



TURKISH ECONOMIC ASSOCIATION

DISCUSSION PAPER 2019/2

<http://www.tek.org.tr>

# **Returns to Investment in Education: The Case of Turkey**

Harry Anthony Patrinos & George Psacharopoulos & Aysit Tansel

March 25, 2019

# **Returns to Investment in Education: The Case of Turkey<sup>1</sup>**

**Harry Anthony Patrinos**

The World Bank

**George Psacharopoulos**

Georgetown University

**Aysit Tansel**

Middle East Technical University (METU); IZA Institute of Labor Economics;  
Economic Research Forum (ERF)

---

<sup>1</sup> The views expressed here are those of the authors and should not be attributed to their respective organizations. The contents are work in progress.

*Abstract:* This paper estimates private and social returns to investment in education in Turkey, using the 2017 Household Labor Force Survey and alternative methodologies. The analysis uses the 1997 education reform of increasing compulsory education by three years as an instrument. This results in a private rate of return on the order of 16 percent for higher education and a social return of 10 percent. Using the number of children younger than age 15 in the household as an exclusion restriction, the analysis finds that returns to education for females are higher than those for males. Contrary to many findings in other countries, private returns to those working in the public sector are higher than those in the private sector, and private returns to those who followed the vocational track in secondary education are higher than those in the general academic track. The paper discusses the policy implications of the findings.

JEL Codes: I21, I26, J24

Keywords: Education, Returns to Education, Turkey

## Introduction

Since the advent of human capital theory in economic thought, estimating the returns to investment in education has been a very popular subject among researchers (see Psacharopoulos and Patrinos 2018 for a recent review on the subject).

Yet, most of the recent estimates in this proliferating literature have several limitations:

- Conceptually, the authors rarely make a distinction between private and social returns, typically estimating only private returns – often not even using the word *private* in their papers.
- Methodologically, the estimates are done by what we describe as the easy-way; that is, by using the convenient Mincerian earnings function rather than the full-discounting method.
- Policy-wise, invalid recommendations are made based on private returns.

Anne Krueger (1972) estimated a very high return to education including higher education using data for Turkey from 1968. She used those estimates to explain the high demand for higher education at the time. The purpose of this paper is to estimate private and social returns to investment in education based on different methodologies using data from the Turkish 2017 Household Labor Force Survey (HLFS).

Turkey provides a useful ground for cost-benefit analysis of its education system. The education system in Turkey has shown remarkable improvement in the last 15 years in terms of better student performance and reduced inequality with a concurrent and sustained increase in enrollment. The expansion of primary and secondary schooling was accompanied by the development of a new curriculum in primary and secondary education. A recent independent assessment of the revised secondary school curriculum regarded it as an improvement over the curriculum used in the past. Curriculum reform was accompanied by initiatives to improve the teaching profession policies (World Bank 2013).

The paper is organized as follows: we start with a review of the different methodologies used to estimate returns to education, followed by a compilation of previous estimates for Turkey. Then we move on to estimate private returns based on the Mincerian earnings function for comparison with other studies that have used this methodology. Finally, we estimate private

and social returns based on the discounting method that we consider to be the most valid method and discuss policy implications.

## **Methodology**

There are essentially two ways to estimate returns to education: The earnings function method and the discounting method.

### Earnings function method

Following Mincer (1974), the earnings function method fits a regression of the form:

$$\ln W_i = \alpha + \beta S_i + \gamma_1 EX_i + \gamma_2 EX_i^2 + \varepsilon_i$$

where  $W$  is the individual's earnings,  $S$  the number of years of schooling and  $EX$  years of labor market experience defined as *Age - S - School starting age*. In this function, the  $\beta$  coefficient on years of schooling can be interpreted as the average rate of return to one additional year of schooling regardless of the education level to which it refers. This method assumes that forgone earnings represent the only cost of education, and so measures only the private rate of return.

### Discounting method

According to this method, the social rate of return to investment in a given level of education is estimated by finding the rate of discount ( $r$ ) that equalizes a stream of discounted benefits to the costs at a given point in time. In the case of university education lasting five years, for example, the formula is:

$$\sum_{t=1}^{42} \frac{(W_u - W_s)_t}{(1+r)^t} = \sum_{t=1}^5 (W_s + C_u)_t (1+r)^t$$

where  $(W_u - W_s)$  is the earnings differential between a university graduate (subscript  $u$ ) and a secondary school graduate (subscript  $s$ , the control group).  $C_u$  represents the direct costs of university education (tuition, fees, books), and  $W_s$  denotes the student's foregone earnings or indirect costs. A similar calculation can be made for the other levels of education. Omitting the direct cost of schooling in the formula would produce a private rate of return.

