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EFFECTS OF FIELD OF EDUCATION ON LABOR MARKET OUTCOMES: THE CASE OF TÜRKİYE

Asst. Prof. Taylan AKGÜL (Ph.D.)*

ABSTRACT

This study explores the influence of higher education fields on labor market outcomes in Türkiye, addressing a critical gap in the literature. Utilizing data from Household Labor Force Survey from 2009 to 2023, the analysis examines how field-specific education impacts employment probabilities, wage disparities, and gender differences via the regressions run over for both genders and pooled sample. The descriptive findings reveal significant variations across disciplines, with science, technology, health, and law graduates experiencing higher employment rates and earnings compared to humanities and arts graduates. Produced statistics also show that gender disparities persist, with women disproportionately selecting lower-paying fields and facing barriers in traditionally male-dominated sectors. Regression results highlight the interplay between educational specialization, societal norms, and labor market structures. This research underscores the need for targeted policies to align educational outputs with labor market demands, reduce skill mismatches, and promote gender equity. These findings contribute valuable insights for policymakers and educators aiming to optimize the socio-economic returns of higher education in Türkiye.

Keywords: *Field of Education, Wage Inequality, Skill Mismatch, Labor Market Outcomes, Survey Data.*

JEL Classification Codes: *C81, I21, J24, J3.*

1. INTRODUCTION

The economic returns to education consistently capture the attention of scholars within the field of labor economics. It is extensively documented that a college degree is pivotal to economic opportunity, bestowing significantly higher lifetime earnings upon individuals with credentials compared to those without. Data indicate a substantial economic return associated with attending college and obtaining at least a two- or four-year degree. Private market returns on higher education are estimated to surpass those of other financial investments (McMahon, 2009). Therefore, higher education is regarded as one of the primary avenues for upward social mobility (Brennan and Naidoo, 2008). Moreover, higher education not only unlocks access to the highest-paying jobs but also reveals a

* Anadolu University, Labor Economics and Industrial Relations Department, Faculty of Economics and Administrative Sciences, Eskişehir/ Türkiye, Email: takgul@anadolu.edu.tr.

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significant pay disparity within occupations, with individuals possessing advanced education typically earning markedly more than their less-educated peers.

Although it is widely established that college graduates earn significantly high, less attention has been paid to the variations across different majors and how these differences impact an individual's labor market outcomes, such as employment, occupational status, and earnings. It is the center of the present study to examine the employment probability differences and wage disparities among college graduates who specialized in different fields. Investing in a college education enables an individual to generate a stream of labor income, contingent upon the characteristics of the chosen major. Global empirical evidence suggests that labor market outcomes (particularly wages) of college graduates are profoundly shaped by their chosen field of study. The analysis of labor market outcomes by field of study has become an increasingly prominent area of research, as wage disparities across higher education fields are likely to influence students' choices of university major. Furthermore, understanding the factors contributing to earnings differences across fields would provide valuable insights for academic policies. This is particularly vital in light of the continued growth of tertiary education in both developed and emerging countries, as the distribution of graduates across various fields significantly influences the skill composition of the future workforce (Di Paolo and Tansel, 2017).

In the majority of studies within the literature, the findings suggest that, after accounting for other influential factors, the income disparity among college graduates from different academic disciplines averages between 25% and 35%. The results of these studies demonstrate that, regardless of their occupations, STEM (Science, Technology, Engineering, and Mathematics) graduates earn considerably more over their lifetimes than graduates from non-STEM fields. College graduates in STEM majors are more likely to find employment and receive higher salaries than their peers who majored in non-STEM fields (Aydede and Orbay, 2015). Moreover, returns in fields such as law, social sciences, and business are significantly higher than those in the arts, education, and the humanities.

Earnings disparities are not only observed between individuals from different fields of study. There is also a significant variation across genders by field of study. Women who prioritize traditional gender role specialization may gravitate toward non-professional fields such as business, economics, humanities, liberal arts, or education, while men may tend to pursue engineering. The relative returns in these fields may be lower for women in comparison to men. The significant gender differences by field of study are further elucidated. This is due to both pecuniary and non-pecuniary factors associated with majors and their respective occupations. In terms of major selection, women's choices are influenced approximately twice as much by non-pecuniary attributes as by pecuniary ones. Studies indicate that women are more likely to select majors that experience less depreciation, thereby minimizing the costs associated with time spent away from the labor market for childcare. Furthermore, gender disparities in major choice are often attributed to the lingering effects of past labor market discrimination. Studies

identify gender segregation across fields of study, particularly the tendency of men to select higher-paying majors, as a key mechanism driving the gender earnings gap.

Why do different fields of study hold varying levels of value in the labor market? From the perspective of human capital theory, it is proposed that the learning environments, along with the competencies and skills acquired, differ across disciplines. Some areas of study may develop more productive skills than others. Additionally, fields vary in the balance they strike between imparting general skills and providing occupation-specific expertise. Signaling theory offers a different explanation, suggesting that certain fields of study demand greater prior ability for success. These more challenging fields are believed to yield higher labor market rewards. As a result, fields of study often act as a sorting mechanism, with students of higher ability gravitating toward more rigorous and rewarding areas, while less capable students tend to choose fewer demanding fields with lower returns. Employers, aware of these ability distributions, attribute greater signaling value to fields where success is closely tied to prior ability compared to those that rely less on such factors (Spence, 1973).

Another explanation, drawn from the social closure perspective, highlights the role of supply constraints on specific fields. Limited numbers of graduates in these fields can lead to unequal outcomes, as rising labor market rewards for scarce skills drive greater competition for program admissions. Through institutionalized selection processes, cognitively or financially advantaged individuals are more likely to secure entry into competitive programs, which raises the average ability of students in these fields and enhances their signaling power in the labor market (Weeden, 2002). The characteristics of educational institutions and their influence on the education-to-labor market transition also play a role. Employers may find it easier to assess productivity differences among graduates if higher education produces well-defined, structured degrees. In countries where most degrees are occupation-specific, such as law or engineering, employers may be less inclined to hire or promote graduates from fields with broader qualifications, like the humanities.

