Comparison of Economic Benefits of University and Vocational High School Education among Different Majors in Turkey

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Abstract: Increasing demand for university education in Turkey means a difficult decision for students choosing their majors. On the other hand, for a developing country like Turkey, it is crucial to allocate educational resources efficiently. In the last two decades, the number of private universities substantially increased, and these new universities naturally allocate their own resources towards the more highly demanded departments. This paper aims to shed a light on the economic benefits of different majors. For this purpose, using micro level data from 2009 to 2012, we comparatively analyse wages earned by university degree holders in different disciplines. The data and the Turkish education system also allow us to compare the market returns of majors between secondary and postsecondary degree holders. This helps us understand marginal returns to university education after high school for each major. After organizing our data about individuals into cells built on different sets of demographic attributes, we estimated a regression model, which controls these demographic attributes. The estimations result in many interesting observations: (1) after controlling individual attributes, we clearly identify the differences in market returns for 21 majors at both vocational high school and university levels; (2) we identify disciplines where the difference in the market returns between high school and university degree holders is not significant; and (3) the most crowded disciplines have relatively lower market returns. To our knowledge, due to the data that have become available recently, this is the first study of its kind that analyses differences in market returns for different disciplines in Turkey.

Keywords: Education, Economic returns to study fields, Wage differentials.

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1. Introduction

Understanding the economic returns to education always attracts the interest of labour economics researchers. Most of the studies in this literature concentrate on the returns of the number of years or the specific level of education. Although the studies focusing on the differences in returns of different majors are relatively fewer, the number of works on this topic are steadily growing. These studies mostly use data from the US and the UK. Grubb (1992) and Rumberger and Thomas (1993) analysed wage returns in different fields of study in the US and showed a substantial wage difference for these fields. Black, Sanders and Taylor (2003) also used US data but focus on the financial reward for studying economics. Finnie and Frenette (2003) obtained similar results for Canada. Blackaby, Murphy and O'Leary (1999); Blundell et al. (2000); Bratti, Naylor and Smith (2008); and O'Leary and Sloane (2005) derived similar findings from UK data. More recently Livanos and Pouliakas (2011) also showed that wage returns are considerably different across the field of study for Greece. In most of these studies, results indicate that returns to fields such as law, engineering, social sciences and business are substantially higher than for the fields of the arts, education and the humanities.

This paper aims to shed a light on the economic benefits of different majors in Turkey. Analysing these benefits will be helpful for students and their parents in choosing the students' majors. Besides, since the Higher Education Council (YÖK) is the government authority, which gives approval for the capacity of each program in Turkish universities, this kind of analysis of the economics benefits of majors will provide an important guide for them also.

Table 1: Population by education levels and sex (15 years of age and over), 2013

Education level	Total	%	Male	%	Female	%
Illiterate	2,643,712	4.60	443,640	1.55	2,200,072	7.64
Literate but no school completed	3,829,953	6.67	1,203,461	4.21	2,626,492	9.12
Primary school	14,994,232	26.11	6,454,722	22.56	8,539,510	29.65
Primary education	11,959,942	20.83	6,783,011	23.71	5,176,931	17.97
Junior high school	2,828,299	4.93	1,720,425	6.01	1,107,874	3.85
High school or vocational school	12,085,335	21.05	6,976,694	24.38	5,108,641	17.74
Higher education	6,706,780	11.68	3,762,530	13.15	2,944,250	10.22
Master	532,757	0.93	313,397	1.10	219,360	0.76
Doctorate	154,180	0.27	93,407	0.33	60,773	0.21
Literacy status unknown	1,683,918	2.93	862,885	3.02	821,033	2.85
Total	57,419,108		28,614,172		28,804,936	

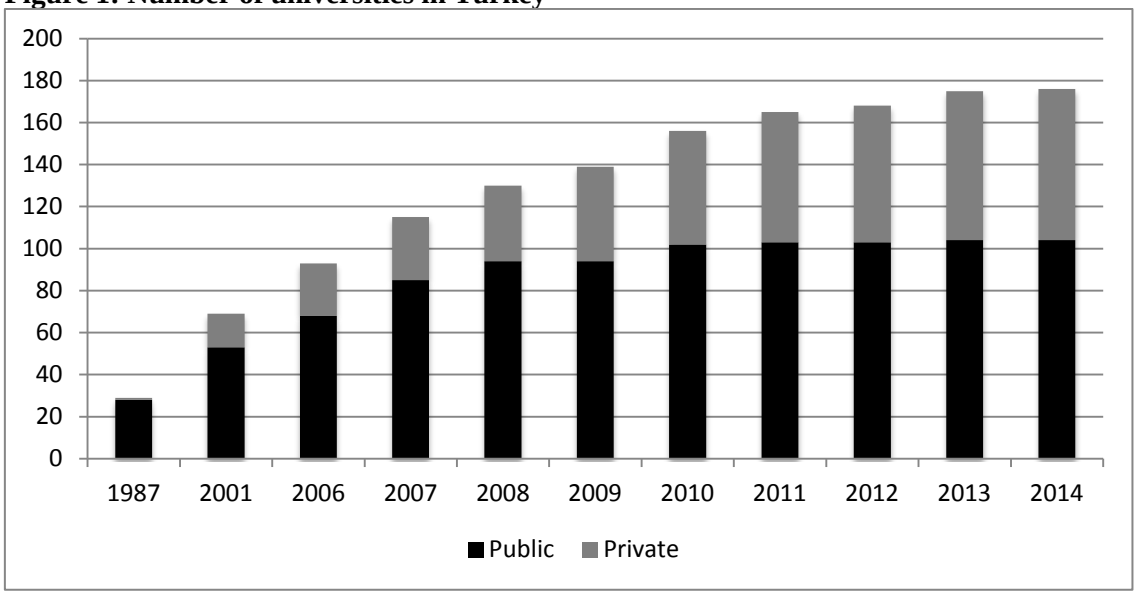
Source: TurkStat

Table 1 shows the distribution of people 15 years of age and over by education levels as of 2013. As seen in the table, only 13 percent of the population have a university degree, as compared to 21 percent of high school graduates. This study will also help us understand marginal returns to university education after high school for each major. The Turkish education system is briefly summarised in Appendix A.

