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A REVIEW OF EMPIRICAL RESEARCH ON VERTICAL MISMATCH AND FIELD OF STUDY MISMATCH IN TURKEY AND ADDITIONAL EVIDENCE FROM THEIR OVERLAPPING MISMATCH*

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Abstract

The aim of this paper is two folds. First, we perform a review of empirical research that report the vertical mismatch and/or field of study mismatch in Turkey. Second, we provide additional evidence from two perspectives which are (i) change in vertical mismatch and field of study mismatch over time and (ii) their overlapping mismatch. Using dataset from Turkish Statistical Institute labor force surveys, we conduct our analyses for two separate target groups, namely vocational and technical high schools and higher education. The main findings are as follows: The incidence of both vertical and field of study mismatch is higher for vocational and technical high schools. Both mismatches increased over time for both target groups. More notably, the rate of increase in higher education is higher than that in vocational and technical high schools. Regarding the overlapping mismatch, we define three mismatch categories, namely mere field of study mismatch, mere overeducation and full-mismatch. We find that 40.6% of employees from higher education and 70.2% of employees from vocational and technical high schools are mismatched by any category.

Keywords: Vertical mismatch, Overeducation, Field of study mismatch, Overlapping mismatch

Türkiye'deki Dikey ve Yatay Uyumsuz Eşleşmeye İlişkin Literatür Taraması ve Bunların Kesişimini de İçeren Yeni Bulgular

Öz

Bu çalışmanın iki amacı bulunmaktadır. Birincisi, Türkiye'deki eğitim sistemiyle iş gücü piyasası arasındaki yatay ve dikey uyumsuz eşleşmeyi inceleyen ampirik çalışmaların literatür taramasını yaparak temel bulguları raporlamaktır. İkincisi, TÜİK Hanehalkı İşgücü Anketi veri setlerini kullanarak mesleki ve teknik ortaöğretim düzeyi ve yükseköğretim olmak üzere her bir hedef kitle için yeni ve daha detaylı bulguları iki farklı perspektiften sunmaktır. Bu kapsamda, önce uyumsuz eşleşme düzeylerinin yıllara göre değişimleri incelenmiş, ardından yatay ve dikey uyumsuz eşleşmelerin kesişimi (overlapping mismatch) üç farklı kategoride analiz edilmiştir. Bunlar, "sadece yatay uyumsuz eşleşme", "sadece dikey uyumsuz eşleşme" ve "tam uyumsuz eşleşme"dir (aynı anda hem yatay hem de dikey uyumsuz eşleşme). Temel bulgular şunlardır: Her iki eğitim seviyesi için de yatay ve dikey uyumsuz eşleşme düzeyi zaman içerisinde artış göstermiştir. Bu artış oranı yükseköğretim için daha yüksektir. Yatay ve dikey uyumsuzluğun kesişimiyle ilgili bulgulara göre, ortaöğretim düzeyindeki mesleki ve teknik eğitimden mezun olanların %70,2'si ve yükseköğretimden mezun olanların %40,6'sı söz konusu üç kategoriden herhangi biri itibarıyla uyumsuz eşleşmeye sahiptir.

Anahtar Sözcükler: Dikey uyumsuz eşleşme, Aşırı eğitimlilik, Yatay uyumsuz eşleşme, Kesişen uyumsuz eşleşme

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A Review of Empirical Research on Vertical Mismatch and Field of Study Mismatch in Turkey and Additional Evidence from Their Overlapping Mismatch

Introduction

Vertical mismatch (under/overeducation) and field of study mismatch (horizontal mismatch) are two forms of mismatch between the education system and the labor market. Vertical mismatch is a situation where the highest level of education held by a worker is higher or lower than the required level of education in an occupation group. Field of study mismatch is an outcome that occurs when the attained field of worker is different from the field required for doing the job well (McGuinnes, 2006: 387; Beduwe and Giret, 2011: 69; Montt, 2017: 1).

The empirical research has revealed that the global expansion in higher education within many countries has caused a quantitative imbalance between the supply of and demand for graduates in the labor market mechanism. This imbalance has been considered one of the main drivers of mismatch (Wolbers, 2003: 250; Ghignoni, 2011: 102; Flisi et al, 2014: 1212; Verhaest et al, 2017:4). Similarly, Turkey has also been experiencing a significant expansion in higher education since 2006. Hence, the number of graduates potentially entering into labor market increased sharply by 3.4 times from 322 thousand in 2006 to 1.1 million in 2021 (CoHE, 2022). This remarkable increase led to a growing concern among the policy makers and researchers because of undesirable implications of mismatch at individual, social and macro-economic levels.

In line with the growing concern stemming from the sharp expansion in higher education in Turkey, Table 1 indicates that the number of empirical research on mismatch issue has been increasing for the recent years but is still very limited.

Table 1: Empirical Research on Turkey: Vertical Mismatch and Field of Study Mismatch

No	Author	Country	Incidence of		Determinant of		Consequence of	
			VM	**FoSMM**	**VM**	**FoSMM**	**VM**	**FoSMM**
1	Quintini (2011)	35 countries	✓	✓				
2	Kurnaz (2015)	Turkey	✓	✓				
3	OECD (2016)	34 countries	✓	✓	✓	✓	✓	✓
4	Ege (2020)	Turkey		✓		✓		
5	CASGEM (2019)	Turkey	✓	✓	✓			
6	MoNE (2018)	Turkey		✓				
7	Orbay et al.(2021)	Turkey	✓	✓				✓
8	Suna et.al. (2020)	Turkey				✓		
9	Galasi (2008)	25 countries	✓				✓	
10	Filiztekin (2011)	Turkey	✓		✓		✓	
11	Mercan et al (2015)	Turkey	✓				✓	
12	Acar (2016)	Turkey	✓				✓	
13	Dereli (2019)	Turkey			✓			
14	Dereli (2017)	Turkey	✓		✓			
15	Duman (2018)	Turkey	✓				✓	
Summary			**11**	**7**	**5**	**3**	**6**	**2**

Notes: VM: Vertical Mismatch; FoSMM: Field of Study Mismatch. Source: Own construction

To the best of our knowledge, there are only 15 studies that cover vertical mismatch and field of study mismatch on Turkey, five of which concentrate on both mismatches. These studies include not only the articles published in academic journals but also the national-level governmental reports. Seven of them have been published recently since 2018, majority of which include field of study mismatch. Further, two of those most recent studies are national-level reports (namely, CASGEM, 2019 and MoNE, 2018), which implies that the concern on mismatch issue has been growing further among the policy makers in Turkey.