A related issue is the impact of a college major on occupational outcomes. The value of educational credentials depends on the alignment between a worker's field of study and their job. Graduates employed outside their field of study often face wage penalties, which vary by discipline. For example, fields like engineering, which are highly specialized, tend to incur larger penalties for mismatches than generalist fields like the liberal arts. Consequently, the connection between educational attainment and occupational placement has become a critical area of focus. While some degrees, such as medicine, lead directly to specific careers, others, like social sciences, offer less direct pathways. This alignment—or lack thereof—between credentials and jobs reflects structural characteristics of the education system that shape labor market outcomes. Mismatch in the labor market is categorized into two types: vertical mismatch, where workers are overqualified or underqualified for their roles, and horizontal mismatch, where workers' fields of study do not align with their job functions. Both types result in a gap between the skills acquired during education and those utilized in the workplace. Research

increasingly examines whether horizontal stratification—differences between fields of study—has become more influential than vertical stratification in determining labor market outcomes.

Lastly, gendered patterns in the choice of field of study influence occupational outcomes, particularly among women. Horizontal disparities between women are most pronounced at mid-career, coinciding with childbearing years for highly educated women, who often have children after establishing their careers. This suggests that the choice of field of study, particularly along gendered lines, plays a crucial role in shaping gender-specific occupational trajectories.

Türkiye, as a developing nation, has seen remarkable growth in its higher education sector over the past two decades. Between 2000 and 2018, the number of universities expanded significantly, leading to a sharp increase in university enrollment rates. Consequently, the number of graduates entering the workforce surged, growing 3.4 times between 2006 and 2021 (CoHE, 2022). While this rapid expansion in higher education has successfully addressed a substantial societal demand for college degrees, it has also given rise to an oversupply of graduates. Many are struggling to find jobs that align with their qualifications, pushing the country into a state of overeducation. This phase is marked by elevated levels of unemployment and underemployment among degree holders (Habibi, 2017). Research highlights a pronounced mismatch between the qualifications obtained through education and the skills required in the job market. Moreover, the economic returns on higher education vary significantly across fields of study, reflecting the differing supply and demand conditions for each discipline within the labor market (Aydede and Orbay, 2015; Di Paola and Tansel, 2017).

Numerous studies have analyzed education and skill mismatches in Türkiye. However, research focusing on the labor market outcomes of fields of study in higher education is remarkably scarce, while such studies are predominantly conducted for the developed country cases. An important reason for this lack in Türkiye is because the field-of-study question was not available before 2009 in labor force statistics. The relationship between labor market outcomes and college major choice is expected to provide valuable insights, particularly in countries with a large share of young population, such as Türkiye.

The present study adds to a modest yet expanding body of evidence that examines labor market disparities across fields of study in the context of a developing country. This is among the few studies that investigate the link between college major and labor market outcomes in the context of the Turkish labor market. To the best of our knowledge, this is the first study to examine the employment probability among college graduates who hold a degree in a different field of study in addition to earnings differences which previous studies in the Turkish literature specifically provide evidence on. The findings are expected to offer new insights into labor market outcomes across fields of study, providing valuable evidence for policy interventions aimed at improving the alignment between education and labor markets in Türkiye.

The outline of the study is as follows. Section 2 reviews the existing literature. In Section 3, data and methodology is reported. Section 4 presents the findings. Finally, Section 5 concludes.

2. LITERATURE REVIEW

There is a substantial body of research examining the economic benefits of education at different levels, but scholars have increasingly turned their attention to the labor market outcomes associated with specific fields of study. Much of this research has concentrated on the role of academic disciplines in explaining wage differences, often relying on data from developed nations (e.g., Hansen, 2001; Van de Werfhorst and Kraaykamp, 2001; Finnie and Frenette, 2003; Kelly et al., 2010; Long et al., 2015; Altonji et al., 2012; Altonji et al., 2014). Notably, graduates in Natural Sciences consistently earn the highest wages, whereas those in the Arts and Humanities tend to earn the least. This pattern has been observed across various countries (e.g., Wahrenburg and Weldi, 2007 for Germany; Rumberger and Thomas, 1993, and Arcidiacono, 2004 for the US; Bratti and Mancini, 2003 for the UK; Finnie and Frenette, 2003 for Canada; Chia and Miller, 2008 for Australia; Kelly et al., 2010 for Ireland). Additionally, Black et al. (2003) analyzed U.S. data to investigate the financial advantages of studying economics. Livanos and Pouliakas (2011) highlighted that wage returns differ considerably between fields of study in Greece, finding that disciplines like law, engineering, social sciences, and business yield significantly higher earnings compared to areas such as arts, education, and humanities.

Only a small number of studies have explored how labor market outcomes influence the choice of college majors, particularly in the context of developing countries. Hastings et al. (2016) use survey and administrative data from Chilean students to examine the role of perceptions about earnings and costs in selecting degrees, defined at the institution-major level. They find that students who prioritize labor market outcomes when choosing their degrees are less likely to overestimate the earnings of past graduates and are more inclined to select programs associated with higher earnings potential. In a related study, Hastings et al. (2015) investigate the impact of providing information about earnings and costs on degree selection among Chilean students. Students were initially asked about their college preferences and their perceptions of costs and earnings. A random subset of students was then provided with specific information about the earnings and costs of graduates from their preferred programs, and their subsequent enrollment decisions were tracked. The findings indicate that such interventions encourage low-SES students to pursue degrees with higher net earnings.