It is important for students, faculty and university administrations to know what current data suggest about the market evaluation of degrees obtained from universities and vocational high schools (VHS). For university administrators, this information is useful for their resource

allocation decisions among departments. This information is also important for students and their parents who make financial sacrifices to enable the students to pursue university education with the expectation of reaping financial benefits in the future. It is also important for university faculty members, as they determine the demand for their research and the courses they offer. Offering courses to students that will improve their market reward from university education is a desirable response from an economic point of view.[1] Using micro level data from 2009 to 2012, we compare wages earned by university degree holders in different disciplines.

Figure 1: Number of universities in Turkey

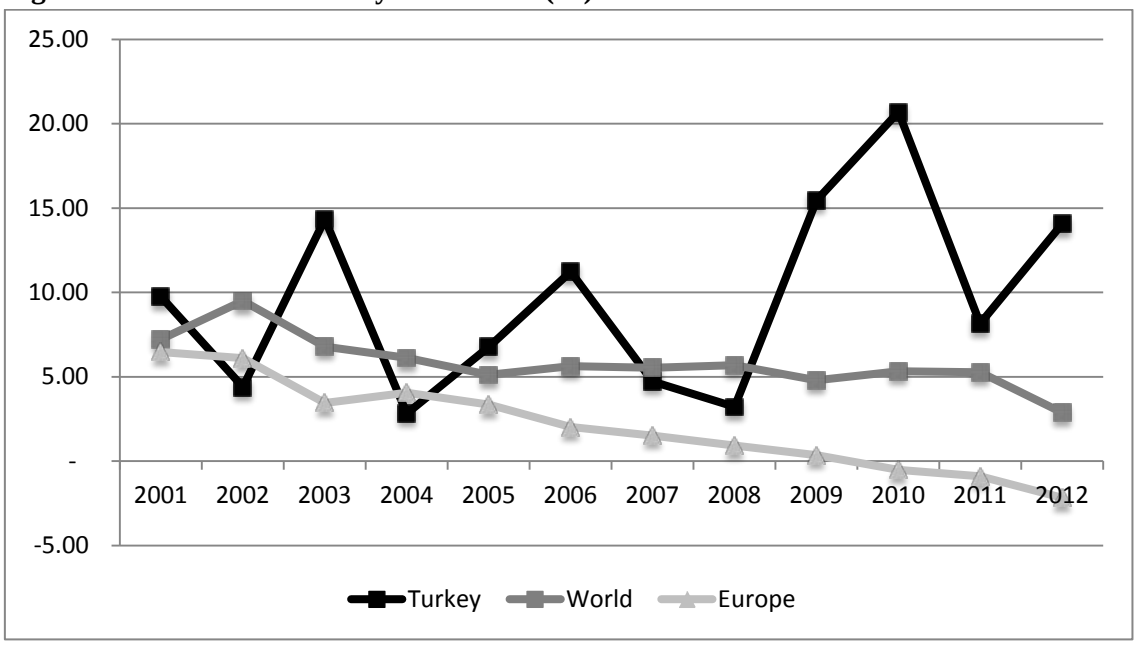


Source: Gunay (2014)

Figure 1 shows the number of institutions providing tertiary education in Turkey. Between 2001 and 2014, the number of private universities increased from 16 to 72, while the number of public universities rose from 53 to 104, which reflects the unparalleled demand in higher education where the enrolment has gone up from 1.5 million to 5.4 million during the same period. This trend is also shown in Figure 2 where the growth rates in enrolment numbers in Turkey are compared with those in the whole world and in Europe. Moreover, between 2009 and 2014, the gross enrolment rate (GER) in higher education, which shows the number of enrolled students in their respective age groups, has gone up from 45 percent to 82 percent (Gunay, 2014). UNESCO statistics, on the other hand, show low enrolment numbers in VHS education, which increased from 1.1 million in 2000 to 1.8 million in 2012, confirming that the higher demand is unique to tertiary education in Turkey. Are these trends and developments in higher education in line with the economic reward that the tertiary education is expected to create for degree holders in Turkish labour markets? How would this economic reward differ across fields of study in both VHS and tertiary education? These are the questions that we try to answer in this analysis.

[1] Of course, social externalities generated by higher education remain important for the consideration of public funding of higher education.

Figure 2: Growth in university enrolments (%)



Source: UNESCO Education database

In this analysis the most critical issue is to control for individuals' differences in their demographic compositions. After organizing our data about individuals into cells built on different sets of demographic attributes, we estimated a regression model, which controls these demographic attributes.

The estimation results in many interesting findings. First, after controlling individual attributes, we clearly identify the differences in market returns for 21 majors at both high school and university levels; second, we identify disciplines where the difference in the market returns between high school and university degree holders is not significant. And third, we observe that the most crowded disciplines have relatively lower market returns

To our knowledge, due to the data that have become available recently, this is the first study of its kind that analyses market returns for different disciplines for Turkey. The analysis conducted in this paper is mostly based on the Black, Sanders and Taylor (2003) model, which analysed reward for studying economics by controlling demographic characteristics of workers using US data. Estimating a similar model, we first identify rewards for different disciplines by taking into account the overall average wage of workers with the same demographic characteristics. Then, we compare the rewards for university and VHS education in each discipline.[2]

Most studies of market returns to a higher education in different disciplines use a wage determination framework to understand the differences between market rewards of high school and university degrees. As stated above, understanding the determination of wage differentials across majors is beyond the objective of our paper. Our study aims to report wage differentials

[2] Students in Turkey may choose VHS after completing the eight-year compulsory primary education. Vocational high school graduates may choose two-year polytechnics programs or may continue with a related tertiary degree.

between majors in Turkey for workers with identical demographic, regional and occupational characteristics. We do believe that even achieving this objective as a first attempt is very important for Turkey. The rest of the paper is organized as follows: Section 2 describes the data; Section 3 explains the econometric framework and reports the estimation results; and the last section provides concluding remarks.