### Comparing the two methods

The two methods, and as demonstrated below, can give very different estimates of the returns to education. In the first place, the earnings function method gives only private returns. Second, it tacitly assumes that primary school students aged 6 to 12 incur foregone earnings. This is certainly not true, even in agrarian settings. The result is that the earnings function method underestimates the true private returns.

In this sense, the discounting method is a better way to estimate private and social returns as it allows to incorporate true direct and indirect costs of schooling.

### **Previous studies**

Though estimates of the returns are relatively recent undertakings in economics, estimates for Turkey were among the first to be published. Annex Table A-1 shows a plethora of previous rate of return estimates for Turkey, as early as 1968. Note that the early estimates were based on the discounting method, as this was the only available method based on the work of Becker (1964). Following the publication of Mincer (1974), earnings function estimates dominate, and social returns tend to disappear. Some studies have used both methodologies on the same data set, producing divergent estimates, such as Kara (2008).

Overall, previous estimates show increasing returns for men (Salehi et al. 2009; Tansel and Bodur 2012) and higher returns for women (Vural and Gulcan 2008). Using the same methodology over time, Montenegro and Patrinos (2014) show a slightly declining return overall from 10.8 percent in 2002 to 9.3 percent in 2010. The returns to primary and secondary education have been low for some time.

While Ozelli (1970) estimated a low 2.5 percent rate of return to higher education using the full discounting method for 1960, Krueger (1972) on the other hand, estimated the returns to higher education in 1968 at 26.0 percent using the full discounting method. In 1994, the full discounting

returns to higher education are estimated at 13.2 percent by Kara (2008). By 2015, the OECD (2018) estimates the full discounting returns to higher education for men at 31.0 percent.

The Mincerian returns to higher education for men are estimated at 13.0 percent in 1987 (Tansel 1994) to 19.0 percent in 1994 (Tansel 2005). Overall, they range from 10.8 percent in 1994 (Kara 2008) to 13.1 percent in 2002 (Tansel and Bodur 2012), to 16.0 percent for the period 2009-14 (Karatas 2018). Using the same methodology over time, Montenegro and Patrinos (2014) show a consistently large private return to higher education of about 18 percent from 2002 to 2010, slightly higher for females. Di Paolo and Tansel (2017) analyze wage differentials by college major.

## **Data**

We are using data from Turkey's 2017 Household Labor Force Survey (HLFS), covering nearly 400,000 individuals aged 15 and over. The HLFS is a nationally representative survey of individuals. We use wage and other information for individuals aged 15 and over in full time dependent employment. We estimated the number of years of schooling of the individual based on the highest educational level completed and taking into account the changes in the required years of schooling for a degree over time. We define a policy dummy variable equal to one for those who were affected by the 1987 educational reform that increased compulsory schooling from five to eight years. This policy dummy is used as an instrument for schooling. Table 1 gives summary statistics.

For the working population, the average years of schooling is 7.5. Only 11 percent of the sample has no education, most have primary or secondary, and 16 percent have higher education. For those with secondary schooling only, the majority, at 80 percent, attended a vocational school. For the working wage earners who report positive labor market earnings, the average years of schooling is 10.1 and more than three-quarters are employed in the private sector.

**Table 1: Descriptive Statistics of Key Variables**

Variable	Mean
<i>Whole sample (N = 378,691)</i>	
Years of schooling	7.5
<i>Educational level:</i>	
None	11%
Primary	39%
Secondary	34%
Higher	16%
<i>Secondary school type:</i>	
General	52.4%
Vocational	47.5%
Education reform 1997 affected	29%
Children aged 15 or less in household	1.0
<b><i>Workers (N = 97,050)</i></b>	
Annual earnings	7,342 \$US
Years of schooling	10.1
Years of labor market experience	21.0
Private sector employee	76%
Public sector employee	24%

Source: 2017 Turkish Household Labor Force Survey (HLFS)

### Earnings function estimates

Table 2 presents our earnings function estimates of the private overall rate of return to one extra year of schooling by gender, economic sector and secondary school curriculum.