Another branch of research emphasizes the importance of the specific field of study in influencing social stratification and examines its effects on various labor market outcomes, including occupational prestige (van de Werfhorst, 2004; Smyth, 2005), job mismatches (van de Werfhorst, 2002; Wolbers, 2003), access to high-status professional positions (Kim and Kim, 2003), employment status (Smyth, 2005; Reimer and Steinmetz, 2007; Reimer et al., 2008), and income (van de Werfhorst, 2004; Bobbitt-Zeher, 2007). Reimer et al. (2008) provide an extensive analysis of how different educational fields

impact two key labor market outcomes—unemployment risk and occupational status—across 21 European countries. Their findings underscore the importance of analyzing these outcomes together, as fields that lead to higher occupational prestige may not always reduce unemployment risks. Other studies reveal variations in the alignment between educational qualifications and occupational outcomes, both across and within national education systems (Vogtenhuber, 2014; DiPrete et al., 2017; Forster and Bol, 2018). For example, DiPrete et al. (2017) highlight significant heterogeneity in how educational attainment translates into occupational distributions within a single country and identify substantial cross-national differences in both the strength and pattern of these linkages.

Several studies indicate that in cases of vertical mismatch, individuals receive a diminished return for educational qualifications that exceed or fall short of the requirements for their jobs, as compared to those whose qualifications align with the job's demands (McGuinness, 2006; Nordin et al., 2010). Similarly, Pedulla (2016) finds a pronounced scarring effect of mismatch: workers with a history of holding qualifications higher than those required for previous positions face penalties in the labor market. The economics literature (e.g., Kirkeboen et al., 2016) has increasingly drawn on earlier sociological work on horizontal mismatches (Van de Werfhorst, 2002; Wolbers, 2003), examining whether workers are employed in jobs that correspond to their field of study, and exploring the labor market consequences of such horizontal (mis)matches.

Several other studies in another line examine how relative wage disparities across fields of tertiary education are likely to influence the choice of university major (Montmarquette et al., 2002; Arcidiacono (2004); Beffy et al., 2012; Long et al., 2015; Altonji, 2016; Yu and Hsieh, 2022). Arcidiacono (2004) highlights the significant disparities in earnings and abilities across different majors, using data from U.S. students who chose their college majors in 1972 (during their first year) and 1974, with reported earnings in 1986. He finds that considerable earnings differences persist even after controlling for self-selection based on ability. Yu and Hsieh (2022), by analyzing longitudinal survey data from Taiwan, which tracked the 1984-1985 birth cohort from 2001 to 2015, reveals that social class significantly influences students' choice of majors and career pathways, which, in turn, plays a crucial role in shaping their labor market outcomes.

Gender side of the issue has also been considered. Charles and Bradley (2002) argue vertical and horizontal stratification to explain gender segregation in higher education. A considerable body of sociological research has examined the influence of field of study on the gender wage gap (Bobbit-Zeher, 2007; S. Morgan et al., 2013). While these studies highlight gender segregation in academic fields as a key factor contributing to the gender earnings gap, there is evidence suggesting that lucrative fields benefit both men and women equally (e.g., Ma and Savas, 2014). Smyth and Steinmetz (2008) examine gender segregation across educational fields and occupational industries in 17 European countries. This issue is particularly pertinent given that gender inequality in university attendance has largely diminished, or even shifted in favor of women. However, gender segregation in the labor market

remains notably persistent. It is crucial to determine whether occupational segregation is entirely attributable to educational field segregation, or whether it continues to exist independently even after controlling for educational factors. Kim et al (2015) investigates the role of field of study in steering women and men into 'gender-appropriate' occupations. This study explores how selected institutional factors contribute to cross-national variations in gender-specific occupational allocation processes. Furthermore, it considers whether the impact of field of study differs across countries and examines the extent to which these variations can be explained by specific institutional factors.

Due to the absence of field-of-study data in the Household Labor Force Survey (HLFS) prior to 2009, there is a lack of studies in Türkiye that explore the relative labor market outcomes of different majors or examine wage disparities across fields of study. There are studies comparing labor market outcomes for general versus vocational and technical secondary education (VHS) (Tunali, 2003), estimating the impact of school quality on transitions to higher education (Ilhan and Oz, 2013), analyzing the wage premium of tertiary education (Salehi-Isfahani et al., 2009; Tansel and Bircan, 2010), and assessing the returns to VHS versus general high school education (Tansel, 1999a, 1999b).

More recently, Di Paolo and Tansel (2017) examine the factors influencing wage disparities among college graduates based on their respective fields of study. Their empirical analysis draws on data from the HLFS Survey, covering the period from 2009 to 2015. The authors identify wage differences across fields of study, partially attributed to variations in observable characteristics such as occupation and employment sector. They estimate conditional wage gaps by field of study using ordinary least squares (OLS) regressions. To further explore the distributional wage disparities by field of study, the authors present estimates across the unconditional wage distribution using RIF regressions. Aydede and Orbay (2016) analyze the labor market dynamics driving the unparalleled demand for higher education and the stagnating growth rates in vocational high school (VHS) education in Türkiye. Utilizing data from the 2009-2012 Labor Force Surveys, the study examines wage differentials across various fields of study for both VHS and higher education graduates, providing a comparative analysis. The authors find that, in most majors, university graduates enjoy significant wage premiums compared to both non-degree holders and VHS graduates, supporting the growing demand for higher education. However, this trend does not apply to workers with vocational certificates as their highest level of education. Furthermore, while 13% of university graduates occupy jobs requiring only elementary education, only 53% of positions that demand higher education are filled by university degree holders. The remaining labor demand is satisfied by undereducated workers with lower qualifications. The study concludes that only 10 out of 21 fields of study provide graduates with the skill sets necessary to secure higher wages than non-degree holders. Patrinos et al. (2019), using data from the 2017 Household Labor Force Survey (HLFS), find that the average rate of return to education in Türkiye is 8.8 percent, which is close to the global average. The study further reveals that women experience higher returns to education compared to their male counterparts.

