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HORIZONTAL MISMATCH AND LABOR MARKET OUTCOMES: EVIDENCE FROM KOSOVO

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Abstract

Horizontal mismatch, the misalignment between workers' fields of study and their current occupations, is a structural issue in Kosovo's labor market. Evidence on its consequences remains scarce and primarily descriptive. This study analyzes its impact on hourly wages, working hours, quit intentions, and short-term contracts using data from the Kosovo Labor Force Survey (LFS) for 2012–2023. While descriptive statistics and OLS estimates indicate lower wages and slightly higher working hours among mismatched workers, mismatch status may be non-random and subject to endogeneity concerns. To address selection on observables, kernel propensity score matching (PSM) is implemented as the primary estimator. The findings, consistent with existing literature, suggest that mismatched workers earn €0.163 less per hour (6 percent relative to the mean hourly wage) and work 0.374 additional hours per week (0.9 percent relative to the mean weekly hours) compared to adequately matched workers. The estimated effects on short-term contracts (−0.1 percentage points) and quit intentions (+0.3 percentage points) are small and statistically insignificant. Overall, the results suggest that the primary economic cost of horizontal mismatch in Kosovo operates through earnings penalties rather than contractual instability or pronounced dissatisfaction.

JEL Classification: *J24, J31, J62*

Keywords: *horizontal mismatch, kernel propensity score matching, labor-market outcomes, wage penalty, working hours, short-term contracts, quit intentions.*

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1. Introduction

The link between education and labor-market needs has become a central concern for policymakers, educators, and economists alike. While much of the attention has focused on vertical mismatch, where individuals work in jobs requiring higher or lower qualifications than they possess, growing evidence points to the equally important phenomenon

of horizontal mismatch, which occurs when individuals are employed in fields unrelated to their education (McGuinness et al. 2025). This form of mismatch reflects inefficiencies in the allocation of specialized human capital and can have significant consequences for productivity, wages, and worker well-being (Robst 2007a; McGuinness, Pouliakas, and Redmond 2019; Albert, Davia, and Legazpe 2023).

Despite growing academic and policy interest, horizontal mismatch remains relatively underexplored, particularly in emerging and transition economies. Most existing studies focus on high-income or European Union (EU) countries with well-developed labor markets and institutional structures (Montt 2017; Handel 2019; Choi and Hur 2020). As a result, far less is known about mismatch dynamics in smaller, emerging labor markets such as Kosovo. In Kosovo, tertiary enrollment has expanded rapidly over the past decade, while job creation has remained concentrated in sectors with limited demand for highly specialized skills. National and international reports consistently identify horizontal mismatch as a persistent feature of the labor market (European Commission 2024; Bartlett, Gashi, and Skikos 2016; ALLED2 2022a; Cojocaru 2017). However, while the prevalence of mismatch is well documented, systematic evidence on its labor-market consequences remains scarce and primarily descriptive.

This paper addresses this gap by providing an empirical analysis of horizontal mismatch in Kosovo using data from the Labor Force Survey (LFS) spanning the years 2012–2023. The study focuses on the impact of horizontal mismatch on four key labor-market outcomes: hourly wages, weekly working hours, short-term contract status, and quit intentions (as a limited proxy for job satisfaction). The empirical strategy begins with a benchmark ordinary least squares (OLS) specification that documents conditional associations and subsequently applies kernel matching to address selection on observables under the Conditional Independence Assumption (CIA). A stricter exact matching design is also implemented to further assess the robustness of the findings.

In addition to estimating the average treatment effect on the treated (ATT), the paper explores heterogeneity across key demographic and structural dimensions — gender, age, region, education level, and field of study — to identify particularly vulnerable groups. These subgroup analyses deepen the understanding of how mismatch affects different segments of the labor force, revealing whether certain groups are better equipped than others to withstand or offset its impacts.

Descriptive statistics and benchmark OLS estimates indicate lower hourly wages and slightly longer working hours among mismatched workers. However, because the mismatch status may be non-random and subject to endogeneity concerns, kernel matching is employed to address potential selection bias. The findings, consistent with the existing literature, indicate that mismatched workers earn €0.163 less per hour, or 6 percent relative to the mean hourly wage, and work about 0.4 additional hours per week, or 0.9 percent relative to the mean weekly hours, potentially suggesting compensatory behavior for lost earnings. Meanwhile, no robust association is found with contract type, and effects on quit intentions are small and not statistically robust. Furthermore, heterogeneity analysis shows that wage penalties are particularly pronounced among prime-age and older workers, non-tertiary-educated individuals, and urban residents, groups likely to face more rigid occupational structures. These findings point to the potential economic costs of skill underutilization and the importance of targeted labor-market and education-policy reforms in transition economies.

The remainder of the paper is structured as follows. Section 2 reviews the existing literature on horizontal mismatch and its labor-market consequences. Section 3 presents the labor market context of Kosovo. Section 4 describes the data and empirical methodology. Section 5 presents the main results, while Section 6 offers a detailed heterogeneity analysis. Section 7 concludes with key policy implications and directions for future research.

2. Literature review

Early contributions to the study of horizontal mismatch can be traced to research examining the fit between educational training and occupational outcomes. Witte and Kalleberg (1995) were among the first to empirically examine whether individuals work in positions aligned with their vocational education and the economic implications of such alignment. Similarly, Solga and Konietzka (1999) examined occupational matching as a mechanism of status allocation and social stratification, highlighting how educational credentials translate into labor market positions. The economic implications of horizontal mismatch were substantially developed by Wolbers (2003) and Robst (2007a), who provided foundational theoretical models and empirical analyses of labor-market outcomes. Recent literature highlights a surge in academic interest since 2015, with increasing focus on drivers, measurement strategies, and consequences across various

contexts (Albert, Davia, and Legazpe 2025). This growing attention underscores its increasing relevance in policy debates concerning labor market efficiency and human capital allocation.

A central concern in this growing body of research is the lack of consensus on how to consistently measure horizontal mismatch. Measurement debates center around three main approaches: the normative approach, also known as Job Analysis (JA), the statistical approach or realized matches (RM), and the subjective method, or Workers Assessment (WA) (Albert, Davia, and Legazpe 2025; Somers et al. 2019; Sellami, Verhaest, and Van Trier 2018).

The job analysis (JA) approach relies on expert evaluations that determine the educational requirements associated with specific occupations, typically using standardized occupational classification systems (Solga and Konietzka 1999; Wolbers 2003). Common occupational classification systems include the International Labor Organization's (ILO) International Standard Classification of Occupations (ISCO), the United States' O*NET (Occupational Information Network), the United Kingdom's SOC (Standard Occupational Classification), Canada's NOC (National Occupational Classification), and ANZSCO (Australian and New Zealand Standard Classification of Occupations) (Nordin, Persson, and Rooth 2010; Béduwé and Giret 2011; Sulaimanova 2022). The RM approach infers the "typical" field of education within each occupation — usually based on the modal or mean distribution — and classifies workers whose field deviates from this benchmark as mismatched (Nieto, Matano, and Ramos 2015; Morgado et al. 2016; Rudakov et al. 2022). The WA approach is based on workers' self-assessment of whether their field of education matches the requirements of the job (Witte and Kalleberg 1995; Berlingieri 2019).

Much of the variation in reported mismatch rates results from these methodological differences (Montt 2017; Sellami, Verhaest, and Van Trier 2018). Sellami, Verhaest, and Van Trier (2018) demonstrate that RM-based measures tend to produce the highest mismatch rates, sometimes reaching 62 percent. These measures classify many workers as mismatched even when their job tasks overlap with their field-specific skills. Subjective measures, on the other hand, typically yield lower mismatch rates. The authors argue that job analysis and carefully designed worker assessments provide more conceptually sound ways to measure mismatch.