2. Some characteristics of the data used in this study

This study uses a data set pooled from four Labour Force Surveys (LFS) conducted annually between 2009 and 2012. LFS has added a variable to its questionnaire that identifies a person's major field of study in which the person was granted the highest degree in either VHS or universities. To use LFS data for the purposes of our study, we accessed the micro data sets with special permission from TurkStat, which codes the major fields of study in 21 basic learning areas by following the International Standard Classification of Education – UNESCO (ISCED) 1997. Details of the ISCED 1997 classification are given in Appendix B.

The overall sample is restricted to fulltime wage earners who are ages 15–65 years and who work in a permanent, private-sector position. After these restrictions, the sample has 203,265 observations, of which 31,239 have a VHS degree and 30,952 have a university degree. Table 2 shows the weighted distribution of these observations by learning areas so the numbers reflect population values for Turkey.

Table 2: Distribution of fulltime wage earners by learning areas (15 years of age and over), 2009–2012

	All			VHS			University		
ISCED 97 Learning Areas	Male	Female	Total	Male	Female	Total	Male	Female	Total
Teacher education and educational science	59.04	40.96	4.50	76.79	23.21	1.57	55.48	44.52	7.21
Arts	41.58	58.42	3.89	44.31	55.69	4.00	38.91	61.09	3.80
Humanities	78.74	21.26	5.68	90.76	9.24	8.49	47.98	52.02	3.07
Social and behavioural sciences	59.12	40.88	4.75	15.04	84.96	0.01	59.16	40.84	9.15
Journalism and information	46.24	53.76	0.23	82.15	17.85	0.03	44.12	55.88	0.42
Business and administrative sciences	59.16	40.84	26.26	65.81	34.19	21.04	55.00	45.00	31.09
Law	43.07	56.93	0.72	100.00	0.00	0.02	42.15	57.85	1.36
Life sciences	45.60	54.41	0.56	n/a	n/a	n/a	45.60	54.41	1.08
Natural sciences	61.12	38.88	2.08	64.39	35.61	0.15	61.00	39.00	3.86
Mathematics and statistics	66.07	33.93	0.77	64.21	35.79	0.01	66.09	33.91	1.48
Computing	70.87	29.13	2.46	72.49	27.51	2.06	69.78	30.22	2.83
Engineering	94.87	5.13	26.33	96.57	3.43	37.03	91.33	8.67	16.43
Manufacturing and processing	83.59	16.41	9.43	88.85	11.15	16.38	56.89	43.11	2.99
Architecture and building	80.75	19.25	3.70	93.70	6.30	2.66	73.94	26.06	4.67
Agriculture, forestry and fishery	69.97	30.03	1.54	84.12	15.88	0.33	68.35	31.65	2.67
Veterinary	64.22	35.78	0.26	53.40	46.60	0.04	65.19	34.81	0.45
Health	38.24	61.76	2.68	29.79	70.21	1.76	42.15	57.85	3.52
Social services	3.03	96.97	1.07	1.22	98.78	2.17	65.69	34.28	0.06
Personal services	55.53	44.47	2.49	58.89	41.11	1.93	53.53	46.47	3.01

Transport services & environmental protection	64.32	35.68	0.37	87.92	12.09	0.20	56.04	43.96	0.53
Security services	93.78	6.22	0.22	100.00	0.00	0.11	91.80	8.20	0.32

Notes: While the gender distributions show a horizontal distribution of the study field, columns under the heading 'Total' present a vertical distribution of all workers across the study fields.
Source: Authors' calculation based on LFS 2009–2012.

We make several interesting observations based on Table 2. First, Business and Administrative Sciences (BAS) and engineering together represent more than 50 percent of all degree holders. The gender distribution of these fields also indicates that while engineering is mostly populated by male degree holders, female degree holders dominate BAS.

To provide a general overview of the overall labour market performance of workers who have obtained university and VHS degrees in different disciplines, we report the average hourly wage rate and unemployment rates in Tables 3 and 4, respectively. As these data are weighted, they reflect values for the entire population.

Table 3: Average hourly wage by learning areas (15 years of age and over), 2009–2012 – Turkish Lira (TL)

	All		VHS		University	
ISCED 97 Learning Areas	Male	Female	Male	Female	Male	Female
Teacher education and educational science	7.97	7.95	5.27	4.50	8.72	8.31
Arts	7.16	5.91	5.40	4.37	9.13	7.28
Humanities	5.50	7.91	4.62	3.96	9.75	9.71
Social and behavioural sciences	14.17	11.98	n/a	5.54	14.18	11.99
Journalism and information	16.18	9.04	7.18	2.29	17.17	9.16
Business and administrative sciences	8.36	7.46	5.04	4.92	10.85	8.67
Law	16.04	14.16	5.22	n/a	16.45	14.16
Life sciences	10.52	8.78	n/a	n/a	10.52	8.78
Natural sciences	12.56	10.56	7.41	4.77	12.76	10.76
Mathematics and statistics	11.20	12.02	n/a	n/a	11.27	12.08
Computing	8.82	7.25	4.41	3.92	11.90	9.30
Engineering	7.24	9.15	5.48	4.59	11.13	12.91
Manufacturing and processing	5.67	5.84	5.25	4.35	8.93	7.80
Architecture and building	9.25	8.57	5.16	4.97	11.98	9.03
Agriculture, forestry and fishery	8.52	6.60	6.41	3.78	8.81	6.76
Veterinary	11.17	7.50	5.88	4.98	11.55	7.80
Health	26.57	16.01	5.68	5.64	33.40	21.85
Social services	8.25	3.91	3.74	3.88	11.15	7.77
Personal services	7.67	5.94	5.82	3.80	8.89	7.06
Transport services & environmental protection	10.20	10.36	6.91	3.97	12.01	10.98
Security services	19.15	5.28	6.40	n/a	23.57	5.28

Note: Since wages are adjusted to 2012 prices, the numbers reflect average wages as of 2012.
Source: Authors' calculation based on LFS 2009–2012.