Research on labor market mismatches in Türkiye has gained prominence, with several studies exploring different aspects of education and job alignment. Filiztekin (2011) investigates education mismatches in the Turkish labor market using data from the 1994 and 2002 Household Budget and Expenditure Surveys. The study applies the Realized Matches (RM) approach and evaluates mismatches using both the mean and mode methods. Using the ORU model to analyze the impact on earnings, the findings reveal that overeducation affected 20.3% (mode) and 13.4% (mean) of the workforce in 1994, increasing to 24.6% (mode) and 15.1% (mean) by 2002. Overeducated individuals earned more than their less-educated peers in mismatched jobs but earned less than those with equivalent education in well-matched roles. Orbay and Aydede (2015) analyze educational mismatch and underutilization costs using Labor Force Survey data from 2009 to 2012. Their study, employing the ORU, RM, and VV models, reveals a 54% mismatch rate in Türkiye and shows that overeducation leads to wage reductions, whereas undereducation results in unexpected wage gains. Similarly, Mercan et al. (2015) adopt a sectoral perspective and identify significant levels of both undereducation and overeducation within various sectors of the Turkish labor market. Acar (2016) uses panel data from the Survey of Income and Living Conditions (2006–2010) to assess the effect of education mismatches on wages and finds no significant influence of either overeducation or undereducation on earnings. Duman (2018), using data from the European Working Conditions Survey and the 2015 Household Labor Force Survey, examines sectoral wage effects and finds that overeducation reduces earnings compared to required education levels in both public and private sectors, although the wage penalty is smaller in the private sector.

Ege (2020) shifts focus to unemployment and employment rates by field of study, showing that graduates from fields with high employment rates are less likely to experience mismatched employment. However, no statistically significant relationship was found between mismatch and unemployment rates at the field-of-study level. Orbay et al. (2021) use 2014–2016 HLFS data to explore mismatch rates and wage penalties among university graduates, reporting that over 40% of the workforce works outside their field of study. However, the study concludes that field-of-study mismatches do not significantly affect wages. Ege and Erdil (2023) conduct a comprehensive review of studies on vertical and field-of-study mismatches in Türkiye, analyzing trends over time and their overlap using Turkish Statistical Institute labor force survey data. They find that mismatch rates in higher education have grown faster than those in vocational and technical high schools. Additionally, 40.6% of higher education graduates and 70.2% of vocational and technical high school graduates experience at least one form of mismatch. Finally, Plevneli Düzçay (2024), utilizing OECD's Programme for the International Assessment of Adult Competencies (PIAAC) data, examines the gaps between educational outcomes and labor market demands in Türkiye. The study emphasizes the growing need for policy interventions to better align education with labor market requirements, particularly in light of technological advancements shaping job demands.

Finally, there are three more studies examining the issue from a different angle, the college major choice decision. Caner and Okten (2010) investigate a college major risk decision and return. Using a random sample from individual-level university entrance exam (OSS) data from 2002, they discover that parental income and self-employment status are key factors in determining whether students choose riskier majors over less risky ones. In a similar vein, Yazici and Yazici (2010) conduct a survey of 449 undergraduate students across three universities in Türkiye. Their findings highlight that students prioritize factors such as interest in the subject, job security, expected earnings, university entrance exam scores, and the prestige of the career when selecting their college major. Lastly, in her thesis study, Erdemli (2018) examines the relationship between major-specific quotas, labor market outcomes, and students' college major choices, using extensive nationwide data from the Student Selection and Placement Centre (OSYM), which includes information on all students admitted to undergraduate programs in Türkiye, as well as data from the Household Labor Force Statistics. The findings indicate that students are more responsive to unemployment rate information related to their chosen major than to data concerning wages or employment probabilities.

3. DATA AND METHODOLOGY

3.1. Data

We use HLFS microdata for the period 2009-2023 because the question regarding the education field was firstly asked to individuals with a vocational high school or university and higher education diploma in 2009. Since there is a heterogeneous distribution regarding fields of vocational high school degree holders, we include only the individuals with university or higher education. Thus, our sample consists of individuals with university or higher education degree whose ages are less than 65. Three years (2009, 2016 and 2023) are selected for presentation of analysis as the beginning, middle and end of the period. Descriptive statistics and regression results for other years are available upon request. Table 1 offers an extensive analysis of indicators across various college degree fields from 2009 to 2023. The data tracks four selected main aspects: the female ratio in graduates, the rate of employment in public sectors, unregistered employment rate, and unemployment rate.

The female ratio in graduates shows significant variation across fields. Traditional fields like Education, Arts, and Health maintain a strong female presence, with an increase over time. For instance, in Educational Sciences, the female ratio increased from 48.6% in 2009 to 63.3% in 2023. Mathematics and Statistics, Biology and Environmental Sciences, Languages, Social and Behavioral Sciences and Law are also among the fields that female ration in graduates has increased significantly over the analyzed period. Conversely, fields such as Engineering and Security services show persistently low female representation, with minor growth. Social Services field experienced sharp fluctuations. While the female ratio peaked at 91.1% in 2016, it declined to 78.0% in 2023, alongside volatile employment rates.

The rate of public sector employment generally declines over the years for most fields. Educational Sciences exemplifies this trend, dropping from 75.8% in 2009 to 66.8% in 2023. Security services remain an outlier with consistently high public sector employment as expected, though it decreased from 91.3% in 2009 to 72.6% in 2023. Declines in public sector rates suggest a shift towards private sector roles or diversification in employment opportunities. The total public sector employment rate declined from 47 % in 2009 to 38.2 % in 2023.

Unregistered employment rates largely decrease, highlighting improved formalization in the job market. For example, the Arts field's unregistered employment rate dropped from 13.8% in 2009 to 8.5% in 2023. However, Journalism and Information experienced an increase in unregistered employment, rising to 11.8% by 2023, reflecting possible challenges in formal job creation within that sector. The total unregistered employment rate declined from 8.7% in 2009 to 5.7 % in 2023.

Unemployment rates reflect varying economic pressures and job market dynamics. Fields like Health, with a low unemployment rate (3.0% in 2009), saw slight increases to 9.9% in 2023, hinting at growing saturation or broader economic issues. Meanwhile, Arts and Humanities fields saw notable declines in unemployment rates over time, indicating improved alignment with job opportunities. The total unemployment rate has declined from 12.2 % in 2009 to 10.2 % in 2023.