Horizontal mismatch is driven by a combination of individual characteristics, educational background, and labor market conditions. Somers et al. (2019) and Sellami, Verhaest, and Van Trier (2018) report that gender, ethnicity, and migration background are strong predictors of mismatch. Women and migrants face greater risks, often due to limited job networks and insufficient career guidance. Educational background is crucial, as graduates from generalist fields like Arts and Humanities face higher mismatch risks than those from more specialized fields such as Engineering and Health Sciences (Albert, Davia, and Legazpe 2025; Kiss 2024). However, evidence shows that even graduates from specialized fields may experience high mismatch rates when labor market demand is insufficient to absorb field-specific skills; for example, Pholphirul (2017) documents horizontal mismatch rates exceeding 40 percent among science graduates in Thailand. Lower-achieving students are also more susceptible (Somers et al. 2019). Montt (2017) highlights field saturation and skill transferability as additional risks in crowded sectors. Mismatch prevalence increases in countries with generalized education systems (systems emphasizing broad, non-occupation-specific curricula) and weak employer-education linkages (Montt 2017; Albert, Davia, and Legazpe 2025), indicating systemic labor market distortions.

Empirical consensus confirms wage penalties associated with horizontal mismatch. Robst (2007b) finds that horizontally mismatched workers earn approximately 11.9 percent less for men and 10.1 percent less for women relative to adequately matched workers with similar observable characteristics. Zhu (2014) reports smaller wage penalties, ranging from 1.2 to 1.5 percent, among Chinese graduates. Similarly, Vecchia et al. (2023) document a modest average wage penalty of 1.5 percent in the UK, with steeper losses for horizontally mismatched workers relative to adequately matched workers in high- and low-skill occupations. Nevertheless, some workers strategically accept a mismatched job for higher wages or career advancement (Robst 2007a; Bender and Roche 2013).

Beyond wages, some studies find that the mismatch negatively affects job satisfaction, increases turnover intentions (Béduwé and Giret 2011; Shevchuk, Strebkov, and Davis 2015), and correlates with inferior working conditions, such as temporary contracts (Li, Harris, and Sloane 2018). Some studies also aim to estimate the causal association between mismatch (mainly overeducation) and job satisfaction and consistently find that overeducation negatively affects job satisfaction (Verhaest and Omey 2006; Herrera and Merceron 2013; Sam 2019).

In both vertical and horizontal mismatch research, attention is paid to methodological rigor due to the potential endogeneity and measurement biases inherent in these studies. While many analyses rely on

OLS applied to cross-sectional data, these are susceptible to omitted variable bias and fail to address the endogeneity of mismatch status (Reis 2017). Alternative methods, including PSM, fixed-effects models, and instrumental-variable (IV) approaches, are increasingly employed in an attempt to isolate causal effects (Verhaest and Omey 2011; Dolton and Silles 2008; Korpi and Tåhlin 2009). McGuinness (2008), McGuinness and Sloane (2011), and Karymshakov and Sulaimanova (2019) use PSM to estimate wage penalties by accounting for observable confounders. Iriondo Múgica (2022) incorporates fixed effects to address unobserved heterogeneity and finds that the estimated wage penalty for horizontal mismatch falls from 5.8 percent under OLS to 2.6 percent once these factors are accounted for. These approaches are consistent with studies that use fixed effects to control for time-invariant unobservables (Bauer 2002; Cutillo and Di Pietro 2006; Verhaest and Omey 2011).

The existing literature on educational mismatch remains predominantly based on evidence from advanced economies. Empirical evidence from low- and middle-income countries is comparatively limited, even though mismatch rates tend to be higher and institutional constraints more binding in these contexts (Handel 2019). Using the Kosovo Labor Force Survey (2012–2017), Frimmel, Murati, and Prenaj (2021) examine the effects of vertical mismatch on labor-market outcomes. Applying a combination of exact and propensity score nearest-neighbor matching, they find that over-educated workers incur a 15 percent wage penalty and are more likely to hold short-term contracts. Building on a similar identification strategy and the same dataset, this paper shifts the focus from vertical to horizontal mismatch and extends the analysis through 2023.

3. Kosovo's labor market context

Despite solid Gross Domestic Product (GDP) growth relative to the other Western Balkan countries, Kosovo's labor-market performance remains among the weakest in the region. As Table 1 shows, Kosovo's labor market is characterized by persistently low participation and employment rates, as well as elevated unemployment. Between 2012 and 2023, labor force participation rose marginally from 37 to 41 percent, while employment reached just 36 percent by 2023. Although declining over time, youth unemployment remained elevated at 17 percent in 2023, underscoring persistent structural constraints. Compared to other Western Balkan countries, where labor force participation rates typically exceed 50 percent (World Bank and Vienna Institute for International Economic Studies (WIIW) 2024), Kosovo's underperformance is striking. Table 1 further indicates that the employment rate among the working-age population (15-64) followed a similar trend, increasing from 28 percent in 2012 to 36 percent in 2023. Male employment

Table 1. Key Labor Market Indicators in Kosovo by Gender (%), 2012–2023

Indicator	Gender	2012	2015	2018	2020	2021	2022	2023
Labor Force Participation (15–64)	Male	55.4	56.7	63.3	56.0	56.6	55.5	57.8
	Female	17.8	18.1	18.4	20.8	22.0	22.0	24.2
	Total	36.9	37.6	40.9	38.3	39.3	38.6	40.7
Employment Rate (15–64)	Male	44.0	38.7	45.3	42.8	45.9	49.4	53.4
	Female	12.9	11.5	12.3	14.1	16.5	18.4	19.8
	Total	28.4	25.2	28.8	28.4	31.1	33.8	36.3
Unemployment Rate (15–64)	Male	28.1	31.8	28.5	23.5	19.0	11.0	7.7
	Female	40.0	36.6	33.4	32.3	25.0	16.5	18.2
	Total	30.9	32.9	29.6	25.9	20.7	12.6	10.9
Youth Employment Rate (15–24)	Male	15.1	12.9	14.6	16.1	18.4	20.8	24.5
	Female	4.6	3.7	4.9	6.4	8.0	9.7	11.9
	Total	10.0	8.5	10.0	11.4	13.4	15.4	18.3
Youth Unemployment Rate (15–24)	Male	50.4	54.2	51.5	45.2	33.7	18.6	14.4
	Female	68.4	67.2	64.7	57.2	46.5	27.0	22.8
	Total	55.3	57.7	55.4	49.1	38.0	21.4	17.3

Source: Kosovo Agency of Statistics, Labor Force Survey (LFS) 2012–2023

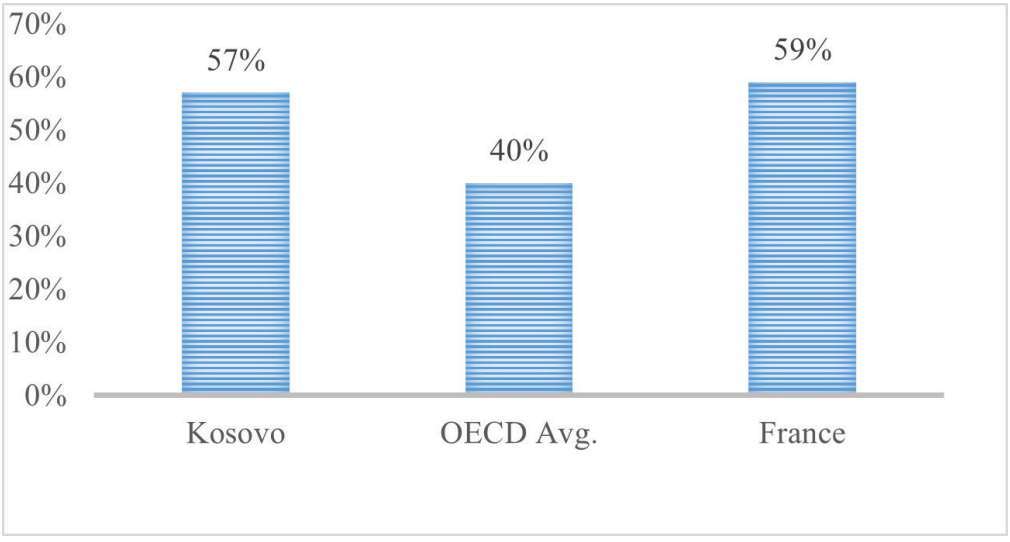
increased overall to 53 percent by 2023, whereas female employment has grown modestly to 20 percent, underscoring persistent structural barriers that limit women's employment. These structural weaknesses suggest a limited capacity of the labor market to absorb expanding cohorts of tertiary-educated workers, creating conditions under which horizontal mismatch may emerge.