As Tables 3 and 4 show, wage and unemployment rates vary dramatically by fields of study. For example, hourly wages vary from 5.50 TL in humanities (for males) to 26.57 TL in health, and the unemployment rate varies from 1.28 percent in social services to 13.79 percent in computing. The two highest average wages are earned by health and security services majors. Interestingly, the most crowded majors, BAS and engineering, are among the majors with the lowest average hourly wage rates. Except for a few majors, gender differences in unemployment rates and wages are significant: male workers have lower unemployment rates with higher average hourly wages than female workers do. Another striking finding is that, despite the fact that law, health, and security services have the highest average hourly wage, they are among the least populated majors.

Table 4: Unemployment rates by learning areas (15 years of age and over), 2009–2012

	All		VHS		University	
ISCED 97 Learning Areas	Male	Female	Male	Female	Male	Female
Teacher education and educational science	7.05	10.79	10.71	23.16	6.74	10.22
Arts	12.62	23.13	11.76	22.58	13.29	23.58
Humanities	6.04	16.99	6.74	22.54	4.73	14.31
Social and behavioural sciences	6.99	15.30	36.20	0.00	6.98	15.34
Journalism and information	9.35	24.02	0.00	0.00	9.92	24.13
Business and administrative sciences	9.14	21.34	9.85	20.84	8.74	21.56
Law	2.55	4.80	27.83	n/a	1.89	4.80
Life sciences	9.53	15.87	0.00	0.00	9.56	15.94
Natural sciences	9.46	15.15	14.45	19.92	9.28	14.99
Mathematics and statistics	8.18	13.55	0.00	0.00	8.19	13.61
Computing	13.79	25.58	15.31	29.12	12.68	23.23
Engineering	9.17	19.16	9.17	23.58	9.16	15.08
Manufacturing and processing	8.68	21.71	8.29	20.14	11.35	23.92
Architecture and building	9.00	17.26	9.52	31.97	8.74	15.43
Agriculture, forestry and fishery	8.45	20.96	7.89	11.02	8.50	21.25
Veterinary	4.77	5.66	7.01	0.00	4.64	5.86
Health	2.32	3.35	5.82	5.68	1.58	2.64
Social services	1.28	27.59	2.80	27.87	0.00	18.91
Personal services	11.62	17.45	11.52	17.35	11.67	17.49
Transport services & environmental protection	11.38	17.69	10.92	28.76	11.59	15.40
Security services	1.76	2.45	6.02	24.92	1.32	1.78

Note: The data used here include the entire labour force regardless of whether or not workers are full wage earners.
Source: Authors' calculation based on LFS 2009–2012.

3. Estimations of wage differentials across disciplines

The above results are informative, but in order to draw a meaningful comparison between workers who earned their degrees in different disciplines, we must control for differences in their demographic compositions. In this Section, we compare the hourly wage rates of workers who hold a VHS or a university degree by following a method similar to one applied by Black,

Sanders and Taylor (2003). We organized our data into different cells built on a set of demographic attributes (explained below) and estimated the following regression model:

$$\ln(w_i) - \ln(\overline{w_j}) = \mathbf{\beta Z} + \varepsilon_i, \quad (1)$$

where w_i is the wage of the person i, $\overline{w_j}$ is the average wage of the cell j built on a set of demographic attributes that the person i possesses, $\mathbf{Z}$ is the vector of dummy variables for 21 majors, $\mathbf{\beta}$ is the vector of coefficients of interest, and ε_i is the error term. The expression above demeans the wage (in natural logs) at each observation by taking the difference between a person's wage and the average wage of the cell that the person belongs to. Hence, $\mathbf{\beta}$ can be interpreted in two ways. First, when a major is selected as a base, coefficients reveal percentage differences between the base major and other majors in hourly wages for workers with identical demographic, regional and occupational characteristics. Second, without a base, they show the wage premium of each major, i.e., the difference in percentage from the overall average hourly wage rates, after controlling for personal and regional characteristics. These interpretations depend on how the average wage of the cell, $\overline{w_j}$, is calculated, which we discuss below.

We understand that wage differential between two majors should be measured for comparable students. In other words, market returns to a major are what students earn with a degree in that major as opposed to that which the 'same' students would earn in a different major. In that sense, wage differentials that we report across majors reflect differences in unobserved attributes such as abilities of individuals as well as differences in market returns to those majors. Unfortunately there are no available data that we can use to control for differences in unobserved attributes. Therefore, in our study we report the wage differentials rather than differences in pure market returns between majors.

However, the problem of unobserved differences in individual ability can be partially eliminated if one compares majors that have similar requirements in admission, such as GPA scores, and in obtaining the degree. In other words, wage differentials between similar majors (such as engineering, mathematics, computing) would reflect differences in market returns, as degree holders in those majors have similar abilities in terms of meeting the admission and degree requirements. Moreover, we also control workers' skill level by using 9 occupational categories.