Hence, considering the quick review of empirical research (Table 1), the aim of this paper is two folds to fill the literature gap on Turkey. First, we perform a review of empirical research on vertical mismatch and field of study mismatch. Second, using micro dataset from Turkish Statistical Institute (TURKSTAT) labor force surveys, we provide the researchers and policy makers with additional new evidence.

Accordingly, this paper contributes to mismatch-literature on Turkey in four ways. To the best of our knowledge, this is the first study (i) that comprehensively reviews, synthesizes and reports the earlier relevant empirical research on Turkey; (ii) that examines the increase or decrease in any type of mismatch over time; (iii) that measures and analyzes the overlapping mismatch of vertical and field of study mismatches; (iv) that conducts all analyses and presents the main findings on the basis of two separate target groups, namely the vocational and technical high schools (hereafter VTHS) and higher education (hereafter HE) to contribute to design of more target-group oriented policies.

The paper proceeds as follows. The second section presents the data and methodology. Section three summarizes and synthesizes the basic findings of earlier empirical research on Turkey. The fourth section provides additional new evidence obtained from our own analyses. The fifth section discusses the main results and presents the conclusions and policy implications.

1. Data, Methodology and Limitations

We have two different methodologies because this paper concentrates on two different aims. First, we present the method for reviewing the earlier empirical research on Turkey. Second, we explain the method and data used in our own analyses to provide additional new evidence.

1.1. Method For Reviewing Earlier Empirical Research on Turkey

We conduct three different bibliometric searches. First, we focus on empirical articles published in academic journals. For this purpose, we performed a search using different combinations of terms or keywords, namely, ‘match, ‘mismatch’, ‘horizontal mismatch’, ‘field of study mismatch’, ‘education mismatch’, ‘vertical mismatch’ or ‘qualifications mismatch’, combined with ‘education’, ‘labor market’, ‘job’, ‘field’, ‘occupation’, or ‘Turkey’. We examine the search results and pick up the ones which focus specifically on Turkey or the ones that include Turkey in their cross-country analyses. We conduct this search in English and Turkish languages. Second, we concentrate on international reports published by OECD, ILO and the World Bank. Similarly, we also search for relevant studies such as national-level reports, case studies and policy papers prepared or published by Turkish governmental institutions or NGOs.

1.2. Own Analyses: Data, Method and Limitations

We use the micro dataset from TURKSTAT labor force surveys. Table 2 summarizes the composition and size of the sample, the measurement method and the focus of analyses.

Table 2: Summary of Measurement Methods, Composition and Size of Sample

	Vertical Mismatch		**Field of Study Mismatch**		**Overlapping Mismatch**						
	Common for all mismatch types: Wage-based employees, age-group of (15-65+)[1], male-female, part-time+full-time, private-public-NGOs, permanent-temporary jobs										
Sample consists of	Employees who graduated from all education levels		By definition, field of study levels and categorization is available only for HE + VTHS		Since this is overlapping mismatch of vertical and field of study mismatches, the sample size should be the joint one, that is same as field of study mismatch.						
Measurement method	Mean method, a type of realized matches method.		Coding scheme[2], a type of job analysis method.		By deriving three categories of mismatch. These are mere vertical mismatch, mere field of study mismatch and full-mismatch.						
Analyses focus on	Increase or decrease in mismatch over time				Overlapping mismatch by different age-group categories and gender						
Time period	2014 and 2018		2012 and 2016		2016 only						
Sample size					Age	Age	Age	Age	Age	Female	Male
	2014	*2018*	*2012*	*2016*	*15-19*	*20-24*	*25-44*	*45-64*	*65+*		
VTHS	12380	13459	12473	12857	755	2121	7967	1979	35	2898	9959
HE	26878	31507	26498	29637	18	2744	21303	5455	117	11477	18160
Total	118905	106632	38971	42494	773	4865	29270	7434	152	14375	28119

Notes: VTHS: Vocational and Technical High Schools; HE: Higher Education. 'Total' for vertical mismatch is greater than the sum of VTHS and HE because vertical mismatch is measured for all levels of education (e.g., primary education) within each ISCO-08 occupation code at one-digit level. Then, while measuring overlapping mismatch, we pick up the ones who graduated from VTHS and HE separately. Source: Own construction

We measure field of study mismatch by relying on the coding scheme, a type of job analysis method. It is a matrix and has two dimensions. The first dimension is field of study on the basis of Fields of Education and Training-1999 (FOET-99) classification. The second one is International Standard Classification of Occupations (ISCO) codes. The coding scheme shows the occupation codes in which any employee graduated from a particular field of

1 Different from many other studies, we include the 65+ age-group to examine the incidence of mismatch specifically for this group. We aim to identify any remarkable discrepancy (if any) from the average incidence level to infer relevant policy implications.