These structural constraints are also reflected in growing evidence of a substantial mismatch between educational output and occupational demand. Bartlett, Gashi, and Skikos (2016) find that over one-third of Western Balkan graduates, including in Kosovo, work outside their field of study, largely reflecting continued expansion in social science programs despite rising employer demand in technical science, technology, engineering, and mathematics (STEM) fields. Recent evidence on the relevance of vocational education and training (VET) further supports this interpretation. A strategic assessment of VET – private sector cooperation in Kosovo (ALLED2 2022b) reports persistent shortages in manufacturing, construction, and Information and Communications Technology (ICT)–related occupations, alongside limited structured collaboration between firms and training institutions. The same study further notes that employers frequently report the need to retrain newly hired workers for several months before they reach adequate productivity levels, suggesting not only quantitative imbalances but also qualitative deficiencies in skill formation.

Rapid educational growth since 2010, marked by the establishment of new public and private universities, produced many tertiary-educated individuals whose qualifications often outstripped specialized job availability. This gap between the rapid expansion of tertiary education, particularly in social science fields, and the limited availability of field-specific jobs appears to be central to horizontal mismatch in Kosovo. The 2024 Friedrich-Ebert-Stiftung (FES) Youth Study reports that 48 percent of employed young Kosovars work in occupations unrelated to their education, while only 25 percent feel fully matched to their occupations. Adult workforce data offers an even starker picture: Krasniqi et al. 2022, report that 63.5 percent of workers are horizontally mismatched.

Kosovo's horizontal mismatch rate, shown in Figure 1, is strikingly high at 57 percent. This result is consistent with earlier research (Bartlett, Gashi, and Skikos 2016; Krasniqi et al. (2022); Friedrich-Ebert-Stiftung 2024), and stands well above the Organization for Economic Co-operation and Development (OECD) average of 40 percent (Montt 2017). It also approaches the upper bound of 59 percent reported for France in the international literature review by Sellami, Verhaest, and Van Trier (2018). A key driver of the high incidence of mismatch in Kosovo appears to be the imbalance between the type of skills offered and those demanded in the labor market. For example, between 2015 and 2019, the Public Employment Service in Kosovo managed to fill only 30 percent of registered vacancies, suggesting poor alignment between

Figure 1. Mismatch rates in Kosovo, OECD and France



Source: Kosovo (LFS 2012-2023, authors' calcualtions), OECD average (Montt 2017), and France (Béduwé and Giret 2011)

job seeker profiles and employer requirements (Gashi 2021; Employment Agency of the Republic of Kosovo (EARK) 2020). The Kosovo Skills Barometer (ALLED2 2022a) and vacancy data from a United Nations Development Programme (UNDP) (2020) study point to persistent shortages in engineering, ICT, and skilled trades — fields where educational uptake remains low — alongside an oversupply of graduates in Business, Administration and Law, as well as Arts and Humanities graduates. The UNDP (2020) study also notes that, in response to these shortages, 63 percent of employers hired underqualified workers, and 19 percent redistributed tasks among existing staff, highlighting the labor market's limited flexibility.

The consequences of mismatch reflect global trends: skills mismatch negatively affects workers' productivity, earnings, and motivation, reduces firms' efficiency, and wastes public resources. Employer surveys in Kosovo confirm that skills gaps constrain growth, especially for innovative firms (World Bank 2019). Institutional shortcomings perpetuate mismatch: universities overproduce graduates in low-demand fields while STEM and vocational programs remain undersubscribed, and labor market feedback is weak due to limited employer involvement in curricula and inadequate career guidance (European Training Foundation 2019). These dynamics may be particularly pronounced in small economies with relatively young institutional frameworks.

4. Data and methodology

4.1. Data and variables

The study uses individual-level data from the LFS, covering twelve annual waves from 2012 to 2023. Conducted by the Kosovo Agency of Statistics and harmonized with Eurostat standards, the LFS is Kosovo's first nationally representative labor market survey. It provides detailed information on demographics, employment status, occupational codes, education, and wages. Crucially, it records occupations using the 3-digit ISCO codes and education fields using the International Standard Classification of Education (ISCED) classifications, enabling standardized mismatch analysis over time. Due to revisions in international classification systems and updates during the survey period, two different versions of ISCO and ISCED are used: ISCO-88 and ISCED-97 for the years 2012–2017, and then ISCO-08 and ISCED-F (International Standard Classification of Education – Fields of Education and Training) 2013 for the data from 2018 onward. To maintain consistency across survey years, mismatch coding is adjusted to align with these shifts.

Horizontal mismatch is defined using an objective-normative approach (JA), whereby a worker is classified as mismatched if their current occupation is not listed among the occupations normatively associated with their field of education. For the period 2012–2017, this association is based on the ISCED-97 to ISCO-88 field–occupation correspondence proposed by Wolbers (2003) (see Table A.1). For the period 2018–2023, the classification relies on the ISCED-F 2013 to ISCO-08 correspondence used by Sulaimanova (2022), which builds on Eurostat's official mapping tables (European Commission n.d.) (see Table A.2).

The study focuses on four labor-market outcomes: hourly wages, weekly working hours, short-term contract status**,** and quit intentions. To reduce simultaneity bias, mismatch status is measured at the first available interview (time t), while outcomes are measured at the final interview (time t+1), typically three quarters later. This lag aims to ensure temporal ordering and to help address reverse causality concerns. Net monthly wages are recorded in €50 intervals. To compute the hourly wage, each respondent is assigned the midpoint of their reported wage interval, which is then divided by their reported weekly hours (excluding overtime). A binary variable is used to capture short-term contracts, equal to 1 if the contract duration is one year or less. The quit intentions variable is measured using a question asking whether respondents would prefer to change jobs; this is interpreted as a measure of job dissatisfaction or quit intentions. All control variables — including gender, age, education, prior employment status, household composition, industry, tenure, firm size, and region — are measured at time t. The sample is restricted to employed individuals with valid occupation and education codes, who are not temporarily absent from work, and who are observed in multiple survey waves. This yields a final sample of 20,994 observations, enabling robust, representative estimation of mismatch patterns and their effects. To account for changes in classification systems and potential shifts in labor market structure, year fixed effects are included in all models. This ensures comparability across waves and mitigates distortions caused by switching from ISCO-88 to ISCO-08 and from ISCED-97 to ISCED-F 2013.

One important limitation of the JA approach to measuring horizontal mismatch is that it may misclassify workers whose actual skills or job roles are not fully captured by formal qualifications or standardized classifications. For example, some workers may perform well in jobs outside their field of study through informal learning, self-directed training, or prior work experience. In such cases, they are classified as mismatched even though their skills align with job

demands. Conversely, some formally matched workers may not be adequately prepared for their jobs, especially if their education was too general or outdated. These scenarios can lead to measurement error in the classification of mismatch status. In addition, this method assumes a fixed relationship between fields of study and occupations. This may not fully reflect the diversity of skills among graduates within a field or the variation in job content across occupations with the same ISCO code. For example, a business graduate specializing in accounting may be better suited for finance roles than a peer with a focus on marketing. However, both are treated identically in the classification. Similarly, some occupations, especially in the service sector, may involve tasks that overlap with several fields, making a one-to-one mapping imprecise. To address these concerns, the empirical approach includes controls for important characteristics such as prior employment status, education level, field of study, industry, and firm size. These variables help adjust for differences in background and job environment that may influence how skills are developed and applied. Furthermore, heterogeneous effects across subgroups (e.g., age, gender, field of education, region) are analyzed to explore whether mismatch penalties vary in ways that reflect differences in skill transferability and occupational flexibility.