As a common practice, we use the number of hours worked in the reference week. Hence, the hourly wage is calculated in this study as the total annual wage earned during the year divided by the product of the number of weeks worked during the year and the number of hours worked in the reference week. We first report results for both VHS and university degree holders. In order to control demographic, regional and occupational attributes, we first organize the data in cells developed by age, gender, 12 regions and 9 occupation levels.[3] Thus we created 900 cells (10 age groups x 2 genders x 12 regions x 9 occupation levels). To avoid smaller cell sizes, we

[3] The 12 regions are the following: 1 - İstanbul (TR1); 2 - West Marmara (TR2); 3 - Aegean (TR3); 4 - East Marmara (TR4); 5 - West Anatolia (TR5); 6 - Mediterranean (TR6); 7 - Central Anatolia (TR7); 8 - West Black Sea (TR8); 9 - East Black Sea (TR9); 10 - Northeast Anatolia (TRA); 11 - Central East Anatolia (TRC; 12 - Southeast Anatolia (TRC). The 9 occupations are the following: 1 - Legislators, Senior Officials and Managers; 2 - Professionals; 3 - Technicians and Associate Professionals; 4 - Office Clerks; 5 - Service Workers and Shop & Market Sales Workers; 6 - Skilled Agricultural and Fishery Workers; 7 - Craft and Related Trades Workers; 8 - Plant and Machine Operators and Assemblers; 9 - Elementary Occupations.

restrict the estimations with cells that have 20 or more members.[4] We calculate the average hourly wage of the cell, $\overline{w_j}$, at two levels. First, to identify the wage premium for each major, we calculate an overall average for each cell, including only workers who are not VHS or university degree holders, which make up 70 percent of our sample. The estimation results of Equation (1) using those averages are given in Table 5. Second, to measure the relative wage earnings of each major, we calculate the average wage of each cell for degree holders only, which accounts for 30 percent of the sample. The estimation results with these averages are reported in Table 6.[5]

Table 5: Weighted estimates of average hourly wage differentials for 21 learning areas (%) with $\overline{w_j}$ calculated for nondegree holders, 2009–2012

	All		VHS		University	
ISCED 97 Learning Areas	Coef.	t	Coef.	t	Coef.	t
Teacher education and educational science	2.8	2.76	4.7	2.27	2.4	2.08
Arts	3.9	3.97	1.1	0.92	6.7	4.34
Humanities	-0.1	-0.14	-1.4	-1.66	3.2	1.65
Social and behavioural sciences	27.2	20.87	n/a	n/a	27.2	20.87
Journalism and information	-3.2	-0.54	-2.7	-0.11	-3.2	-0.53
Business and administrative sciences	9.9	22.53	0.1	0.14	16.1	25.95
Law	15.5	4.86	10.7	0.63	15.6	4.82
Life sciences	9.8	2.89	n/a	n/a	9.8	2.89
Natural sciences	18.3	10.50	8.4	0.94	18.7	10.52
Mathematics and statistics	11.8	4.26	2.0	0.14	11.9	4.26
Computing	14.7	10.94	6.7	4.00	20.0	10.48
Engineering	16.0	41.66	11.0	26.48	26.6	33.66
Manufacturing and processing	8.6	15.00	8.2	13.83	10.9	6.09
Architecture and building	10.7	9.41	4.0	2.89	14.2	9.09
Agriculture, forestry and fishery	10.3	5.76	2.4	0.59	11.3	5.78
Veterinary	9.9	2.06	-2.2	-0.26	10.9	2.12
Health	33.7	17.91	13.3	7.31	43.3	16.89
Social services	-5.7	-3.49	-6.3	-3.90	21.1	1.77
Personal services	11.9	7.60	5.3	2.21	15.8	7.75
Transport services & environmental protection	18.6	4.56	13.5	2.18	20.3	4.04
Security services	36.4	4.83	-15.2	-1.72	53.8	6.02
Number of Observations		58811		30015		28796
Population Size		9781711		4749037		5032674

Notes: (1) The dependent variable is the demeaned log hourly wage rates as stated in Equation (1). (2) The results show weighted OLS estimates.

The results show wage premiums in percentages for each major from the overall average hourly wage rates calculated for nondegree holders, after controlling for personal and regional

[4] The test results show that the regression results are not sensitive to cell sizes.
[5] Hereafter we call VHS and university degree holders 'degree holders', and we call the rest 'nondegree holders.'

characteristics. The first two columns report the results for all degree holders together, the next two columns are for VHS degree holders, and the last two columns are for university degree holders. For example, degree holders in health services earn 33.7 percent higher wages than the average wage of nondegree holders. This positive difference becomes 13.3 percent when it is compared with VHS graduates' average wage, and it is 43.3 percent higher than the average wage of workers with a university degree. Observe in the third and fourth columns of Table 5 that holding a VHS degree does not necessarily entail a wage premium for each major. On the other hand, except for journalism, every major in tertiary education provides varying but significant wage premiums for postsecondary degree holders. In general, wage premiums for majors in social and behavioural sciences, law, transport services and environmental protection, natural sciences, engineering, computing (information technologies), and health and security services become more substantial. Note also that the main portions of the differences come from university degree holders. For instance, for engineering, which is among the most crowded majors, VHS degrees provide 11 percent wage difference; however, university degrees provide a 26.6 percent wage difference. Except for journalism and information, these high and significant gaps in wage differentials between VHS- and university degree holders are clear evidence about high economic returns to education in postsecondary degrees. This is particularly important when higher education degree holders account for only 11 percent while high school degree holders represent 22 percent of the total population in Turkey.

The estimates in Table 5 reflect differential wage premiums for degree holders in each major relative to nondegree holders. When Equation (1) is estimated with cell averages, $\overline{w_j}$, calculated for VHS-only and university-only degree holders separately, estimates reflect wage differentials across majors for degree holders only. Table 6 reports those results. The third and fifth columns give the coefficients for which $\overline{w_j}$ is calculated for VHS- and university degree holders, respectively.