Across all fields, there is a clear trend of increasing female representation, albeit unevenly distributed. The total female share in graduates increased to 49.4 % in 2023 from 42.4 in 2009. Employment in the public sector is gradually diminishing, and unregistered employment rates are decreasing. These indicators point to structural shifts in education and employment landscapes, with varying impacts across disciplines.

Table 1. Selected Indicators About College Degree Fields

Year	**2009**				**2016**				**2023**			
Education Fields	**Female Ratio in Graduates**	**Rate of Public in Employment**	**Unregistered Employment Rate**	**Unemployment Rate**	**Female Ratio in Graduates**	**Rate of Public in Employment**	**Unregistered Employment Rate**	**Unemployment Rate**	**Female Ratio in Graduates**	**Rate of Public in Employment**	**Unregistered Employment Rate**	**Unemployment Rate**
Educational sciences	48.6	75.8	6.9	9.4	53.9	74.5	4.2	8.8	63.3	66.8	4.7	9.1
Arts	63.1	28.8	13.8	22.1	60.0	22.0	10.4	21.5	59.7	20.2	8.5	12.8
Humanities	46.5	71.3	5.5	10.7	47.5	78.6	3.4	10.8	57.0	61.3	7.5	12.8
Languages					64.4	54.7	7.2	14.4	72.2	37.1	8.9	12.2

Social and behavioral sciences	36.3	40.8	8.1	11.9	43.0	36.5	5.2	13.7	51.5	33.6	6.3	11.3
Journalism and information	54.8	38.5	3.7	20.3	50.6	26.7	8.9	21.0	51.2	26.3	11.8	13.4
Business and management	47.2	32.5	9.5	16.1	46.9	31.9	5.9	14.1	46.6	32.3	5.8	9.8
Law	38.9	26.6	14.1	3.6	42.3	33.8	6.9	6.4	54.0	28.3	7.7	8.7
Biology and Environmental Sciences	55.0	58.3	5.5	12.6	60.2	50.1	2.0	14.9	65.1	44.0	6.2	10.7
Physical sciences	45.8	40.0	8.4	14.1	44.0	37.4	3.9	12.5	45.3	38.0	3.6	8.9
Mathematics and statistics	38.9	54.1	6.7	11.7	47.4	49.8	6.5	14.8	54.6	38.6	7.6	11.2
Information and Communication Technologies	33.6	18.5	11.9	17.0	38.7	16.9	8.6	17.2	36.4	18.5	7.7	12.2
Engineering and works	10.8	19.4	12.2	11.9	16.0	19.6	5.7	9.7	19.4	15.9	4.5	8.5
Manufacturing and processing	46.3	21.4	11.2	19.6	57.6	20.9	8.2	19.0	59.3	17.7	5.6	16.0
Architecture and construction	30.5	29.1	11.9	12.0	28.0	24.7	6.3	13.3	33.8	23.3	6.7	10.0
Agriculture forestry and fishing	35.3	47.9	9.8	15.7	34.7	43.4	6.7	13.2	34.2	42.3	6.6	8.4
Veterinary	38.9	60.5	6.3	6.1	45.6	68.3	1.8	6.8	42.9	48.6	9.7	8.6
Health	62.8	69.9	4.2	3.0	66.3	65.6	2.5	6.5	66.9	54.0	3.3	9.9
Social services	60.7	73.6	5.7	0.0	91.1	33.5	5.9	24.4	78.0	44.6	7.2	22.2
Occupational Health and Transportation services	47.6	36.0	10.9	20.6	23.5	21.9	12.9	23.1	38.5	21.5	4.5	13.0
Security services	2.8	91.3	4.4	1.2	9.9	83.3	4.5	4.6	19.6	72.6	6.5	6.3
Personal services	54.1	31.2	10.2	15.8	49.0	26.9	8.5	17.1	46.7	23.4	6.3	10.9
Total	42.4	47.0	8.7	12.2	45.3	42.5	5.5	12.3	49.4	38.2	5.7	10.2

Source: Author's own calculations

The second table presents an analysis of wage ratios across selected education fields for the years 2009, 2016, and 2023, focusing on three dimensions: male/female wage ratio, public/private wage ratio, and registered/unregistered wage ratio.

In general, wage disparities between men and women have narrowed over time. In 2009, fields like Journalism and Information showed significant gender disparity, with a male/female wage ratio of 2.8. By 2023, this had reduced to 1.5. Similarly, in Health, the ratio decreased from 1.7 in 2009 to 1.4 in 2023, though progress has been uneven in some fields. Mathematics and Statistics experienced an increase in disparity, rising from 0.9 in 2016 to 1.3 in 2023. Overall, the total male/female wage ratio improved from 1.3 in 2009 to 1.2 in 2023, signaling modest strides toward gender parity.

The public/private wage ratio remained relatively stable, with slight fluctuations. Fields such as Law had a consistently high ratio, starting at 3.6 in 2009 and decreasing to 1.5 in 2023, suggesting a narrowing wage gap between these sectors. Conversely, Security Services showed a temporary increase, reaching 1.7 in 2016, before returning to 1.1 in 2023. This trend indicates that differences in

compensation between public and private sectors are decreasing in most fields, potentially reflecting shifts in employment policies or market dynamics.

The most notable changes occurred in the registered/unregistered wage ratio, reflecting stark disparities. For instance, in Educational Sciences, the ratio plummeted from 5.5 in 2009 to 2.2 in 2023, indicating improvements in formal wage structures. Similar reductions occurred in other fields like Arts (from 4.3 to 1.1) and Social and Behavioral Sciences (from 4.4 to 1.6). However, some fields, such as Mathematics and Statistics, saw an increase in the registered/unregistered wage ratio, climbing from 3.2 in 2016 to 3.5 in 2023, suggesting lingering challenges in equitable wage distribution.