4.2. Descriptive statistics

Table 2 compares descriptive statistics[1] for adequately matched (9,011) and horizontally mismatched (11,983) workers, revealing notable selection patterns into mismatch. Horizontally mismatched individuals

Table 2. Characteristics of adequately matched and horizontally mismatched workers

	Matched		Horizontally Mismatched		Difference
	Mean	S.D	Mean	S.D	
Individual characteristics at time t					
Age (years)	39.90	(12.49)	38.10	(12.63)	***
Below 35 years old (%)	0.338	(0.473)	0.392	(0.488)	***
35-50 years old (%)	0.363	(0.481)	0.356	(0.479)	
Above 50 years old (%)	0.298	(0.457)	0.252	(0.434)	***
Male (%)	0.587	(0.492)	0.690	(0.463)	***
Married (%)	0.759	(0.428)	0.708	(0.455)	***
Tenure (years)	12.00	(10.34)	9.937	(9.327)	***
Years of education (years)	14.50	(2.207)	13.75	(2.166)	***
Employed one year ago (%)	0.906	(0.292)	0.872	(0.334)	**
Minority city (%)	0.030	(0.144)	0.027	(0.151)	*
Household characteristics in period t					
Number of children 10-18 years	0.766	(1.144)	0.810	(1.175)	**
Number of children 6-10 years	0.290	(0.683)	0.291	(0.695)	**
Number of children < 6 years	0.150	(0.454)	0.147	(0.452)	**
Number of household members > 60 years	0.789	(0.886)	0.847	(0.845)	***
Firm characteristics in period t					
Firm size (categorical 1-4)	2.487	(1.069)	2.333	(1.102)	***
Labor market outcomes in period t+1					
Hourly wage (EUR)	2.724	(1.233)	2.453	(1.549)	***
Short-term contract (%)	0.438	(0.496)	0.471	(0.499)	***
Quit intentions (%)	0.015	(0.120)	0.024	(0.153)	***
Working hours (weekly hours)	41.15	(7.195)	42.67	(8.080)	***
Number of observations	9,011			11,983	

Notes: Firm size is coded as an ordinal variable (1 = 1–10 employees; 2 = 11–19; 3 = 20–49; 4 = 50+ employees). Binary variables are reported as proportions. Household variables represent counts of household members.

Sigificance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Kosovo LFS (2012-2023), authors' calculations

are slightly younger on average (38.1 vs. 39.9 years), more frequently under 35, and less often above 50. Gender differences are pronounced, with mismatched workers predominantly male (69% vs. 59%).

Other individual characteristics also differ; mismatched workers exhibit shorter tenure (9.9 vs. 12.0 years), lower educational attainment (13.75 vs. 14.5 years), are less likely to be married, and have marginally lower employment rates one year prior to the survey. Household composition diverges subtly but systematically, with mismatched workers typically having more household members aged 60 or older and slightly more children aged 10–18 years. Firm size differences are also evident, with mismatched workers more likely to be employed in smaller firms. Labor-market outcomes measured in the last wave (t+1) show significant disparities, with mismatched workers earning lower hourly wages (€2.45 vs. €2.72), being more likely to hold short-term contracts (47.1% vs. 43.8%), reporting higher quit intentions (2.4% vs. 1.5%), and working longer weekly hours (42.7 vs. 41.1). These descriptive differences indicate that horizontal mismatch is associated with worse labor-market outcomes, although more sophisticated methods are necessary in an attempt to establish causality.

4.3. The likelihood of being mismatched

Table 3 presents results from a linear probability model[2] estimating the conditional likelihood of being horizontally mismatched as a function of observable characteristics. This specification is descriptive in nature and serves to document selection patterns into mismatch rather than establish causal determinants. The dependent variable is a binary indicator equal to 1 if the individual is mismatched and 0 otherwise. Several individual characteristics are significantly associated with the likelihood of mismatch. Male workers are 7.3 percentage points more likely to be mismatched than female workers, a difference statistically significant at the 1 percent level. Conversely, greater educational attainment and longer tenure reduce the likelihood of mismatch: each additional year of education lowers the likelihood of mismatch by 5.1 percentage points, and each additional year of tenure decreases it by 0.4 percentage points; both effects are highly significant. Being married has a small but statistically significant positive association with mismatch, increasing the likelihood of mismatch by 1.7 percentage points. Living in a minority city does not significantly affect mismatch likelihood. Firm characteristics and regional factors also play an important role.

Table 3 The likelihood of being mismatched (Linear Probability Model)

	P (Horizontal Mismatch)	
Individual characteristics at time t		
Age	-0.002	(0.002)
Male	0.073***	(0.009)
Years of education	-0.051***	(0.002)
Tenure	-0.004***	(0.001)
Employed one year ago	0.018	(0.011)
Married	0.017*	(0.009)
Minority city	-0.037	(0.025)
Household characteristics in period t		
Number of household members >60 years	-0.003	(0.004)
Firm characteristics in period t		
Firm size	-0.011***	(0.004)
Region effects		
Prishtine (baseline)		
Mitrovica	-0.019*	(0.013)
Peja	0.018	(0.013)
Prizren	0.064***	(0.013)
Ferizaj	-0.021*	(0.013)
Gjilan	-0.017	(0.012)
Gjakove	-0.008	(0.013)
Fixed effects		
Field of study FE	Yes	
Industry FE	Yes	
Wave FE	Yes	
Number of observations	14,962	
R-squared	0.23	
Mean of dep.var	0.56	

Notes: Estimation based on a linear probability model with a binary outcome variable being 1 if horizontally mismatched, and zero otherwise. Standard errors in parentheses.

Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01

Source: Kosovo LFS (2012-2023), authors' calculations

Larger firm size is associated with a reduced likelihood of mismatch, with a coefficient of −0.011 significant at the 1 percent level. Among regional effects, workers in Prizren are significantly more likely to be mismatched (6.4 percentage points higher compared to Prishtine), whereas workers in Ferizaj and Mitrovica face a lower likelihood of mismatch. Overall, the model indicates that observable demographic, household, firm, and regional characteristics play a role in shaping the incidence of horizontal mismatch in Kosovo.

4.4. Estimation strategy

To assess the association between horizontal mismatch and subsequent labor-market outcomes, the following baseline model is estimated[3]:

$$Y_{i,t+1} = \beta_0 + \beta_1 M_{i,t} + \Gamma' X_{i,t} + \tau_t + \epsilon_{i,t}$$

Where $Y_{i,t+1}$ is one of four outcomes measured at time $t+1$ (the time span mostly covers three quarters after the first interview): hourly wage, weekly working hours, short-term contract status, or a binary indicator of quit intentions. $M_{i,t}$ equals 1 if individual i is horizontally mismatched at time t. The control vector $X_{i,t}$ includes gender, age-cohort dummies constructed in five-year bands, years of education, job tenure, marital status, prior-employment status, household composition (number of adults aged 60+), minority-municipality status, firm size, and field of study. Further, region, two-digit Nomenclature of Economic Activities (NACE) codes for industry, and survey-wave (year) fixed effects τ_t are added to absorb spatial, sectoral, and temporal heterogeneity in labor-market conditions.