Table 6: Weighted estimates of average hourly wage differentials for 21 learning areas (%) with $\overline{w_j}$ calculated for degree holders only, 2009–2012

	All		VHS		University	
ISCED 97 Learning Areas	Coef.	t	Coef.	t	Coef.	t
Teacher education and educational science	-5.0	-4.84	-1.1	-0.51	-9.3	-7.90
Arts	-7.6	-7.12	-1.0	-0.74	-12.0	-7.03
Humanities	-11.6	-14.06	-7.3	-8.83	-10.3	-5.40
Social and behavioural sciences	14.4	11.03	n/a	n/a	6.2	4.65
Journalism and information	-11.6	-2.04	13.3	0.59	-15.4	-2.65
Business and administrative sciences	-1.3	-2.88	-1.1	-2.02	-2.9	-4.69
Law	13.1	4.04	13.2	0.81	12.2	3.68
Life sciences	1.6	0.50	n/a	n/a	-5.4	-1.62
Natural sciences	8.8	5.15	2.8	0.31	3.4	1.95
Mathematics and statistics	5.5	2.03	n/a	n/a	0.9	0.32
Computing	7.7	5.53	4.0	2.37	11.2	5.51
Engineering	3.5	8.89	3.8	9.37	8.7	10.21
Manufacturing and processing	-4.3	-7.34	0.1	0.17	-5.0	-2.61
Architecture and building	0.2	0.21	-1.8	-1.26	0.0	0.02

Agriculture, forestry and fishery	-1.6	-0.86	-6.0	-1.22	-9.2	-4.52
Veterinary	1.2	0.26	-12.8	-1.12	-2.5	-0.51
Health	25.9	13.28	11.7	5.33	32.8	11.96
Social services	-18.4	-10.31	-5.4	-3.06	-1.7	-0.18
Personal services	-0.7	-0.46	2.5	0.94	-5.7	-2.77
Transport services & environmental protection	7.1	1.69	0.5	0.07	5.5	1.05
Security services	19.0	2.24	-17.5	-2.18	16.2	1.74
Number of Observations	54774		25498		25135	
Population Size	9242484		4145529		4529823	

Notes: (1) The dependent variable is the demeaned log hourly wage rates as stated in Equation (1). (2) The results show weighted OLS estimates. (3) Some coefficients are not available (n/a) due to the insufficient number of observations in respective majors.

Comparing Tables 5 and 6, we see that once the wage premium of holding a degree against nondegree holders is removed, majors in which workers earn significantly higher wages than do nondegree holders do not entail higher wages any more than what other majors offer to comparable workers. For example, while individuals holding a university degree in the majors of veterinary, security services, social services, transport services, architecture, mathematics, and life sciences earn the average wage rate of their cell levels, the university degree holders in health, law, engineering, computing, natural sciences, and social and behavioural sciences earn significantly more than do their comparable colleagues. Note that university degree holders for majors in education, arts, humanities, journalism, business, manufacturing, agriculture, and personal services earn much less than do their colleagues. When we look at the differences for the VHS degree holders, we observe that workers in three majors – computing, engineering and health – earn significantly more than do other VHS degree holders. While workers in the humanities, business, social services, and security services earn significantly less than the average, holding a degree in another major does not make a difference in wage earnings at the VHS level. Since more than 50 percent of VHS and university degree holders are clustered in only two majors, BAS and engineering, in Table 7 we report the comparative differences between these two majors and the others.

Table 7: Weighted estimates of average hourly wage differentials of BAS and engineering majors from others with $\overline{w_j}$ calculated only for university degree holders (%), 2009–2012

	All		Engineering		BAS	
ISCED 97 Learning Areas	Coef.	t	Coef.	t	Coef.	t
Teacher education and educational science	-9.3	-7.90	-17.9	-12.37	-6.3	-4.76
Arts	-12.0	-7.03	-20.6	-10.84	-9.0	-4.97
Humanities	-10.3	-5.40	-18.9	-9.08	-7.3	-3.66
Social and behavioural sciences	6.2	4.65	-2.4	-1.54	9.2	6.20
Journalism and information	-15.4	-2.65	-24.1	-4.09	-12.5	-2.13
Business and administrative sciences	-2.9	-4.69	-11.6	-11.00	Base	Base
Law	12.2	3.68	3.6	1.04	15.2	4.49
Life sciences	-5.4	-1.62	-14.1	-4.07	-2.5	-0.73
Natural sciences	3.4	1.95	-5.3	-2.75	6.3	3.44

Mathematics and statistics	0.9	0.32	-7.8	-2.71	3.8	1.36
Computing	11.2	5.51	2.6	1.17	14.2	6.65
Engineering	8.7	10.21	Base	Base	11.6	11.00
Manufacturing and processing	-5.0	-2.61	-13.7	-6.50	-2.1	-1.02
Architecture and building	0.0	0.02	-8.6	-4.61	3.0	1.67
Agriculture, forestry and fishery	-9.2	-4.52	-17.8	-8.10	-6.2	-2.93
Veterinary	-2.5	-0.51	-11.2	-2.21	0.4	0.08
Health	32.8	11.96	24.2	8.42	35.8	12.71
Social services	-1.7	-0.18	-10.4	-1.08	1.2	0.13
Personal services	-5.7	-2.77	-14.4	-6.43	-2.8	-1.29
Transport services & environmental protection	5.5	1.05	-3.2	-0.60	8.4	1.60
Security services	16.2	1.74	7.6	0.81	19.2	2.05
Number of Observations			25135			
Population Size			4529823			

Notes: (1) The dependent variable is the demeaned log hourly wage rates as stated in Equation (1). (2) The results show weighted OLS estimates. (3) The bases are Business and Administrative Sciences in the third and fourth columns; Engineering is in the last columns.

The first two columns of Table 7 are taken from Table 6 for a better comparison. A quick look at Table 7 shows that, although BAS is the most crowded major, workers with a university degree in BAS do not fare very well when compared with workers with other degrees. In fact, there are only 5 majors out of 21 whose members earn substantially less than BAS majors: these majors are education, arts, humanities, journalism, and agriculture. In line with earlier findings, among the university degree holders, workers with majors in health (35.8%), security services (19.2%), and law (15.2%) have the largest wage differentials from the BAS majors. Similar to findings in Black, Sanders and Taylor's (2003) study that used 1993 data for the US, BAS majors in Turkey earn higher average hourly wages than do demographically comparable education, arts, and humanities majors in Turkey. However, BAS is one of the majors that earns the least relative to other majors. The second and third columns report the same results for engineering majors. As reported in the first column, although engineering is one of the most populated majors, workers with engineering majors earn 8.7 percent more than the degree holders in other majors on average – which makes it the fifth major earning the highest hourly wage. However, when the wage differentials are evaluated considering engineering as a base, only workers holding a health services degree earn significantly more than do workers with an engineering major.