Overall, wage inequality has decreased across most dimensions. The narrowing male/female wage gap is a positive trend, reflecting efforts toward gender equity. Similarly, the reduction in public/private wage disparities indicates growing alignment between these sectors. The registered/unregistered wage ratio highlights persistent, though diminishing, challenges in formalizing employment structures. These patterns collectively suggest incremental progress in wage equity and labor market dynamics across educational fields over the studied years.

Table 2. Wage Ratios Over Selected Categories

Year	2009			2016			2023		
EducationFields	Male/Female Wage Ratio	Public/Private Wage Ratio	Registered/Unregistered Wage Ratio	Male/Female Wage Ratio	Public/Private Wage Ratio	Registered/Unregistered Wage Ratio	Male/Female Wage Ratio	Public/Private Wage Ratio	Registered/Unregistered Wage Ratio
Educational sciences	1.2	1.8	5.5	1.1	1.4	2.4	1.2	1.5	2.2
Arts	1.3	1.7	4.3	1.2	1.4	1.6	1.1	1.3	1.1
Humanities	1.5	1.5	4.1	1.3	1.5	2.2	1.3	1.4	2.5
Languages				1.2	1.2	2.0	1.2	1.4	1.9
Social and behavioral sciences	1.3	1.4	4.4	1.2	1.2	2.0	1.2	1.2	1.6
Journalism and information	2.8	0.5	7.5	1.3	1.1		1.5	1.2	1.0
Business and management	1.7	1.4	3.3	1.3	1.3	2.1	1.2	1.3	2.2
Law	1.3	3.6	10.8	1.3	1.8	3.6	1.1	1.5	2.4
Biology and Environmental Sciences	1.2	1.7	2.0	1.0	1.3	3.0	1.2	1.5	1.3
Physical sciences	1.4	1.3	5.0	1.2	1.2	2.1	1.1	1.1	2.3
Mathematics and statistics	1.1	1.7	2.7	0.9	1.0	3.2	1.3	0.7	3.5

Information and Communication Technologies	1.2	1.1	4.5	1.2	1.1	2.1	1.2	1.2	2.9
Engineering and works	1.2	1.4	3.0	1.0	1.1	1.7	1.1	1.0	1.4
Manufacturing and processing	2.1	1.6	4.5	1.3	1.3	2.4	1.4	1.4	1.4
Architecture and construction	1.2	1.5	2.8	1.1	1.2	2.1	1.2	1.3	1.9
Agriculture forestry and fishing	1.5	2.2	7.0	1.2	1.6	1.9	1.2	1.5	2.3
Veterinary	0.8	3.4	4.0	1.2	1.3	2.2	1.2	1.6	2.0
Health	1.7	0.4	11.4	1.4	1.2	3.3	1.4	1.6	2.6
Social services	1.9	1.6		1.2	1.7	2.2	1.3	1.6	2.9
Occupational Health and Transportation services	0.7	1.3	6.4	0.8	1.1	2.1	1.5	1.0	2.3
Security services	1.3	1.1	4.3	1.2	1.7	3.2	1.2	1.1	3.3
Personal services	1.5	1.4	2.5	1.3	1.3	2.3	1.3	1.2	2.5
Total	1.3	1.3	4.3	1.2	1.3	2.2	1.2	1.2	2.0

Source: Author's own calculations

3.2. Model and Methodology

We apply a probit model in order to explain the effect of university degree field on employment probability over the HLFS micro data of each year in 2009-2023 interval on male, female and pooled samples. Other than the degree field, explanatory variables include age, square of age, marital status and household size. Also, we include gender as a dummy variable in pooled sample model in addition to mentioned explanatory variables. Marital status is included as a dummy variable whose base category is being "single" and the base category for gender dummy in pooled model is "female". For degree field dummy "Personal Services" is chosen as base category. Thus, the estimated probit regression is:

$$P(Emp)_i = \alpha_0 + \alpha_1 Age_i + \alpha_2 AgeSquare_i + \alpha_3 HouseHoldSize_i + D_1 DegreeField_i + D_2 MaritalStatus_i + \varepsilon_i \quad (1)$$

for male and female samples. For the pooled sample, we estimate:

$$P(Emp)_i = \beta_0 + \beta_1 Age_i + \beta_2 AgeSquare_i + \beta_3 HouseHoldSize_i + D_1 DegreeField_i + D_2 MaritalStatus_i + D_3 Gender_i + \mu_i \quad (2)$$

We anticipate the coefficients for age to be positive across all regressions, as age serves as a proxy for experience, which significantly enhances the likelihood of employment. Conversely, the coefficient for the square of age is expected to be negative, reflecting the diminishing returns associated with increasing age. Household size is projected to exert a negative influence on employment probability across all samples. Additionally, being male is anticipated to yield a positive coefficient in the pooled regression, primarily due to societal norms and traditional gender roles that create structural barriers to female labor force participation.

The regression samples are drawn from individuals under the age of 65 who have attained at least a university degree. The dataset included approximately 24,000 observations for 2009, which progressively expanded to around 63,000 observations by 2023 in the pooled groups. In the initial year, females constituted roughly 36% of the pooled sample, rising steadily to 43% by 2023, reflecting the growing involvement of women in higher education and the workforce. Since each observation is weighted for its representativeness, the samples effectively mirror the entire highly educated labor force of Türkiye.

Before conducting the regressions, normality checks were performed using kurtosis and skewness tests. These checks are crucial because when error terms deviate from a normal distribution, a logit model is generally more appropriate than a probit model. However, given the substantial size of the dataset, it is highly likely that the error terms conform to normality, as confirmed by the tests. Consequently, three regressions were conducted for each year within the study period, disaggregated into female, male, and pooled samples.

4. RESULTS

Table 3 presents probit regression results (coefficients) which evaluate employment probability across pooled, male, and female samples for the years 2009, 2016, and 2023. The regression results for other years are available upon request. This analysis interprets key findings from the regression results and evaluates their implications for understanding employment determinants.