2 The original coding scheme is developed by Wolbers (2003). Later, Quintini (2011) measured field of study mismatch by employing her own correspondence matrix which is developed drawing largely from Wolbers (2003). Then, using Quintini's (2011) coding strategy, Montt (2015) updated the matrix because of the change from ISCO-88 to ISCO-08 classification.

study can work as well-match. Hence, an employee is mismatched if her field of study does not match the corresponding occupation codes in the matrix (see Table 10 in Appendix).

Vertical mismatch is measured by employing the mean method, a type of realized matches method. An employee is overeducated (undereducated) if her actual attained[3] years of education is above (below) one standard deviation from the mean years of education in her ISCO-08 occupation code at one-digit level.

For overlapping mismatch, we derive three categories of mismatch as Verhaest et al (2017: 3) and Montt (2017: 6-7) did. These are mere vertical mismatch (only vertical mismatch but not field of study mismatch), mere field of study mismatch (only field of study mismatch but not vertical mismatch) and full-mismatch (both vertical and field of study mismatch). The rest is full match. Mathematically, field of study mismatch is equal to sum of mere field of study mismatch and full-mismatch, and the vertical mismatch is equal to the sum of mere vertical mismatch and full-mismatch. On the other side, the undereducated employees are grouped as well-match in order to simplify our analysis following Verhaest et al (2017). Hence, under overlapping mismatch context, vertical mismatch corresponds to overeducation only.

Focus of analyses: For vertical mismatch and field of study mismatch, we examine the mismatch over time. We analyze the increase or decrease in incidence of field of study mismatch for the period between 2012 and 2016, and that of vertical mismatch between 2014 and 2018. For overlapping mismatch, we aim to analyze different categories of overlapping mismatch with respect to different age groups and gender. Further, we conduct all analyses and present the main findings for two separate target groups, namely VTHS and HE.

Data limitations: We have two types of data limitation which affects the scope and results of our analysis. First limitation is about aggregation level of occupation codes. The original coding scheme uses three-digit ISCO-08 occupation codes. However, they are not available in TURKSTAT labor force surveys. Therefore, following Ege (2020: 184), the coding scheme is developed by aggregating three-digit codes into two-digit ones which is based on Montt's (2015: 48) coding strategy (see Table 10 in Appendix). As expected mathematically, this aggregation yields more well-matched cases, which in turn

3 The attained level of education is transformed into years of education as follows: 19 years for 5-6 years of higher education, master's degree, doctorate degree; 16 years for 2-4 years of higher education; 12 years for high school level; 8 years for lower secondary education or 8 years of primary education; 5 years for primary education level (5 years); zero for those who did not complete any completion.

results in lower likelihood of field of study mismatch than that of original coding scheme.

For the second data limitation, while measuring field of study mismatch, we were able to use 2016 data at the latest because the field of study dimension of the original coding scheme is based on FOET-99 classification which was used between 2009 and 2016[4] in labor force surveys. Further, we used 2012 data as a starting-time reference because ISCO-08 classification has been in use in labor force surveys since 2012. While measuring vertical mismatch, we start our analysis with 2014, not with an earlier year because the relevant question (in the labor force survey) which captures the education level of an individual was revised in 2014.

2. Main Findings from Review of Earlier Empirical Research on Turkey

2.1. Incidence of Mismatch

Table 3 and Table 4 summarize the findings of the studies that report the incidence of vertical and field of study mismatch on Turkey, respectively. A quick review of the tables shows significant differences in the incidence of mismatch as well across the different studies as within each of the measurement methods. These differences can be potentially explained by the differences in year of data collected, composition of sample used, the measurement method employed, and the way the method is operationalized (Sellami et al, 2018: 144). For this purpose, for each study, each table attempts to specify those parameters which might be responsible for the differences in mismatch.

2.1.1. Vertical Mismatch in Turkey: Empirical Findings from the Literature

Table 3 presents the findings of 11 studies that report the incidence of vertical mismatch. Except for Orbay et al (2021) who measured the mismatch by a different and novel method (see notes under Table 3), the incidence of overeducation ranges from 11.5% to 40.0%. Among the studies that employed the same measurement method, the figures might imply to some extent that the incidence of overeducation increased and that of undereducation decreased over time.

4 Starting from 2017, ISCED classification has been in use instead of FOET-99 classification.

Table 3: Incidence of Vertical Mismatch from Empirical Literature on Turkey

Author	Data Source	Sample Composition	Method	Data Year	Incidence %	
					UE	**OE**
Galasi (2008)	ESS	Total 13,488 individuals, 252 of which are for Turkey. Cross-country, 25 countries	WA	2005	70.8	27.9
Kurnaz (2015)	Field Survey	Higher educated employees in the first 500 large firms and are located in Ankara, 15-64 age-group, N= 159	WA	2014	1.3	35.1
OECD (2016)	PIAAC	All employees from HE and VTHS, 15-64 age-group, N=5.000 (the country average)	WA	2015	12.9	11.5
CASGEM (2019)	Field Survey	Employees in 1,431 firms which have more than 50 employees, 15-64 age-group, N=4,700 for graduates from all levels of education.	WA	2018	7.1	31.6
Filiztekin (2011)	HES	Full-time employees in non-agricultural sectors, 20-64 age group, N=11,408 in 1994 and 4,967 in 2002	Mode	1994 2002	16.5 14.7	20.3 24.6
			Mean	1994 2002	9.9 9.6	13.4 15.1
Quintini (2011)	ESWC	Wage-based employee and self-employed, 15-64 age-group	Mode	2005	4.0	40.0
Acar (2016)	ILCPD	Full-time employees in non-agricultural sectors, 15-64 age-group, N= 22,780	Mean Mode	2006-2010 pooled	14.5 17.7	22.4 29.8
Mercan et al (2015)	LFS	All employees in all sectors, N=145,934	Mean	2009	0.6 to 39.9	0 to 36.5
Dereli (2017)	LFS	Employees in non-agricultural sectors, for higher education and high schools separately,15-64 age-group,	Mean	2009 2014	5.0 10.0	20.0 17.5
Duman (2018)	ESWC and LFS	Wage-based employees, 15-64 age-group, N=2,000 from ESWC, N= 104,378 from LFS. WA by using ESWC; Mean and Mode by using LFS	WA	2015	5.7	25.5
			Mean Mode		14.0 24.0	16.0 26.0
Orbay et al (2021)	LFS	Wage-based employees graduated from all levels of education, 17-65 age-group, full-time only, permanent jobs in private sector only. N=145,244.	NVRI	2014-2016 pooled	-	40.0