Table 8: Weighted estimates of average hourly wage differentials by age groups for selective majors with $\overline{w_j}$ calculated for university degree holders (%) only, 2009–2012

	15–19		30–44		45–65	
ISCED 97 Learning Areas	Coef.	t	Coef.	t	Coef.	t
Teacher education and educational science	-1.1	-0.70	-11.6	-6.73	-45.1	-9.60
Arts	-12.4	-5.69	-11.4	-4.22	-5.8	-0.37
Humanities	-2.0	-0.76	-14.8	-5.37	-14.2	-1.39
Business and administrative sciences	-3.1	-3.99	-3.4	-3.51	22.7	2.92

Law	8.0	1.69	12.9	2.57	62.8	3.98
Natural sciences	0.9	0.34	4.9	2.11	9.4	0.81
Computing	7.5	3.04	16.8	4.51	36.9	3.46
Engineering	8.4	7.43	8.6	6.63	12.3	2.01
Manufacturing and processing	-7.1	-2.91	-2.7	-0.85	-11.2	-0.83
Agriculture, forestry and fishery	-8.5	-3.12	-8.8	-2.97	-59.6	-2.30
Health	14.1	5.28	39.6	11.71	30.1	3.82

Notes: (1) The dependent variable is the demeaned log hourly wage rates as stated in Equation (1). (2) The results show weighted OLS estimates.

Further insights into the above results can be obtained by analysing our data by age cohorts. Such an analysis helps us understand the progress individuals could expect to make with experience on their job in each discipline. Table 8 reports wage differentials for a selective group of majors classified by three age cohorts.

In most cases, for those who major in advantaged disciplines, their wage differentials increase. The 'rewards' of studying computer and information science, health, engineering, law, natural sciences are substantially higher for senior cohorts than for younger ones. The wage difference for the 45–65 age group in law is remarkable. Note that we observe rewards for only the 45–65 age group in BAS. These results are remarkable as they indicate that their rising gaps in disciplines could reflect their 'premia' for being senior members of professional organizations. Interestingly, the earnings for the cohorts in education are increasingly negative for subsequent cohorts. This growing 'penalty' for higher age groups in education, agriculture, arts, and humanities may indicate a declining demand in the job market for seniors in those majors. The wage loss for the 45–65 age group in agriculture is also striking.

4. Concluding remarks

While estimating the economic benefits of a degree has been the subject of many studies in the West, such studies are lacking in Turkey. We analyse 2009–2012 Labour Force Surveys using micro data as an attempt to fill this gap. The results lead to several interesting observations, including the following: (1) after controlling for individual attributes, we clearly identify the differences in market returns for 21 majors at both high school and university levels; (2) we identify disciplines where the difference in the market returns between high school and university degree holders is not significant; and (3) we analyse the returns for all majors relative to the most crowded disciplines, which are BAS and engineering.

To our knowledge, due to the data that have become available recently, this is the first study of its kind that analyses market returns for different disciplines for Turkey. Some descriptive features of the data show that wage and unemployment rates vary dramatically by fields of study. The three highest average wages are earned by the health, law, and security services majors. Interestingly, the most crowded majors, BAS and engineering, are among the majors with the lowest average hourly wage rates. Except for a few majors, gender differences in unemployment rates and wages are significant: male workers have lower unemployment rates with higher average hourly wages than female workers do. Another striking finding is that the despite the fact that law, health, and security services have the highest average hourly wage,

they are among the least populated majors.

For a meaningful comparison between workers who earned their degrees in different disciplines, we controlled for differences in their demographic compositions. First, we analysed the wage premium for holding a degree in 21 different disciplines. Results show that although VHS degree holders represent 22 percent of the population, which is twice as large as the percentage of university degree holders, the market rewards to university degree holders in all majors are substantially higher than those for VHS degree holders. Moreover, a VHS degree does not necessarily entail a wage premium for each major. Health, security services, social and behavioural sciences, and engineering are the majors for which a university degree provides substantial wage return.

When the wage premium of holding a degree, compared to not holding a degree, is removed and the returns are compared for just the university degree holders, we observe that in health, law, engineering, computing, natural sciences, and social and behavioural sciences workers earn significantly more than do their comparable colleagues. Besides, university degree holders with majors in education, arts, humanities, journalism, business, manufacturing, agriculture, and personal services earn much less than their colleagues. A similar analysis for only VHS degree holders shows that the earnings for three majors – computing, engineering and health – are significantly higher than for other VHS degree holders. However, workers in humanities, business, social services, and security services earn significantly less than the average, while holding a degree in another major does not make a difference in wage earnings at the VHS level.

We also examined the returns for university- and VHS-level degree holders by taking the most populated majors, BAS and engineering as a basis. Results show that a BAS ranks fifteenth among wage earners of 21 major disciplines. In line with earlier findings, among the university degree holders, workers in health (35.8%), security services (19.2%), and law (15.2%) have the largest wage differentials from the BAS majors. On the other hand, workers with a university degree in an engineering major earn 8.7 percent more than the university degree owners in other majors on average, which makes it the fifth major earning the highest hourly wage. However, when the wage differentials are evaluated considering engineering as a base, only workers holding a university degree in health services earn significantly more than workers with the engineering major.

Finally, the ‘rewards’ of studying computer and information science, health, engineering, law, and natural sciences are remarkably higher for senior cohorts than for younger cohorts. Interestingly, earnings for the cohorts in education are increasingly negative for subsequent cohorts; there is a growing ‘penalty’ for majors in education, agriculture, arts, and humanities, indicating a declining demand in the job market for seniors in those majors. By demonstrating the market rewards of different fields of study in Turkey, our research also highlights the need for a greater public policy focus in developing mathematical skills among students enrolled at pre-university education levels, as a prerequisite for developing analytical skills that are demanded in labour markets.