Age consistently exhibits a positive and significant association with employment probability across all groups and years. This indicates that older individuals tend to have higher probabilities of being employed, possibly due to accumulated experience, skills, or stable employment patterns as individuals mature. However, the negative coefficient for age squared reflects diminishing returns of age on employment, aligning with the notion that employment likelihood peaks at a certain age before declining, possibly due to retirement or declining physical capacity. The coefficients for age remain statistically significant at the 1% level for all years and gender groups, showing robustness in this relationship. For example, the age effect is slightly stronger for females than males in most years, suggesting that women who remain in the workforce as they age may benefit more significantly from experience.

The positive and significant male coefficient in the pooled sample underscores persistent gender disparities in employment probabilities. Men consistently exhibit higher employment probabilities compared to women across all years, with coefficients showing a modest increase over time. This reflects entrenched structural and cultural norms favoring male employment, although the size of the coefficient also points to potential labor market inequalities.

Marital status plays a crucial role in shaping employment outcomes. Being married significantly increases the likelihood of employment for both genders, though the effect is notably stronger for males.

For instance, in 2009, the male coefficient for being married is substantially higher than the corresponding female coefficient, indicating societal expectations where married men are perceived as primary breadwinners. Divorced individuals exhibit mixed results. For males, the effect of divorce becomes positive in later years, possibly reflecting increased labor market activity as a necessity post-divorce. In contrast, for females, divorce often has a negative association with employment, potentially linked to caregiving responsibilities or reduced social and financial support networks. Widowed individuals similarly show variability; females' coefficients are generally positive, especially in recent years, perhaps indicating a necessity-driven engagement in the labor market.

The negative and significant coefficients for household size across all groups and years suggest that larger households constrain individual labor force participation. This could be due to increased caregiving responsibilities or resource sharing within larger households, reducing the necessity for additional income through employment. The effect is slightly more pronounced for women, reflecting traditional gender roles where women bear a larger share of household responsibilities.

The regression provides a detailed breakdown of how educational background influences employment probabilities. Fields of study exhibits significant variation in their effects, offering insights into labor market dynamics and demand for specific skills. Health and Law fields consistently show high and significant positive coefficients. Individuals with education in these areas enjoy significantly higher employment probabilities, reflecting strong demand for professionals in these sectors. For instance, health-related fields show robust coefficients across all years and gender groups, highlighting the critical and stable nature of healthcare employment. Educational Sciences and Information and Communication Technologies (ICT) fields also display positive coefficients, particularly for females in ICT, suggesting that these areas offer growing opportunities and align with market trends.

Negative coefficients in Arts, Journalism, and Manufacturing fields point to challenges in aligning educational training with labor market demands. For example, journalism and manufacturing exhibit consistently negative effects for females, possibly due to structural barriers or declining industry opportunities. Social and Behavioral Sciences fields show mixed results. While coefficients are generally positive, they are smaller in magnitude, indicating moderate employability compared to high-demand fields.

Certain fields exhibit contrasting impacts by gender. For example, ICT shows stronger positive effects for females than males in some years, suggesting growing inclusivity in traditionally male-dominated sectors. Conversely, fields like Journalism and Manufacturing have more pronounced negative effects for females, indicating persistent gender-specific challenges in these areas.

Pseudo R^2 values decline over time, from 0.154 in 2009 to 0.096 in 2023 (pooled data). This indicates that the model's explanatory power diminishes over time, suggesting increasing complexity in the factors influencing employment probabilities. Changes in labor market dynamics, policy shifts, or

unobserved variables like technology adoption and globalization may play a role. However, such variables are macroeconomic indicators which don't vary across observations. Therefore, it is not possible to include such policy variables into regressions.

In 2009, coefficients for demographic and educational variables, such as marital status and fields like Health and Law, are stronger, reflecting relatively stable labor market preferences. By 2023, these coefficients weaken, highlighting evolving employment trends and potential disruptions, such as technological changes and post-pandemic economic restructuring.

For males, age, marital status, and fields like Law and ICT show consistently strong and positive effects on employment. These results align with traditional labor market dynamics, where men benefit from stable industries and higher demand for technical and professional skills. Notably, the effect of being married is particularly pronounced for males, reinforcing gendered societal expectations. For females, the results highlight greater variability in coefficients and more pronounced challenges in certain fields. For instance, the negative coefficients for Journalism and Manufacturing are stronger for women, reflecting systemic barriers such as gender bias or limited opportunities in these sectors. However, fields like Health and Educational Sciences offer strong positive effects for women, suggesting opportunities in areas traditionally dominated by females.

In conclusion, the probit regression results reveal critical insights into employment probabilities across demographic and educational dimensions. Age, gender, marital status, and field of study emerge as key determinants, with significant variations across genders and years. While high-demand fields like Health and Law consistently boost employment probabilities, low-demand fields such as Arts and Journalism face challenges. The declining pseudo R^2 values and gender-specific disparities underscore the need for targeted policies addressing labor market inequalities, evolving industry demands, and barriers to female employment. These findings provide a robust foundation for developing strategies to enhance labor market inclusivity and adaptability.