This specification serves as a benchmark conditional association model. The coefficient of interest, β_1, captures the conditional association between horizontal mismatch and subsequent labor-market outcomes. However, because workers may sort non-randomly into mismatch based on unobserved characteristics (e.g., ambition, adaptability, or unmeasured ability), β_1 may be biased due to endogenous selection. More ambitious or highly adaptable individuals may voluntarily accept employment outside their original field if such jobs offer better wage prospects, faster career progression, or entry into expanding sectors. In this case, mismatch would be positively correlated with unobserved productivity traits, leading OLS to underestimate the true wage penalty (downward bias). Conversely, individuals with lower unobserved ability, weaker networks, or limited job-search effectiveness may be pushed into mismatched positions due to constraints in securing field-specific employment. In that scenario, mismatch would be negatively correlated with unobserved productivity, potentially exaggerating the estimated penalty (upward bias). Therefore, even after conditioning on the set of observables in $X_{i,t}$, treatment status may remain correlated with the error term $\epsilon_{i,t}$, thereby limiting a causal interpretation of the OLS estimate.

4.5. Matching strategy

To address observable sorting into mismatch and construct a credible comparison group, the ATT is estimated. Such an ATT cannot be identified from the data without further assumptions, since the counterfactual labor-market outcome for horizontally mismatched workers is unobserved. Under the assumption that all relevant observable factors X jointly influencing both labor-market outcomes and selection into mismatch are observed, labor-market outcomes are independent of mismatch status (Lechner 2001; Imbens 2000). This conditional independence assumption can be summarized by

$$E(Y_{it}^0 | M = 1, X = x) = E(Y_{it}^0 | M = 0, X = x)$$

where M is an indicator equal to one if horizontally mismatched, and zero otherwise and Y_{it}^0 denotes the potential labor-market outcome in the absence of mismatch. The suitability of the CIA relies on adequately capturing confounding variables that influence both the likelihood of being mismatched and the labor-market outcomes. If relevant confounders are omitted, the ATT estimate may be biased, as the treated and control groups would differ in unobserved ways that also affect their outcomes.

To address this concern, the analysis relies on theoretical and empirical literature[4] on educational mismatch, which identifies demographic characteristics, educational attainment, tenure, firm characteristics, and regional labor market conditions as key determinants of both mismatch and labor-market outcomes. Tables 2 and 3 serve to document that mismatch is systematically related to these observables in the Kosovo context, thereby supporting the plausibility of the CIA. Variables such as gender, education, tenure, and region were consistently associated with mismatch status, and are thus included in both the matching algorithm and regression models. The model also controls for household composition, firm size, field of study, industry affiliation, and survey wave. Household characteristics, such as the presence of elderly members or living in a minority-majority municipality, are not individually significant. However, their

inclusion remains important, as they help control for potential household-level constraints or broader community contexts that might influence employment decisions. Incorporating this extensive set of observed characteristics increases the plausibility of the CIA, mitigating biases arising from observable heterogeneity. Lastly, all conditioning variables are measured at time *t*, and outcomes at time *t+1*, reducing simultaneity bias and improving temporal ordering.

4.6. Matching estimation

An estimator of the ATT requires that, for each mismatched worker, a comparable adequately matched worker exists with similar characteristics along all observable dimensions that jointly influence both selection into mismatch and subsequent labor-market outcomes. To improve comparability across these groups, kernel matching is applied as the baseline specification. Kernel matching reweights control observations based on their proximity in the propensity-score distribution, allowing the full region of common support to be exploited while smoothing weights across comparable observations[5].

The propensity score is estimated using the set of conditioning variables $X_{i,t}$ capturing individual, household, firm, and regional characteristics measured at time *t*. These include age, gender, marital status, years of education, prior employment status, minority-municipality status, household composition (number of household members above age 60), firm size, industry classification (NACE), regional indicators, and survey-wave fixed effects. In addition, a detailed classification of field of education (e.g., social sciences, life sciences, agriculture, health care) is included. Field of education captures systematic differences in pre-labor-market human capital composition, including variation in technical, linguistic, craft, or social skill orientation. Taken together, this conditioning set captures the primary observable factors jointly determining selection into mismatch and labor-market outcomes. Propensity scores for mismatched workers (M=1) and adequately matched workers (M=0) are estimated using a probit model[6] and subsequently used to implement kernel weighting under the CIA.

$$P^M[M_{it}] = \Gamma X_{it} + \epsilon_{it}$$

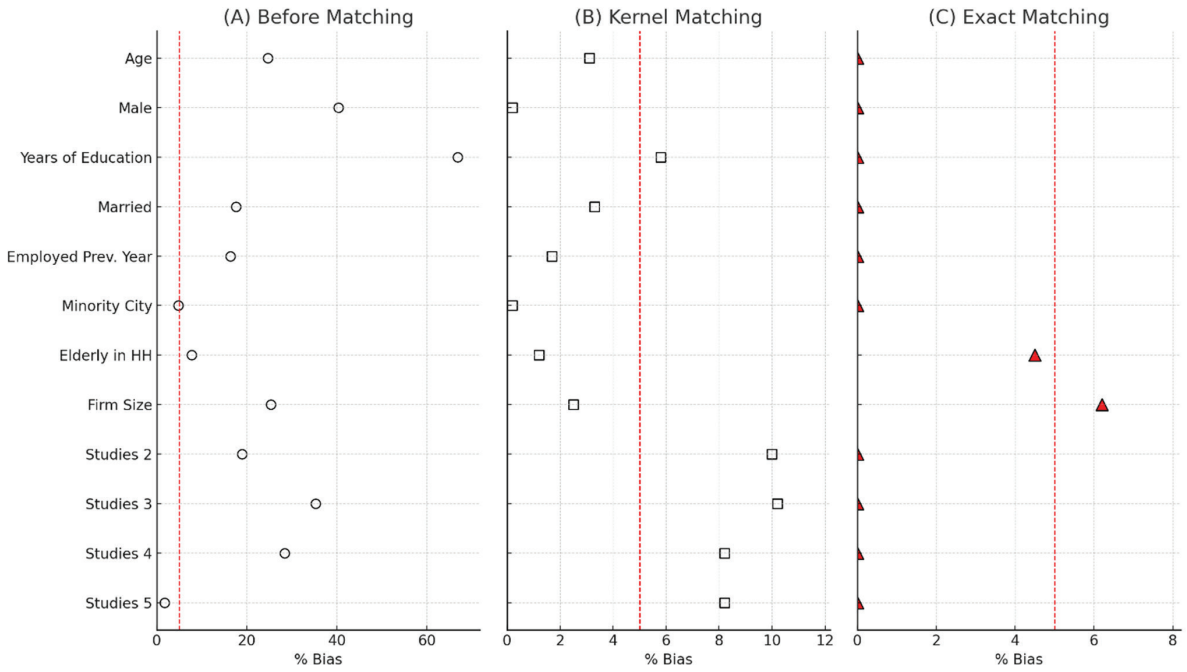
where M_{it} is an indicator equal to 1 if individual i is horizontally mismatched at time t, and 0 otherwise. The effects of mismatch can only be estimated for workers with an overlap in the conditioning variables between both comparison states. The common support is defined in terms of the propensity score, and observations outside the region of common support — defined by the overlap of the propensity-score distributions across treatment states — are excluded from the analysis.

In the final step, the counterfactual expectation of the outcome variable for mismatched workers is estimated. For each mismatched worker, one or more observations are identified within the subsample of adequately matched workers who are (i) similar with respect to the conditioning variables and (ii) as close as possible in terms of the estimated propensity score, where closeness is determined by the kernel weighting scheme. Multiple matches are allowed to ensure sufficient common support and to avoid excessive loss of observations. The treatment effect is computed as the difference in the mean of the outcome variable between the group of mismatched workers and their matched comparison group. Standard errors are obtained via bootstrapping. Figure 2 represents balancing tests for individual characteristics X_{it} of mismatched and adequately matched workers *before and after matching,* showing that standardized bias falls below the conventional 5 percent threshold for nearly all covariates after matching.