Notes: ESS: European Social Survey; HES: TURKSTAT Household and Expenditure Survey; ESWC: European Survey of Working Conditions; ILCPD: TURKSTAT Income and Living Conditions Panel Dataset; LFS: TURKSTAT Labor Force Survey; UE: Undereducation; OE: Overeducation; WA: Worker self-assessment. NVRI: Normalized Vertical Relatedness Index based on Clustering Index. The mean and mode of education years were measured at ISCO two-digit occupation code level, except for Duman (2018), where he used one-digit occupation code. Regarding Mercan et al (2015), the findings correspond to incidence ranges depending on different sectors, and country average was not measured. Orbay et al (2021) reported vertical mismatch by education levels but concentrated on university graduates. So, 40.0 of overeducation is valid for those who are university graduates, implying no undereducation for them because master's and PHD graduates are included in the group as "university degree" as one category.

2.1.2. Field of Study Mismatch in Turkey: Empirical Findings from the Literature

Table 4 presents the findings of the seven studies that report the incidence of field of study mismatch. Ege (2020) is the only study that focuses on VTHS and HE, separately. The rest covers either or sum of them.

Table 4: Incidence of Field of Study Mismatch from Empirical Literature on Turkey

Author	Data Source	Sample Composition	Method	Data Year	Incidence %		
					VTHS	**HE**	**Total**
Quintini (2011)	ESWC	Wage-based employee and self-employed from HE and VTHS, 15-64 age-group,	CS	2005			37.0
OECD (2016)	PIAAC	All employees from HE and VTHS, 15-64 age-group, N=5.000 (the country average)	CS	2015			43.7
Ege (2020)	LFS	Wage-based employee from HE and VTHS separetely,15+ age-group, N= 38,971 in 2012 and 42,494 in 2016	CS	2012	42.4	21.9	28.4
				2016	44.9	24.0	30.3
CASGEM (2019)	Field Survey	Employees in 1,431 firms which have more than 50 employees, 15-64 age-group, N=2,407 for graduates from HE	WA	2018		15.1	
Kurnaz (2015)	Field Survey	Employees from HE, who work in the first 500 largest firms and are located in Ankara, 15-64 age-group, N= 159	WA	2014		15.4	
MoNE (2018)	Survey by email	Employees graduated from 54 different fields of VTHS between 2008 and 2014, N=4,863	WA	2018	53.1		
Orbay et al (2021)	LFS	Wage-based employees graduated from higher education and well-matched by education level, 17-65 age-group, full-time only, permanent jobs in private sector only. N=31,258	NHRI	2014-2016 pooled		41.5	

Notes: ESWC: European Survey of Working Conditions; LFS: TURKSTAT Labor Force Survey; CS: Coding-scheme, a type of job-analysis measurement which is an objective method. WA: Worker self-assessment method; NHRI: Normalized Horizontal Relatedness Index based on Clustering Index; VTHS: Vocational and Technical High Schools; HE: Higher Education; Total: VTHS+HE.

By relying on worker self-assessment method, CASGEM (2019: 142-144) and Kurnaz (2015: 110) found relatively lower incidence level for higher education graduates when compared to the results of coding-scheme method. The

main reason why they found lower incidence might stem from the composition and wording of the response options provided in their surveys. They both asked the survey question "Which field of study is required to do your current job? The options provided were: (1) Strictly own field of education, (2) A completely different field of education, (3) My own or a related field, (4) No particular field required. CASGEM (2019: 144) and Kurnaz (2015: 110) treated option (2) as the only mismatch status, options (1) and (3) as well-match. However, in a similar case, Robst (2007: 401) considered someone who reported working in a job somewhat related to her major as partially mismatched, and a person working in a job not related to her degree field as completely mismatched. Therefore, we claim that the options available in those two aforementioned surveys involve implicitly the partial match or partial mismatch status. In other words, if the options (2) and (3) were considered as mismatch, then the incidence of mismatch would be expected to be higher in CASGEM (2019: 144) and Kurnaz (2015: 110).

By employing coding scheme, Quintini (2011: 24) and OECD (2016: 133) found that, on country average, the incidence of field of study mismatch for Turkey was 37.0% and 43.7%, respectively, which were all above the OECD average of 31.0% and 39.6 % that were measured in their respective studies. Ege (2020: 60) found relatively lower incidence of field of study mismatch (30.3 %) because of data limitation explained in section entitled 'Data and Methodology'. Based on results from Quintini (2011: 24) and OECD (2016: 133), field of study mismatch increased by 18.1% between 2005 and 2015 in Turkey. Similarly, Ege (2020: 65-74) indicated that overall country average of mismatch increased by 6.7 % between 2012 and 2016, and that the rate of increase in HE is remarkably high when compared to that of overall country average. Further, the incidence results from Ege (2020: 65-74) and MoNE (2018: 59) yield that field of study mismatch for VTHS is much higher than that of HE.

Moreover, Orbay et al (2021: 6687-90) measured field of study mismatch for those who are both university graduates and vertically well-match by using a different method of measurement. Hence, the main findings are listed but not explained.