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Appendix A
The Structure of the Educational System in Turkey[6]

The age of entry to school is six or seven. Since 1997, secondary education follows eight years of basic education and covers general, vocational and technical high schools that provide three or four years of education. General high schools do not prepare students for a specific profession but rather for higher education. The following institutions are considered to fall within general secondary education: high schools; high schools with intensive foreign language teaching; Anatolian high schools where a foreign language – English, French or German – is taught during the preparatory year and the teaching of certain subjects is provided in that language in upper grades; science high schools; teacher training high schools; Anatolian fine arts schools; multi-curricula high schools; evening high schools; and private high schools. In general high schools, the average number of weekly periods of teaching in each grade varies from a minimum of 33 to a maximum of 41. In their second year, students in high schools where the general programme is applied may choose to attend branches which specialize in the natural sciences, literature and mathematics, the social sciences, foreign languages, art or physical education.

Vocational high schools provide three-year secondary education, train qualified people for various professions and also prepare students for higher education. Technical high schools offer a four-year programme. Subjects offered in the first year are the same as in the vocational high schools. Secondary education students obtain the Lise Diplomasi, which is the prerequisite for entry to higher education. Admission to university is centralized and based on the Student Selection Examination (ÖSS).

As of 2014, higher education is provided by 104 state universities and 72 foundations (private universities). The supreme authority for the regulation of higher education is the Council of Higher Education (YÖK), which is a fully autonomous national board of trustees without any political or government affiliation. The Interuniversity Council consists of the rectors of all the universities and one member elected by the Senate of each university. Universities, faculties, institutes and four-year schools are founded by law, while the two-year vocational schools, departments and divisions are established by the Council of Higher Education. The foundation universities are under the supervision of the Council of Higher Education and their programmes must be regularly accredited. In the universities, the medium of instruction is Turkish. Some universities use English, French and German as the language of instruction with one preparatory year.

Appendix B
International Standard Classification of Education (ISCED) 1997 – Broad Groups and Fields of Education[7]

1 Education

[6] *The European Education Directory* (EuroEducation.Net).
[7] United Nations Educational, Scientific and Cultural Organization (UNESCO, 2006).

14 Teacher training and education science

Teacher training for pre-school, kindergarten, elementary school, vocational, practical, non-vocational subject, adult education, teacher trainers and for handicapped children. General and specialized teacher training programmes. Education science: curriculum development in non-vocational and vocational subjects. Educational assessment, testing and measurement, educational research, other education science.

2 Humanities and Arts

21 Arts

Fine arts: drawing, painting, sculpture; Performing arts: music, drama, dance, circus; Graphic and audio-visual arts: photography, cinematography, music production, radio and TV production, printing and publishing; Design; Craft skills.

22 Humanities

Religion and theology; Foreign languages and cultures: living or 'dead' languages and their literature, area studies; Native languages: current or vernacular language and its literature; Other humanities: interpretation and translation, linguistics, comparative literature, history, archaeology, philosophy, ethics.

3 Social sciences, business and law

31 Social and behavioural science

Economics, economic history, political science, sociology, demography, anthropology (except physical anthropology), ethnology, futurology, psychology, geography (except physical geography), peace and conflict studies, human rights.

32 Journalism and information

Journalism; library technician and science; technicians in museums and similar depositories; Documentation techniques; Archival sciences.

34 Business and administration

Retailing, marketing, sales, public relations, real estate; Finance, banking, insurance, investment analysis; Accounting, auditing, bookkeeping; Management, public administration, institutional administration, personnel administration; Secretarial and office work.

38 Law

Local magistrates, 'notaries', law (general, international, labour, maritime, etc.), jurisprudence, history of law.

4 Science

42 Life sciences

Biology, botany, bacteriology, toxicology, microbiology, zoology, entomology, ornithology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences.

44 Physical sciences

Astronomy and space sciences, physics, other allied subjects, chemistry, other allied subjects, geology, geophysics, mineralogy, physical anthropology, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, marine science, vulcanology, palaeoecology.

46 Mathematics and statistics

Mathematics, operations research, numerical analysis, actuarial science, statistics and other allied fields.

48 Computing

Computer sciences: system design, computer programming, data processing, networks, operating systems - software development only (hardware development should be classified with the engineering fields).

5 Engineering, manufacturing and construction

52 Engineering and engineering trades

Engineering drawing, mechanics, metal work, electricity, electronics, telecommunications, energy and chemical engineering, vehicle maintenance, surveying.

54 Manufacturing and processing

Food and drink processing, textiles, clothes, footwear, leather, materials (wood, paper, plastic, glass, etc.), mining and extraction.

58 Architecture and building

Architecture and town planning: structural architecture, landscape architecture, community planning, cartography; Building, construction; Civil engineering.

6 Agriculture

62 Agriculture, forestry and fishery

Agriculture, crop and livestock production, agronomy, animal husbandry, horticulture and gardening, forestry and forest product techniques, natural parks, wildlife, fisheries, fishery science and technology.

64 Veterinary

Veterinary medicine, veterinary assisting.

7 Health and welfare

72 Health

Medicine: anatomy, epidemiology, cytology, physiology, immunology and immunoaematology, pathology, anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, neurology, psychiatry, radiology, ophthalmology;

Medical services: public health services, hygiene, pharmacy, pharmacology, therapeutics, rehabilitation, prosthetics, optometry, nutrition; Nursing: basic nursing, midwifery;

Dental services: dental assisting, dental hygienist, dental laboratory technician, odontology.

76 Social services

Social care: care of the disabled, child care, youth services, gerontological services;

Social work: counselling, welfare n.e.c.

8 Services

81 Personal services

Hotel and catering, travel and tourism, sports and leisure, hairdressing, beauty treatment and other personal services: cleaning, laundry, drycleaning, cosmetic services, domestic science.

84 Transport services

Seamanship, ship's officer, nautical science, air crew, air traffic control, railway operations, road motor vehicle operations, postal service.

85 Environmental protection

Environmental conservation, control and protection, air and water pollution control, labour protection and security.

86 Security services

Protection of property and persons: police work and related law enforcement, criminology, fire-protection and fire fighting.