Further, as a robustness check, exact matching is implemented using the original unweighted dataset. Observations are grouped into strata defined by the full set of discrete covariates: gender, age group, prior employment status, region, marital status, field of study, education level, and survey wave. Strata that do not contain at least one treated and one control observation are discarded. Within the remaining strata, 1:1 matching without replacement is performed, and excess observations are dropped. This procedure reduces the estimation sample from 14,962 to 3,426 observations. By construction, the matched sample exhibits exact balance on all matching covariates (see Figure 2). Within the exactly matched subsample, the ATT effect (β_1) is estimated using OLS as a regression-adjustment step, adding household composition, firm-size category, and detailed industry dummies as residual controls to improve precision and account for any remaining imbalance.

Taken together, kernel re-weighting, used as the baseline ATT estimator, and exact matching, implemented as a sensitivity check, provide two complementary approaches to addressing selection on observables. The consistency of estimates across these methods supports robustness under selection on observables. Nevertheless, endogenous sorting into mismatch cannot be entirely ruled out, and treatment status may remain correlated with unobserved factors captured in $\epsilon_{i,t}$. Thus, caution is warranted when

Figure 2. Covariate balance before and after matching (Love Plots)



Source: Kosovo LFS (2012-2023), authors' calculations

interpreting the coefficient of interest β_1 in a causal way. This approach mirrors that of Wolfgang, Murati and Prenaj (2021), who apply a comparable matching framework in the context of mismatch using the same data source. Consistent wage and working hours penalties across the kernel-weighted and exactly matched specifications reinforce robustness to alternative matching designs under selection on observables. The convergence of results also suggests that remaining bias from imperfectly balanced observations is limited, although unobserved heterogeneity cannot be ruled out.

5. Estimation results

To evaluate the effect of horizontal mismatch on subsequent labor-market outcomes while addressing potential selection bias, three complementary specifications are reported. The baseline OLS estimates reported in Column (I) provide a benchmark conditional association between horizontal mismatch and subsequent labor-market outcomes. Horizontally mismatched workers earn €0.114 per hour less, corresponding to 4.2 percent of the mean hourly wage[7] among adequately matched workers. The estimate is statistically significant at the 1 percent level. With respect to working time, mismatched individuals work 0.255 additional hours per week, corresponding to 0.6 percent relative to the mean weekly hours of matched workers, and statistically significant at the 10 percent level. For contract stability, the OLS estimate indicates that mismatched workers are 2.0 percentage points less likely to hold a short-term contract, a statistically significant difference at the 5 percent level. Finally, quit intentions increase by 0.4 percentage points, a modest change relative to the baseline incidence and not statistically significant.

Column (II) reports kernel estimates, which serve as the main identification strategy under selection on observables. The estimated wage penalty increases to €0.163 per hour, corresponding to 6 percent of the mean hourly wage, and remains statistically significant at the 1 percent level. Working hours also increase by 0.374 hours per week, corresponding to 0.9 percent of the mean weekly hours, which is statistically significant at the 5 percent level. In contrast, the estimated effect on short-term contracts is −0.1 percentage points and statistically insignificant. Similarly, quit intentions increase by 0.3 percentage points, but the estimate is not statistically different from zero.

Column (III) presents the regression-adjusted OLS estimates within the exactly matched subsample as a robustness check. The estimated wage penalty increases further to €0.185 per hour, corresponding to 6.8 percent of the mean hourly wage, and remains statistically significant at the 1 percent level. Working hours rise by 0.334 hours per week, corresponding to 0.8 percent of the mean weekly hours, although the estimate is not statistically significant. The effect on short-term contracts turns positive at 2 percentage points but is statistically insignificant. Similarly, quit intentions increase by 0.8 percentage points; however, this estimate is also not statistically distinguishable from zero.

Across all specifications, the wage penalty associated with horizontal mismatch is consistent, statistically significant, and increases once selection on observables is addressed, indicating that the association is robust across alternative identification strategies. Effects on working hours are directionally consistent and suggest that workers may extend their weekly effort to compensate for wage losses, although the statistical strength of this effect varies.

Meanwhile, the short-contract coefficient swings from a modestly negative –2 percentage points in the full-sample OLS and kernel columns to a small, statistically weak positive 2 percentage points once exact matching is imposed. The fact that the coefficient changes sign may partly reflect Kosovo's large informal economy, where roughly one-third of employment is informal (Cojocaru 2017). Quit intentions, used as a proxy for job satisfaction, capture only one facet of satisfaction in a market with limited outside options. Given that only 1.5 percent of matched workers report such intentions, the variable has extremely low base prevalence and is likely too thin to detect a statistically robust mismatch effect.

Nonetheless, the evidence suggests that field-of-study mismatch is associated with meaningful real economic costs, primarily through earnings penalties and increased work intensity, underscoring its relevance as a policy concern in transition labor markets like Kosovo.

6. Heterogeneity analysis

This section examines heterogeneity in the impacts of horizontal mismatch across demographic and structural groups, indicating substantial variation. Results from Figures 3 and 4 and Table 5 indicate that mismatched workers generally experience significant wage penalties, though these vary notably across subgroups (The discussion focuses on kernel estimates, which serve as the main specification).

Male workers experience a wage penalty of €0.174 per hour (6.4 percent), while females face a similar penalty of €0.163 (6.1 percent). Age differences are more pronounced: prime-age workers incur a penalty of €0.210 (7.7 percent), and older workers experience a nearly identical and slightly larger penalty of €0.212 (7.8 percent), whereas younger workers face a

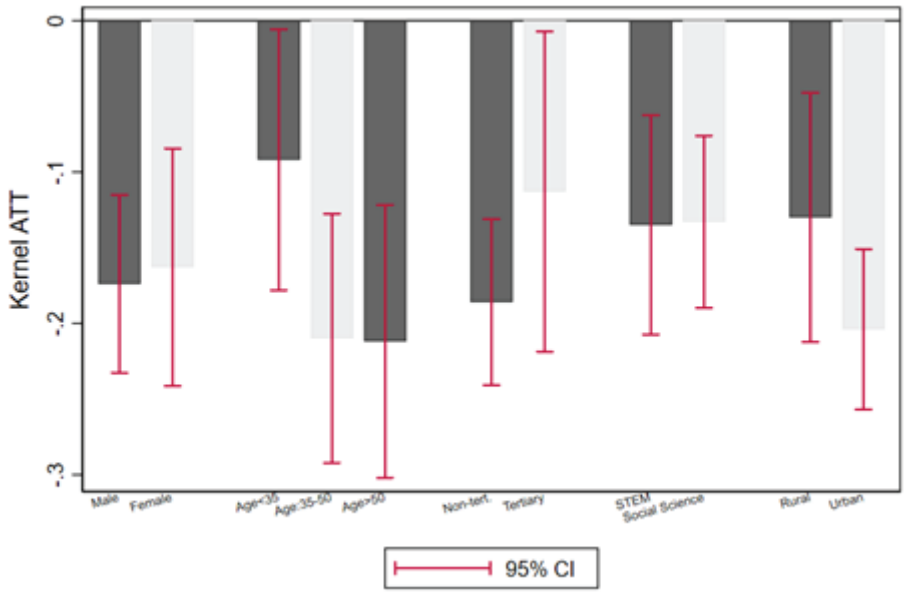
Table 4 Main estimation results

	(I) OLS Full Sample	(II) Kernel (PSM) Full Sample	(III) OLS Exact Match Sample
Hourly wage (t+1)	-0.114*** (0.031)	-0.163*** (0.026)	-0.185*** (0.044)
Working hours (t+1)	0.255* (0.133)	0.374** (0.176)	0.334 (0.275)
Short-term contract (t+1)	-0.020** (0.008)	-0.001 (0.011)	0.020 (0.017)
Quit intentions (t+1)	0.004 (0.003)	0.003 (0.004)	0.008 (0.005)
Observations	14,962	14,962	3,426