2.2. Determinants of Mismatch: Empirical Findings from the Earlier Literature

Table 5 shows the studies which examine the determinants of vertical mismatch (four studies) and field of study mismatch (two studies). However, there are two more studies, CASGEM (2019) and Suna et al (2020), which are not listed in the table because of their different categorization of determinants.

The determinants of mismatch are estimated by using wide range of variables. We categorize them in terms of their relevance level under four variable groups as Wolbers (2003: 254-5) and Ege (2020: 99) did. These are individual characteristics, education background, job-specific characteristics and labor market related determinants.

Table 5: Determinants of Vertical and Field of Study Mismatch from Empirical Literature on Turkey

	Filiztekin (2011)	**Dereli (2017)**	**Dereli (2019)**	**OECD (2016)**	**Ege (2020)**
Type of mismatch	VM	VM	VM	VM + FosMM	FoSMM
Statistical method	ML	ML	ML	ML for VM BL for FoSMM	BL
Individual Determinants					
Age		✓	✓	✓	✓
Gender	✓	✓	✓		✓
Marital status	✓	✓		✓	
Being household head	✓				
Experience	✓				
Education Background					
Level of education last completed			✓		✓
Field of study last completed					✓
Being overeducated or not					✓
University prestigious			✓		
University Type (State/Foundation)			✓		
Job-Specific Characteristics					
Tenure		✓			
Firm size				✓	✓
Government/Private sector	✓	✓			✓
Permanent or temporary job				✓	✓
Part-time or full-time status					✓
Formal sector	✓				
Geographic mobility of worker			✓		
Place of work (NUTS-1 regions)					✓
Membership of a trade union	✓				
Labor Market Conditions					
Unemployment rate			✓		✓
Employment rate					✓

Notes: VM: Vertical Mismatch; FoSMM: Field of Study Mismatch; ML: Multinomial Logit; BL: Binary Logistic
CASGEM (2019) and Suna et al. (2020) studied determinants of vertical and field of study mismatch respectively by examining the descriptive statistics obtained from their survey question asking the reasons of accepting to work as a mismatched employee. However, since their categorization of determinants is different from the others, they are not presented in this Table. Source: Own construction.

The most frequently used determinants under individual characteristics are gender, age and marital status. The common findings present that the males and married workers are more likely to be mismatched. For age, conflicting results are obtained.

For the education background, Dereli (2019: 128) found that college and bachelor degree graduates are more likely to be overeducated than master and PhD degree graduates. Similarly, Ege (2020: 117-18) found that likelihood of field of study mismatch decreases as the education level increases. Moreover, Ege (2020: 119-20) examined the effect of type of field of study, and found that the graduates from (1) humanities, languages and arts, (2) science, mathematics and computing and (3) agriculture and veterinary are more likely to have field of study mismatch when compared to reference category which is teaching and education science. As a novel contribution, Dereli (2019: 128) studied the effect of university prestige on overeducation, and found that employees from a prestigious university are less likely to be overeducated where she could not find any significant effect of university type on overeducation. Further, Ege (2020: 121) analyzed the effect of being overeducated on field of study mismatch and found that overeducated employees are much more likely to work in a mismatched job by field of study.

The common findings under job-specific characteristics yield that employee working in smaller firms, in private sector, with a temporary contract is more likely to be overeducated and mismatched by field of study. For the novel results, Filiztekin (2011: 12) found that the formal sector employees are more likely to be overeducated because those individuals trade formal sector employment with their education. Dereli (2019: 129) found that there is a negative relationship between geographic mobility and overeducation implying that those individuals accept to move to another city if they are vertically well-matched to jobs in that city.

Dereli (2019:126) and Ege (2020: 114-15) are the only ones who studied the effect of labor market conditions. Dereli (2019: 126) used unemployment rate at province level, and found that the graduates searching for jobs in cities which have higher levels of unemployment rates are more likely to be overeducated. As a novel contribution, Ege (2020: 114-15) focused on unemployment and employment rates at field of study level, not on macro-level country average indicators. He found that, at the time of entry into labor market, graduates from field of study which has high level of employment rate are less likely to work in a mismatched job by field of study, where he could not find any statistically significant relationship between mismatch and unemployment rate at field of study level.

On the other hand, CASGEM (2019) and Suna et al (2020) studied determinants of vertical mismatch and field of study mismatch, respectively by examining the descriptive statistics obtained from the survey question asking the reasons of accepting to work as a mismatch. CASGEM (2019: 146) asked the question "Why do you accept to work in your current job as overeducated?", and provided nine options to be selected. The first three responses which have the highest frequencies were (1) Personal reasons, (2) I consider this current job as a transition step to a more decent job, (3) It is costly to move to a different location to work in a well-matched job. Suna et al (2020: 942-45) asked the same question for field of study mismatch version but as an open-ended question for the graduates from vocational and technical high schools. The most common reasons expressed by the graduates were the inability to find a job in their field of study, low wages, lack of vocational skills in their field of study, lack of required experience, working conditions, and antipathy to the field of study.

In sum, it is clear that the majority of empirical research on the determinants of mismatch is concentrated on overeducation. Further, the recent studies such as Dereli (2019) and Ege (2020) attempted to explain the differences in mismatch by focusing on all types of variable groups. They found that the individual characteristics, education background, job-specific characteristics and labor market conditions are all statistically significant determinants in explaining the differences in overeducation and field of study mismatch across individuals.

2.3. Consequences of Mismatch: Empirical Findings from the Earlier Literature

In the literature, consequences of mismatch have been analyzed under six outcomes. These are wage effect, job satisfaction, search for a new job while working, occupation status, participating in formal education/training and field of study regret (Somers et al, 2019). However, Table 6 indicates that the empirical research on Turkey covers only the wage effect.