Table 3. Employment Probability (Probit) Results on Male, Female and Pooled

	2009			2016			2023		
	Pooled	Male	Female	Pooled	Male	Female	Pooled	Male	Female
age	.154***	.117***	.166***	.148***	.124***	.145***	.13***	.111***	.14***
ageSq	-.002***	-.001***	-.002***	-.002***	-.001***	-.001***	-.001***	-.001***	-.001***
Male	.155***			.321***			.368***		
Marital St.									
Married	.567***	.866***	.305***	.408***	.722***	.161***	.322***	.677***	.08***
Divorced	.059***	-0.004	.028***	.045***	.183***	-.114***	-.026***	.109***	-.143***
Widowed	-.16***	-.85***	-.098***	.583***		.146***	.422***	.374***	.402***
HHSize	-.045***	-.07***	-.026***	-.08***	-.083***	-.091***	-.065***	-.085***	-.061***
Field									

Educational Sci.	.207***	.136***	.301***	.314***	.306***	.304***	.094***	-.031***	.183***
Arts	-.146***	-.151***	-.123***	-.059***	-.237***	.053***	-.055***	-.196***	.05***
Humanities	.046***	.079***	.031***	.138***	.408***	-.079***	-.121***	.047***	-.212***
Social and beh. sciences	-.015***	-.029***	0.013	.039***	.131***	-.064***	-.076***	-.122***	-.038***
Journalism and information	-.247***	.195***	-.438***	-.213***	-.343***	-.073***	-.049***	-.157***	.071***
Business and management	-.025***	.025***	-.059***	.089***	.187***	-.013**	-.026***	-.053***	-0.001
Law	.717***	.824***	.609***	.574***	.712***	.435***	.228***	.284***	.209***
Biology and Env.Sciences	.1***	0.01	.215***	-0.011	.075***	-.097***	-.043***	-.253***	.081***
Physical sci.	-.037***	.04***	-.092***	.088***	0.012	.156***	-.1***	-.155***	-.064***
Mathematics and statistics	.136***	-.029**	.343***	.04***	.116***	-.056***	-.106***	-.332***	.063***
Inf.and Comn. Technologies	.194***	.151***	.299***	.233***	.333***	.105***	-.041***	-.035***	-.106***
Engineering and works	.117***	.124***	0.013	.251***	.275***	.261***	.052***	-.016***	.155***
Manufacturing and processing	-.149***	-.074***	-.223***	0.008	.074***	-.039***	-.288***	-.251***	-.29***
Architecture and construction	.032***	-.051***	.218***	.062***	.083***	.042***	.06***	0.007	.107***
Agri. forestry and fishing	-.145***	-.13***	-.186***	.075***	.204***	-.086***	-.057***	-.153***	.057***
Veterinary	.27***	.209***	.466***	.397***	.636***	.211***	.085***	-.086***	.225***
Health	.741***	.684***	.798***	.603***	.443***	.641***	.284***	.128***	.366***
Social services				-0.005	-0.008	-0.007	-0.004	-0.007	-0.006
				.039***	-.103***	.015*	-.252***	-.2***	-.224***
Occ.Health and Trans. services	-.088***	-.038*	-.052***	-.153***	-.083***	-.269***	.021***	.158***	-.144***
Security services	1.004***	.914***		.614***	.719***	.197***	.108***	-.045***	.346***
Languages				.031***	-.074***	.054***	-.056***	-.411***	.116***
Personal services (base)									
_cons	-2.12***	-1.193***	-2.463***	-2.02***	-1.258***	-1.93***	-1.486***	-.639***	-1.725***
Observations	24112	15036	9059	36962	22506	14437	63012	35824	27188
Pseudo R^2	0.154	0.163	0.139	0.133	0.136	0.114	0.096	0.103	0.068

Source: Author's own calculations, Standard errors are in parentheses *** p<.01, ** p<.05, * p<.1

5. CONCLUSION

This study explores the relationship between fields of higher education and labor market outcomes in Türkiye, offering valuable insights into employment probabilities, wage disparities, and gender dynamics across disciplines. These findings reveal critical questions regarding the evolving nature of higher education and its intersection with labor markets. While specialized fields like STEM and health offer stable economic returns, they may also restrict flexibility in career paths for graduates. On the

other hand, generalist disciplines such as the arts and humanities, despite facing employment challenges, often foster transferable skills like critical thinking and creativity, which are increasingly valued in dynamic and unpredictable labor markets. This duality raises the need for a balanced policy approach—one that recognizes the immediate economic benefits of specialization while fostering broader skills to prepare graduates for future shifts in workforce demands.

From a policy perspective, these results underscore the urgency of aligning higher education curricula with labor market demands. A multi-faceted approach is essential to bridge existing gaps: first, fostering collaboration between educational institutions and industries to ensure that graduates acquire in-demand skills; second, incentivizing participation in high-return fields, especially for underrepresented groups such as women. In other words, education policy should be integrated to the labor market dynamics. For instance, the student capacities of fields with high unemployment and or low wages should be reduced in order to provide improvement in such labor market outcomes. Finally, specific policies should be implemented to eliminate barriers that contribute to gender disparities, such as addressing societal stereotypes and expanding access to mentorship programs in traditionally male-dominated fields.

Limitations of this study include its reliance on survey data, which may not fully capture qualitative nuances such as job satisfaction or informal barriers to employment. The analysis also focuses on general trends and may overlook regional variations or sector-specific dynamics within Türkiye. Moreover, while the study spans 2009 to 2023, recent global shifts, including the COVID-19 pandemic and technological advancements, may have introduced unanticipated disruptions in labor market structures that are not entirely reflected in the data. And finally, some macroeconomic indicators that would be relevant are not included in regression model since macroeconomic variables do not vary across individuals, which would result in statistical and econometric problems.

Future research should address these gaps by integrating more granular data, including longitudinal studies tracking individual career trajectories. Exploring regional disparities and sectoral shifts could yield insights into localized challenges and opportunities. Additionally, examining the long-term effects of policy interventions, such as incentives for STEM education or programs aimed at reducing skill mismatches, would provide evidence-based strategies for optimizing the socio-economic benefits of higher education. Cross-sectional data over the years 2009-2023 are pooled and dummy variables for the years (may be before & after covid19 years) are included in the regression analysis. If linear probability model is employed, as another future research recommendation, interaction effects between years and fields can be employed to see the changes in employment probabilities in specific fields between different time periods.

By addressing these limitations and pursuing targeted research, Türkiye can better align its education system with labor market needs, fostering a more inclusive and resilient workforce. The

findings of this study provide a strong foundation for designing policies that not only enhance employment prospects for graduates but also contribute to broader socio-economic development goals.

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