Notes: Column (I) reports baseline OLS estimates and serves as a benchmark conditional association. Column (II) presents the main identification strategy, kernel matching on the full sample, while exact matching with regression adjustment serves as a robustness check. Standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

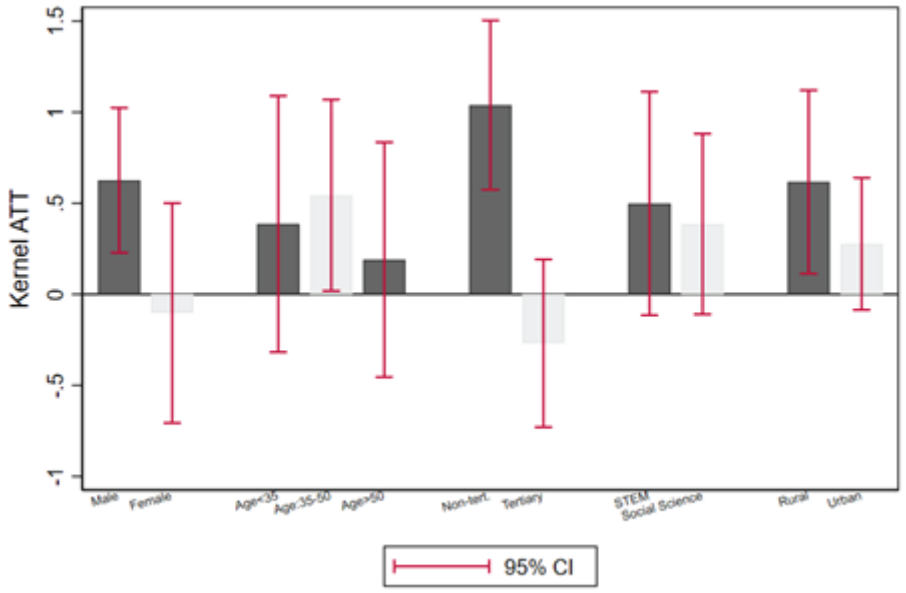
Source: Kosovo LFS (2012-2023), authors' calculations

Figure 3. Heterogeneous treatment effects: Hourly wage



Source: Kosovo LFS (2012-2023), authors' calculations

Figure 4. Heterogeneous treatment effects: Working hours



Source: Kosovo LFS (2012-2023), authors' calculations

substantially smaller effect of €0.092 (3.4 percent). This pattern suggests that horizontal mismatch is particularly costly during peak productivity years. Both STEM and social science graduates experience wage losses of €0.13 (5 percent), indicating that mismatch costs are not confined to specific academic domains but reflect broader structural inefficiencies in occupational allocation. Educational attainment moderates the impact. Non-tertiary-educated workers incur a penalty of €0.186 (6.8 percent), compared to €0.113 (4.2 percent) among tertiary graduates, suggesting that higher education partially buffers mismatch costs but does not eliminate them. Geographically, urban workers experience a larger penalty of €0.204 (7.5 percent),

Table 5 Heterogeneous Effects of Horizontal Mismatch by Outcome and Subgroup

	Male	Female	Young Age<35	Prime Age:35-50	Old Age>50	Non-tert.	Tertiary	STEM	Social Science	Rural	Urban
Hourly wage t+1	−0.174***	−0.163***	−0.092**	−0.210***	−0.212***	-0.186***	-0.113**	−0.135***	−0.133***	−0.130***	−0.204***
	(0.030)	(0.040)	(0.044)	(0.042)	(0.046)	(0.028)	(0.054)	(0.037)	(0.029)	(0.042)	(0.027)
Obs.	10,315	4,595	5,745	5,339	3,832	8,302	6,612	5,137	9,779	7,007	7,909
Working hours in t+1	0.626***	−0.103	0.386	0.544**	0.190	1.039***	-0.269	0.499	0.386	0.617**	0.277
	(0.203)	(0.308)	(0.359)	(0.268)	(0.329)	(0.237)	(0.235)	(0.313)	(0.253)	(0.257)	(0.185)
Obs.	10,341	4,599	5,763	5,347	3,836	8,327	6,619	5,151	9,795	7,026	7,920
Shor- term contract in t+1	−0.002	−0.010	−0.024	0.009	0.022	0.011	-0.019	0.011	0.012	−0.001	0.008
	(0.011)	(0.020)	(0.016)	(0.018)	(0.018)	(0.015)	(0.015)	(0.017)	(0.014)	(0.013)	(0.013)
Obs	10,348	4,611	5,773	5,349	3,843	8,339	6,626	5,157	9,808	7,034	7,931
Quit intention in t+1	0.003	0.006	0.002	−0.007	0.006***	0.003	0.009**	−0.012**	−0.016**	0.003	0.005
	(0.004)	(0.007)	(0.010)	(0.007)	(0.002)	(0.006)	(0.004)	(0.007)	(0.008)	(0.006)	(0.005)
Obs.	10,348	4,611	5,773	5,349	3,843	8,339	6,626	5,157	9,808	7,034	7,931

Note: Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01

Source: Kosovo LFS (2012-2023), authors' calculations

compared to €0.130 (4.8 percent) in rural areas, consistent with stronger competitive pressures in urban labor markets.

Kernel estimates indicate that mismatch is associated with increased working hours for several groups. Male workers increase weekly hours by 0.626 hours (1.5 percent), while the effect for females is small and statistically insignificant. Prime-age workers increase hours by 0.544 (1.3 percent), and rural workers by 0.617 hours (1.5 percent), suggesting compensatory effort in response to wage penalties. The largest increase is observed among non-tertiary-educated workers, who work 1.039 additional hours per week (2.5 percent), indicating that lower-educated mismatched workers may attempt to offset earnings losses by increasing their labor supply.

Across all subgroups, the effects of mismatch on short-term contract status are small and statistically insignificant. The estimated differences range from −2 to +2 percentage points and lack systematic patterns. These findings suggest that contractual instability in Kosovo is not strongly mediated by field-of-study mismatch but may instead reflect broader institutional or labor-market conditions.

Effects on quit intentions are generally limited and concentrated in specific groups. Older workers show a statistically significant increase of 0.6 percentage points, while tertiary-educated workers exhibit a 0.9 percentage point rise, both relative to a low baseline incidence. These magnitudes remain small in absolute terms. In contrast, male workers and younger individuals show no statistically significant change. Overall, dissatisfaction effects appear modest compared to the robust wage penalties documented above.

Taken together, the heterogeneity analysis reinforces three key findings. First, wage penalties are broad-based and particularly pronounced among prime-age and older workers, urban, and non-tertiary-educated workers. Second, increases in working hours across several groups — especially males, rural workers, and non-tertiary-educated individuals — suggest partial compensatory adjustment in response to lower earnings. Third, effects on contract stability and quit intentions are weak and inconsistent, indicating that the primary economic cost of horizontal mismatch operates through wages rather than contractual precariousness or widespread dissatisfaction. These patterns suggest that field-of-study mismatch in Kosovo results in tangible earnings losses across diverse groups, with particularly strong effects among workers in their core productive years.

7. Conclusion

This study presents an empirical analysis of horizontal mismatch and its labor market implications in Kosovo, covering the period from 2012 to 2023. Using data from the LFS, kernel matching is applied to address selection on observables in mismatch status. The baseline kernel estimate indicates that horizontally mismatched workers earn €0.163 less per hour, corresponding to 6 percent relative to the mean hourly wage of adequately matched workers. In addition, mismatched workers work 0.374 additional hours per week, corresponding to 0.9 percent relative to the mean weekly hours. By contrast, effects on short-term contracts and quit intentions are small and statistically insignificant once selection on observables is addressed.