Table 6: Wage Effect of Overeducation: Empirical Research on Turkey

Author	Data Year	Mincerian	Duncan and Hoffman			Oaxaca Decomposition
		Return to Attained Education	(A) Return to Required Education	(B) Return to Over-education	(A)-(B) Wage Penalty	
Galasi (2008)	2005	8.6%	10.3%	4.2%	6.1%	
Filiztekin (2011)	1994	9.3%	10.9%	5.4%	5.5%	
	2002	7.7%	10.7%	3.2%	7.5%	
Mercan *et al* (2015)	2009					✓
Acar (2016)	2006-2010		12.0%	5.1%	6.9%	
Duman (2018)	2015	20.0%	17.2%	13.1%	4.1%	✓
OECD (2016)	2015			22.8%		

Notes: Table shows only the studies that examine the wage effect of overeducation but not that of field of study mismatch.

While analyzing the wage effect of vertical mismatch, the most frequently used methods are (1) the standard Mincerian model, (2) the Duncan and Hoffmann equation where the attained education level is decomposed into years of required education, overeducation and undereducation, (3) the Oaxaca decomposition model, and (4) the 'use of dummy variable method which are all different types of ordinary least squares (OLS) regression (McGuinness, 2006: 394-95). Table 6 presents that the relevant empirical research on Turkey employed the first three estimation models which are Mincerian, Duncan&Hoffman and Oaxaca wage equations but not the 'use of dummy variables method'.

In all of the studies that utilize Duncan and Hoffmann equation for Turkey, the overeducated employees are found to earn a return to overeducation which is positive but less than the return to required education, which is in parallel with literature. In other words, overeducated employees are earning more than their colleagues with lower levels of educational attainment working in the same job but less than employees with same level of education who work at well-matched jobs, which implies a wage penalty ranging from 4.1% to 7.5% in Turkey. However, Acar (2016: 350) claimed that these results are valid under individual homogeneity assumption. She found no statistically significant effect of overeducation in workers' earnings when unobservable heterogeneity and measurement error bias are accounted for.

When Mincerian equation is employed to estimate the wage effect of overeducation, Galasi (2008:9-11), Filiztekin (2011: 13-15) and Duman (2018: 236) all found positive return on each year of attained education. The reward ranges from 8.6% to 20.0%. These findings imply that the reward for additional

year increase over time and that schooling is valuable in Turkey (Duman, 2018:236).

On the other side, two studies, namely OECD (2016) and Orbay et al (2021) examined the effect of field of study mismatch on wages but did not find statistically significant effect. Hence, for wage effect of field of study mismatch, these two studies are not listed in Table 6.

In sum, the studies on consequences of mismatch are highly concentrated on vertical mismatch but not on the field of study mismatch, and they studied only the wage effect for Turkey. The results indicate that additional year of attained education is rewarded in Turkey. However, overeducated employees earn more than their colleagues who work in the same job and have lower levels of educational attainment. However, overeducated employees earn less than the ones who have same level of education and work at well-matched jobs, which implies a wage penalty for the overeducated employees.

3. Additional New Evidence: Mismatch Over Time and Overlapping Mismatch

This section aims at providing further but more detailed evidence obtained from our own analyses from two perspectives. First perspective concentrates on the change in incidence of vertical mismatch and field of study mismatch over time. Second one focuses on their overlapping mismatch as of 2016.

3.1. Vertical Mismatch and Field of Study Mismatch Over Time

Table 7 presents the change in the incidence of vertical mismatch and field of study mismatch over time. It is clear that Turkey has witnessed an increase in incidence of both overeducation and field of study mismatch over time for all target groups. The overall country average of overeducation increased from 15.3% in 2014 to 17.6% in 2018, and that of field of study mismatch[5] increased from 28.4% in 2012 to 30.3%in 2016. The incidences of overeducation and field of study mismatch in VTHS are much higher than those in HE. However, the rate of increase of both incidences is remarkably high in HE when compared to the increase in VTHS.

5 Field of study mismatch is measured by following Ege (2020) as explained in section entitled 'Data and Methodology'

Table 7: Vertical Mismatch and Field of Study Mismatch Over Time, %

	Undereducation			Overeducation			Field of Study Mismatch		
	2014	2018	%Change	2014	2018	%Change	2012	2016	%Change
VTHS	5.8	5.0	-13.9	40.6	42.5	4.7	42.4	44.9	5.9
HE	0.0	0.0	0.0	25.4	29.1	14.3	21.9	24.0	9.6
Total	8.9	8.2	-8.0	15.3	17.6	15.2	28.4	30.3	6.7

Notes: VTHS: Vocational and Technical High Schools; HE: Higher Education; For vertical mismatch, "Total" includes not only HE and VTHS. It includes all levels of education starting from 'not completed any education' to 'higher education. For field of study mismatch, 'Total' includes only the sum of higher education and vocational and technical high schools because FOET-99 is valid only for those two education levels by definition. Source: Own construction

For overeducation, the findings are reasonable and consistent with the earlier empirical findings which were generated by employing the same measurement method. More specifically, as shown in Table 2, Filiztekin (2011: 4-6), Dereli (2017: 120) and Duman (2018: 129) both measured overeducation by employing mean of years of education method as we did, and found incidence of overeducation ranging from 13.4% in 1994 to 16.0% in 2015.

For field of study mismatch, the overall country average of incidence of mismatch is 30.3% in 2016 which is relatively lower than the findings from OECD (2016: 133) and Quintini (2011: 24) which all employed the same coding scheme method for measuring mismatch. As we recall, the incidence of field of study mismatch for Turkey was found to be 37.0% in Quintini (2011: 24) and 43.7% in OECD (2016: 133). It can be claimed that our finding is an improvement for Turkey when compared to two findings above. However, the finding would be higher than 30.3% if we do not have any data limitation as explained in section entitled Data and Methodology.

