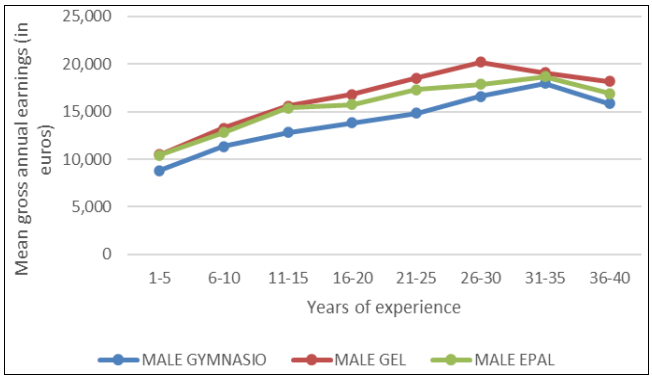

Fig 2: Mean gross annual earnings of male graduates by years of work experience in secondary education in Greece

Fig 2 shows earnings advantage for male GEL graduates across nearly all work experience categories, with a peak observed in the 26-30 years bracket. Male graduates of EPAL similarly exhibit higher earnings compared with Gymnasium graduates across the work experience spectrum. Specifically, male GEL graduates receive an average annual gross income of €14,668, which is 10.1% higher than that of male Gymnasium graduates (€13,321). This difference is statistically significant at the 5% level. Similarly, male EPAL graduates earn an average of €14,080, representing a 5.7% income premium over Gymnasium graduates, also statistically significant (Tables 2 and 3).
Fig 3 shows the mean gross annual earnings of female graduates by years of work experience in secondary education.

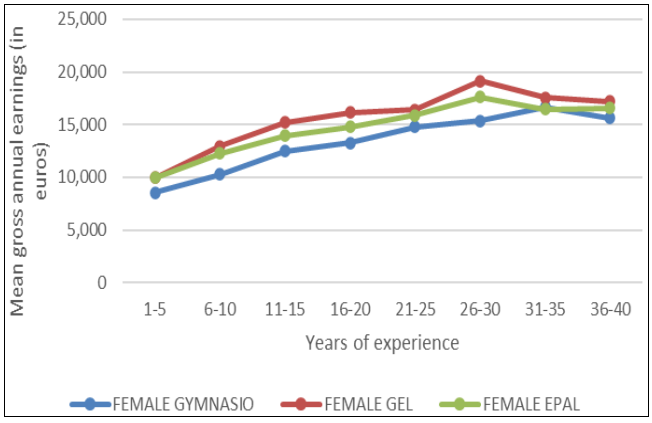

Fig 3: Mean gross annual earnings of female graduates by years of work experience in secondary education in Greece

Fig 3 shows that female graduates of GEL consistently achieve higher mean annual earnings compared with EPAL and Gymnasium graduates across all work experience categories. Earnings of women GEL and EPAL graduates tend to rise with experience, reaching a peak in the 26-30 years of work experience, followed by a slight decline.
Specifically, female GEL graduates earn an average of €14,017 annually, which is 17.8% higher than the earnings of Gymnasium graduates (€11,904). Similarly, EPAL graduates report an average income of €13,314, corresponding to an 11.8% increase over Gymnasium graduates (Tables 2 and 3). These differences are statistically significant at the 5% level, suggesting that completion of upper secondary education-whether in the general or vocational track-is associated with significantly higher earnings for women in Greece's private sector.
Table 4 presents the regression results for the age-earnings function (1), estimated for the private sector. The analysis distinguishes between two levels of education (Gymnasium and Lyceum), as well as between the two types of Lyceum (General and Vocational).

Table 4: Regression results for the age-earnings function in secondary education in Greek private sector

Independent variables	Employee in private sector			
	$W_{Gymnasium}$	W_{Lykeum}	W_{GEL}	W_{EPAL}
c (constant)	-5,380.798* (-3.76)	-6,046.409* (-9.58)	-6,195.839* (-8.18)	-5,125.596* (-4.62)
A	682.375* (9.47)	835.666* (25.12)	846.113* (21.32)	775.345* (13.07)
A^2	-5.4186* (-6.17)	-7.0001* (-16.77)	-7.0765* (-14.25)	-6.3661* (-8.48)
R^2	0.6072	0.7136	0.7029	0.7557
Adj. R^2	0.6050	0.7132	0.7024	0.7545
F	265.93	1,932.32	1,376.69	594.06
Signif	0.000	0.000	0.000	0.000
N	347	1,554	1,167	387

Notes: 1. The values in parentheses correspond to the t statistic.
2. * Significant at the 5% level.
Source: Authors' calculations

In Table 4, the values of the t statistics are satisfactory. The values of the coefficient of determination R^2 are also satisfactory because the survey data are cross-sectional. These values are consistent with those reported in comparable empirical studies.
The results show that the age variable enters with linear and quadratic terms which are statistically significant ($\alpha = 0.05$), and with the expected signs, indicating a concave age-earnings profile. The impact is stronger for Lyceum graduates than for Gymnasium graduates. Furthermore, when comparing graduates of General Lyceum (GEL) and Vocational Lyceum (EPAL), the estimated coefficients indicate a clear earnings advantage for GEL graduates. These findings are consistent with the human capital theory.

5. Concluding Remarks

This study examines the earnings differentials in the Greek private sector, focusing on differences between lower and upper secondary education graduates (Gymnasium and Lyceum), as well as between the two types of Lyceum (General and Vocational), overall, by gender, years of work experience and age.
The findings of this primary statistical survey reveal that Lyceum graduates earn, on average, 12.7% more annually than Gymnasium graduates, lending support to human capital theory. Specifically, graduates of GEL and EPAL earn, on average, 13.8% and 9.2% more, respectively, than Gymnasium graduates.
Furthermore, graduates of GEL earn 4.2% more on average than graduates of EPAL. Gender-based analyses confirm the persistence of wage disparities in favor of men, even when educational attainment is equivalent. These results are also

graphically corroborated when earnings are analyzed by years of work experience.

Overall, the study highlights the need for policy measures that promote equal opportunities, improve the efficiency of educational investments, and address earnings inequality. In this context, the improvement of vocational education in terms of quality and alignment with labor market needs, as well as its broader social perception, emerges as a critical policy priority. Aligning EPAL curricula more closely with labor market needs, expanding work-based learning opportunities, and enhancing career guidance services could improve the wage returns of vocational graduates and contribute to a more equitable and inclusive labor market.

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