These findings are consistent with international evidence, showing that wage penalties are the most robust consequence of horizontal mismatch across diverse contexts (Albert, Davia, and Legazpe 2025). The estimated 6 percent wage loss in this study falls within the range reported in prior research, including more modest penalties found by Zhu (2014) and Vecchia et al. (2023), and closer estimates by Robst (2007b), Montt (2017), and Pholphirul (2017). While some workers may accept mismatch status strategically (Robst 2007a), the broader literature also links mismatch to reduced job satisfaction, increased turnover intentions (Béduwé and Giret 2011; Shevchuk, Strebkov, and Davis 2015), and precarious contracts (Li et al. 2018). In the present analysis, however, the most robust effect is observed for wages. Evidence for non-wage outcomes is more limited: working hours increase modestly, indicating possible compensatory effort, while effects on short-term contracts and quit intentions are small and generally not statistically robust across specifications. These results indicate that, in the Kosovo context, the primary economic cost of horizontal mismatch operates through earnings rather than contractual instability or pronounced job dissatisfaction.

Importantly, the identification strategy relies on selection on observables (CIA). Although the analysis conditions on a rich set of demographic, educational, firm, regional, and time controls, unobserved factors, such as ability, motivation, career preferences, or informal networks, may still influence both mismatch status and subsequent outcomes. Thus, caution is warranted when interpreting the results as fully causal effects.

The findings of this paper suggest important policy implications. Because the estimated wage penalties persist even after conditioning on field of study and other observable characteristics, the results suggest that mismatch imposes costs within fields rather than merely reflecting compositional differences across educational tracks. Improving alignment between educational institutions and labor market demand, particularly by strengthening employer engagement in curriculum design and expanding high-demand technical and vocational programs, may therefore help reduce the incidence of horizontal mismatch and its associated penalties. Policies that enhance career counseling, strengthen employer–education linkages, and promote flexible skill acquisition (including lifelong learning programs) are also crucial. Finally, addressing systemic factors such as gender disparities, regional inequalities, and rigid recruitment norms will be essential to ensuring equitable labor-market outcomes.

While this study provides insights into the dynamics of horizontal mismatch in a transitional economy, several limitations remain. Future research could benefit from longitudinal data that combine objective measures of cognitive and non-cognitive ability or task-specific skill proficiency with job histories, richer information on skills utilization, deeper qualitative evidence on firm-side hiring practices, and comparative analyses across similar regional contexts. Addressing these gaps would further clarify the underlying mechanisms of horizontal mismatch and strengthen policies to improve labor-market efficiency and worker well-being.

Endnotes

1 Difference reports the raw mean difference between horizontally mismatched and adequately matched workers. Statistical significance is based on two-sided t-tests.

2 The regression analysis is conducted on the estimation sample (N = 14,962), restricted to individuals observed in consecutive survey waves (t and t+1) with non-missing information on all outcomes and control variables. This restriction ensures temporal ordering between mismatch status and outcomes and guarantees that OLS and matching estimations are performed on an identical sample for methodological comparability.

3 The model is closely aligned with Robst (2007b), Nordin, Persson, and Rooth (2010), Wolbers (2003), McGuinness (2008), Caroleo and Pastore (2018), Iriondo Múgica (2022), and Sulaimanova (2022).

4 Comprehensive reviews and meta-analyses of this literature include Groot and Maassen van den Brink (2000), Hartog (2000), Rubb (2003), Sloane (2003), McGuinness (2006, 2018), Somers et al. (2019), and McGuinness et al. (2025), among others.

5 For a discussion of the properties of matching estimators, see Imbens (2004).

6 The probit specification is used exclusively to construct the propensity scores for matching and does not serve as an outcome equation for estimating treatment effects.

7 Percentage effects are calculated relative to the mean outcome among adequately matched workers in the estimation sample, as reported in Table 2 ("Matched" column). Specifically, percentage wage effects are computed relative to the mean hourly wage (€2.72), percentage changes in working hours relative to the mean weekly hours (41.7), percentage point effects on short-term contracts relative to the baseline incidence (46.0 percent), and percentage point effects on quit intentions relative to its baseline rate (1.5 percent). The same reference means are used across all specifications (OLS, Kernel PSM, and exact matching) to ensure comparability).

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APPENDIX

Table A.1. Mapping adapted from Wolbers (2003), using ISCO-88 to match ASK data (2012–2017)

Field of Education	Matching ISCO-88 (COM) Job Codes
Education	200, 230, 231–235, 300, 330, 331–334
Humanities, Arts	200, 230, 231, 232, 243, 245, 246, 300, 347, 348, 500, 520, 521, 522
Social Sciences, Business, Law	100, 110, 111, 121–123, 130, 131, 200, 230–232, 241–245, 247, 300, 341–344, 346, 400, 401–422
Sciences	200, 211–213, 221, 230–232, 300, 310–313, 321
Engineering, Manufacturing, Construction	200, 213, 214, 300, 310–315, 700, 710–714, 721–724, 730–734, 740–744, 800, 810–817, 820–829, 831–834
Agriculture	200, 221, 222, 300, 321, 322, 600, 611–615, 800, 833, 900, 920, 921
Health, Welfare	200, 221–223, 244, 300, 321–323, 330, 332, 346, 500, 510, 513, 900, 910, 913
Services	300, 345, 400, 410–419, 421, 422, 500, 510–514, 516, 520, 522, 800, 831–834, 900, 910, 913

Table A.2. Mapping based on Eurostat conversion table from ISCED-F 2013 to ISCO-08 for 2018–2023

Field of Education (ISCED-F 2013)	ISCO 2008 at 3-digit codes (minor groups)
Teacher training and education science	134, 230, 231, 232, 233, 234, 235, 342, 530, 531
Humanities; arts	134, 216, 230, 231, 232, 233, 234, 235, 243, 260, 263, 264, 265, 340, 341, 343, 350, 352, 440, 441, 730, 731, 732, 753, 813
Social sciences; journalism and information	110, 111, 112, 134, 230, 231, 232, 233, 242, 260, 262, 263, 264, 343, 440, 441
Business, administration and law	100, 110, 111, 112, 120, 121, 122, 130, 131, 132, 133, 134, 140, 141, 142, 143, 230, 231, 232, 233, 240, 241, 242, 243, 261, 330, 331, 332, 333, 334, 335, 341, 400, 410, 411, 412, 413, 420, 421, 422, 430, 431, 432, 440, 441, 520, 521, 522, 523, 524, 600, 610, 611, 612, 613, 620, 621, 622, 923, 950, 951, 952
Natural sciences, mathematics and statistics	210, 211, 212, 213, 214, 225, 230, 231, 232, 233, 235, 310, 311, 313, 314, 324, 325, 331, 420, 422, 430, 431, 540
Information and Communication Technologies	133, 230, 231, 232, 235, 243, 250, 251, 252, 350, 351, 352
Engineering, manufacturing, construction	122, 132, 210, 214, 215, 216, 231, 232, 310, 311, 312, 313, 315, 700, 710, 711, 712, 713, 720, 721, 722, 723, 730, 731, 732, 740, 741, 742, 750, 751, 752, 753, 754, 800, 810, 811, 812, 813, 814, 815, 816, 817, 818, 820, 821, 834, 930, 931, 932, 940, 941
Agriculture, forestry, fisheries and veterinary	131, 213, 225, 231, 232, 314, 324, 335, 600, 610, 611, 612, 613, 620, 621, 622, 630, 631, 632, 833, 834, 920, 921
Health, welfare	134, 214, 220, 221, 222, 223, 224, 226, 230, 231, 232, 234, 235, 263, 320, 321, 322, 323, 325, 341, 530, 531, 532, 754
Services	134, 140, 141, 143, 226, 311, 315, 325, 330, 333, 335, 340, 342, 343, 400, 420, 422, 430, 432, 500, 510, 511, 512, 513, 514, 515, 516, 521, 524, 540, 541, 754, 830, 831, 832, 833, 835, 900, 910, 911, 912, 933, 940, 941, 950, 951, 952, 960, 961, 962, 010, 011, 020, 021, 030, 031