3.2. Overlapping Mismatch by Education Level, Age-Groups and Gender

Table 8 and Table 9 present the main findings from overlapping mismatch with respect to key characteristics. Table 8 indicates that only 29.8 % of employees from VTHS are well-matched implying that more than 70.0% of them are mismatched by any category. More specifically, for VTHS, 25.3% are overeducated but work in well-matched jobs by field of study; 29.2% of employees are mismatched by field but work at an adequate education level and 15.7% are both overeducated and mismatched by field (full-mismatch). Further, these employees have the highest incidence in all mismatch categories. When

compared to VTHS, although the employees from HE have relatively low level of incidence of mismatch by any category, 47.0% of those who are mismatched by field are also overeducated, and 40.5% of overeducated employees are also mismatched by field. More importantly, Table 9 indicates that these shares are much worse for the 20-24 age-group in HE, which are 58.8% and 46.6%, respectively. Furthermore, Table 9 also yields that younger employees from both VTHS and HE are more likely to be full-mismatched when compared to other age-groups, and that 65.7% of the already retired employees from VTHS (aged 65+) work in mismatched jobs by field of study.

Table 8: Overlapping Mismatch by Education Level, Turkey, 2016, %

	I	II	III	IV	IV/(III+IV)	IV/(II+IV)
	Full Match	**Mere OE**	**Mere FoSMM**	**Full MM**	**OE in FoSMM**	**FoSMM in OE**
VTHS	29.8	25.3	29.2	15.7	34.9	38.2
HE	59.4	16.6	12.7	11.3	47.0	40.5
Total	50.4	19.2	17.7	12.6	41.6	39.6

Notes: VTHS: Vocational and Technical High Schools; HE: Higher Education; OE: Overeducated; FoSMM: Field of Study Mismatched; Source: Own construction.

Regarding the gender, Table 9 shows that females have lower incidence of mismatch in any category than males. The well-matched females are remarkably higher in HE than VTHS. On the other side, whereas only 18.9% of the females from VTHS are overeducated, 72.4% of them are mismatched by field.

For both VTHS and HE, it is clear that mismatched employees work longer hours per week than the well-matched ones. For VTHS, the negative effect of mismatch by any category on wages is clear such that they all earn less than fully well-matched ones. More specifically, fully-mismatched employees earn only 1399 Turkish Lira (TL) per month, that is 75.0% of the wage (1869 TL/month) of fully well-matched colleagues. On the other hand, the findings are vague in HE to some extent. For example, the mere overeducated and the mere field of study mismatched ones who graduated from HE earn more than the well-matched ones. This finding implies that more detailed econometric analyses are required to further examine such findings.

Table 9: Overlapping Mismatch by Age and Gender, Vocational and Technical High Schools and Higher Education Separately, Turkey, 2016, %

	Mismatch		Overlapping Mismatch					
	(A) II+IV	(B) III+IV	I	II	III	IV	(C) IV/(B)	(D) IV/(A)
	OE	FoSMM	Full Match	Mere OE	Mere FoSMM	Full MM	OE in FoSMM	FoSMM in OE
Vocational and Technical High Schools								
Overlapping Mismatch by Age-Group								
15-19	40.1	44.9	32.6	22.5	27.3	17.6	39.2	43.9
20-24	36.6	45.8	32.5	21.6	30.8	15.0	32.8	41.0
25-44	43.4	45.3	27.5	27.2	29.1	16.2	35.7	37.2
45-64	36.5	42.3	34.9	22.8	28.6	13.7	32.5	37.6
65+	20.0	66.7	14.3	20.0	65.7	0.0	0.0	0.0
Overlapping Mismatch by Gender								
Male	47.4	44.5	24.3	31.2	28.3	16.2	36.5	34.2
Female	18.9	46.3	48.5	5.2	32.6	13.7	29.6	72.4
Overlapping Mismatch by Working Hours per Week and Wage (Turkish Lira/month)								
Hours	49	49	47	49	49	49		
Wage	1566	1595	1869	1669	1699	1399		
Higher Education								
Overlapping Mismatch by Age-Group								
15-19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
20-24	35.0	27.7	53.6	18.7	11.4	16.3	58.8	46.6
25-44	27.9	24.0	59.6	16.3	12.4	11.6	48.4	41.6
45-64	23.6	21.8	61.9	16.3	14.5	7.3	33.6	31.1
65+	41.1	32.5	38.5	29.1	20.5	12.0	36.8	29.2
Overlapping Mismatch by Gender								
Male	32.7	29.4	52.6	18.0	14.7	14.8	50.2	45.1
Female	20.2	15.4	70.1	14.5	9.7	5.8	37.3	28.5
Overlapping Mismatch by Working Hours per Week and Wage (Turkish Lira/month)								
Hours	47	46	41	45	44	49		
Wage	3127	2812	2820	3521	3047	2547		

Notes: OE: Overeducation; FoSMM: Field of Study Mismatch. n/a: Sample size below 30. Source: Own construction

4. Discussion, Conclusions and Policy Implications

Turkey has been implementing an expansion policy in higher education since 2006, which has given rise to concerns whether the economy can create sufficient job positions to accommodate those excess supply of graduates and/or whether these graduates will be able to find relevant jobs that fit their fields of study and/or education level. Based on these concerns, we conduct two analyses. First, we perform a review of empirical research on Turkey to provide the researchers with a more comprehensive picture. Second, using micro dataset from TURKSTAT labor force surveys, we present new evidence from two perspectives, which are (i) the change (increase or decrease) in incidence of vertical mismatch and field of study mismatch over time and (ii) their overlapping mismatch as of 2016.

The review of empirical research yields that the mismatch literature on Turkey has been growing for the recent years but is still very limited. Majority of the studies concentrate on the vertical mismatch (overeducation). The empirical research and governmental reports on field of study mismatch have been growing. The studies on consequences of mismatch are highly concentrated on vertical mismatch all of which studied only the wage effect. The number of studies on the determinants of field of study mismatch has been increasing but it is still highly focused on vertical mismatch. On the other side, none of those studies cover a review of literature, the increase or decrease in vertical and field of study mismatches over time and their overlapping mismatch. Hence, we attempt to fill this literature gap on Turkey. However, it is clear that the number and scope of mismatch related studies should be increased with a special emphasis on the determinants and/or consequences of different combinations of mismatch to contribute to design of more comprehensive policies with new evidence from different perspectives.

The new evidence from own analyses indicates four key findings. First, the incidence of both overeducation and field of study mismatch increased over time. Second, the rate of increase in HE is higher than that in VTHS. Third, employees who graduated from VTHS have the highest incidence in all mismatch categories (including mere overeducation, mere field of study mismatch and full-mismatch) with respect education level, age-groups and gender. Fourth, the share of field of study mismatched (overeducated) employees among the overeducated (field of study mismatched) ones is relatively high for both target groups. More importantly, those shares are much worse for the 20-24 age group especially in HE.

The above results can be explained in terms of two perspectives. First, the excess supply of highly educated graduates increased the fierce competition for

the limited job positions available in the labor market. Second, from the employer's point of view, this excess supply might affect the employers' recruitment process in such a way that they prefer highly educated candidates (instead of graduates from high school level) which require less investment in on-the-job training. (Wolbers, 2003: 250; Montt, 2015: 9). In sum, all the findings may indicate a significant imbalance between the education system and the labor market. On the demand side, we can propose that Turkey could not create sufficient jobs especially for the university graduates. On the supply side, we can infer that Turkey can better plan the supply of graduates.

For policy implications, we are aware of the fact that designing more comprehensive and concrete policies require more precise and detailed econometric analyses regarding the determinants and consequences of mismatch(es). Further, we recognize that the Turkish government has already been taking key institutional and legislative measures to improve the alignment between the education system and the labor market. However, after a quick analysis of the results, we aim to re-emphasize the importance of four policy recommendations.

The first policy recommendation may be to balance the supply of graduates by focusing on the highest priority fields of study which have both the highest incidences of field of study mismatch and of full-mismatch. The second policy recommendation may focus on improving the effectiveness of labor market mechanism by taking into account the labor market needs and technological developments. The third policy recommendation might aim at increasing the decent employment of vocational and technical education graduates from both high school level and associate-degree level. If achieved, then many graduates just after graduation from secondary education will be able to directly enter into the labor market which reduces their demand for higher education, which in turn decreases the pressure on university entrance examinations. The last policy recommendation might focus on increasing the awareness of high school students about the occupations/professions, and on improving job-seeking skills of last grade students in both high schools and universities.

In sum, we provide the researchers and policy makers with the main findings from review of empirical research on Turkey, and additional new evidence from different perspectives. First, we present the increase in field of study mismatch and vertical mismatch over time. Second, we generate key findings of overlapping mismatch with respect to different age-groups and gender. Third, all the main findings are presented for two separate target groups to propose more specific policies for each education level, namely HE and VTHS. We expect to further contribute to those achievements already realized by Turkish government and open-up new avenues for policy discussions.

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Appendix

Table 10: Coding Scheme-Coding of ISCO-08 Occupation Codes to Fields of Study

Occupation Codes ⇒ FOET-99 One-Digit Classification ⇓	Based on ISCO-08, 3-digit Codes (Montt, 2015)	Coding Scheme Based on Montt (2015) but Aggregated into 2-Digit Codes (Ege, 2020)
Teacher training and education science	231-235, 342, 531	23, 34, 53
Humanities, languages and arts	216, 231-233, 262-265, 341, 343	21,23,26,34
Social sciences, business and law	112, 121, 122, 131-134, 141-143, 231-233, 241-243, 226, 261-264,331-335, 325, 341, 411-413, 421, 422, 431, 432, 441, 521-524, 952	11-14, 23, 24, 22, 26, 33, 32, 34, 41, 42, 43, 44, 52, 95
Science, mathematics and computing	211-213, 226, 231-233, 251-252, 311, 313,314, 321, 331, 351-352	21, 22, 23, 25, 31, 32, 33, 35
Engineering, manufacturing and construction	214-216, 231, 232, 251-252, 311-313, 315, 335, 351-352, 515, 711-713, 721-723, 731-732, 741, 742, 751-754, 811-818, 821, 831-835, 931-933	21, 23, 25, 31, 33, 35, 51, 71, 72, 73, 74, 75, 81, 82, 83, 93
Agriculture and veterinary	213, 225, 231-232, 314, 321, 324-325, 611-613, 621-622, 631-634, 751, 754, 834, 921	21,22,23,31,32, 61, 62, 63, 75, 83, 92
Health and welfare	213, 221-227, 231, 234, 263, 321-325, 341, 516, 531, 532, 541,	21,22,23,26,32,34, 51, 53, 54
Services	134, 243, 325, 334, 335, 341, 343, 411-413, 421-422, 431-432, 441, 511-516, 521-524, 531, 532, 541, 831-835, 911-912, 941, 951, 952	13,24,32,33,34,41, 42, 43, 44, 51, 52, 53, 54, 83, 91, 94, 95

Note: Three-digit ISCO-08 codes are not available in TURKSTAT labor force surveys. Therefore, following Ege (2020), we aggregate three-digit codes into two- digit ones which is based on Montt's (2015) coding strategy. As expected, this aggregation yields lower incidence of field of study mismatch when compared to that of using original three-digit codes. Any individual who graduated from health and welfare and works in a job whose ISCO-08 code is 23, she/he is treated as well matched. However, if she/he works in occupation code 25, she/he is mismatched by field of study.