**Table 2: Private rates of return to one year of schooling, Mincerian estimates (%)**

Reference group	Ordinary least squares	Selectivity corrected
All workers	8.8	
Males	8.3	
Females	10.3	13.4
<i>Economic sector:</i>		
Private	6.5	
Public	7.9	
<i>Secondary school graduates:</i>		
General curriculum	2.4	
Vocational curriculum	4.2	

Source: 2017 HLFS

Note: All coefficients are highly significant. See full results in Annex Table A-2 and Annex Table A-3

There are several points to note in Table 2. First, the selectivity corrected estimate for women is substantially larger than the OLS estimate. We use the number of children under 15 living in the family as an exclusion restriction frequently invoked in the female labor force participation decision. This is like the studies by Martins (2001), Chang (2011) and Huber and Mellace (2014). This variable potentially impacts the caregiving activities of women but does not affect earnings. Several previous studies also find higher selectivity corrected estimates than the OLS estimates for Turkey (see, for example, Tansel 1994, 2001, 2005, 2010).

Second, returns to education for females are larger than those to males. This is also found in the previous studies for Turkey cited above. In their global survey, Psacharopoulos and Patrinos (2018) also report higher returns for females than for males as a general pattern for many countries. Dougherty (2005) investigates the reasons for this finding and attributes this general observation to discrimination, tastes and circumstances.

Third, returns to education in the public sector are higher than that in the private sector. This is contrary to what is observed for many countries of the world by Psacharopoulos and Patrinos (2018). We can get some idea about the situation in the public versus private sectors although a comparison of the mean wages in these two sectors is not the same as the comparison of the returns to education in these two sectors. The mean wages in the public sector is larger than the mean wages in the private sector in the HLFs data in 2017 and in several years before. This observation is also confirmed with the recent Survey of Income and Living Conditions (SILC). Casual observation also supports this fact. Most people in the private sector work at the minimum wage while public sector salaries are much higher than the minimum wage. There are two points to note here. One is that the presence of larger numbers of Syrian refugees since 2011 has lowered the private sector wages substantially. Second is that there is a large informal sector in Turkey. Almost 30-35 percent of the wage earners are in the informal sector. It is well-known that the wages in the informal private sector are much lower than in the formal private sector (Tansel, 2000; Tansel and Kan 2016).

The fourth observation to note in Table 2 relates to the returns to education by the curriculum of the secondary school. We find that the return to the vocational secondary school is much higher than to the general secondary school. This is consistent with the previous studies on Turkey (Tansel 1994, 1989; Tansel and Bodur 2012). (This is confirmed with an extended Mincerian earnings function, which estimates private returns to secondary education by curriculum type, over primary education, at 5.7 percent for general secondary and 6.5 percent for vocational secondary (see Annex Table A-5.)) However, it is contrary to the general pattern observed in the most countries of the world, as discussed by Psacharopoulos and Patrinos (2018).

We now compare the estimates for 2017 in Table 2 with those in Annex Table A-1 which provides the estimation results from several previous studies in Turkey. The estimates in the two tables are not directly comparable because they pertain to different years. Further, the methodologies employed may also differ. In this section we concentrate on the estimates using the Mincerian earnings function approach. Tansel (1994) is the first study to estimate returns to education in Turkey using the Mincerian method. We note common findings in Tansel (1994), Tansel (2001), Tansel (2005) and Tansel and Bodur (2012). Looking at the results for men, we observe that the return to primary school is rather very low in all three studies. This is because the five-year primary schooling was the compulsory schooling during those years and it was almost universal. Another common observation in these studies is that the return to vocational schooling is higher than to general schooling. Finally, all these studies show very high returns to higher education than to other levels of schooling. This is consistent with the very high demand for university level education albeit restricted with the very competitive entrance examinations. Karatas (2018) also obtains results like Tansel (2001). The higher returns to vocational education than to general education is a similar finding to our estimates in Table 2 for 2017, although our estimates for 2017 are much smaller in size than those obtained by Tansel (2001).

Salehi et al. (2009) report the overall Mincerian estimates for men for 1988, 1994 and 2003. Their estimate for 1988 is lower than our 2017 estimate, but their estimates for 1994 and 2003 are higher than our 2017 estimate. Vural and Gulcan (2008) report estimates for 1994 and 2004. Their estimate for 1994 males is about the same as our 2017 estimate, but for females it is lower than our estimate. In 2004 for both females and males, their estimates are higher than our 2017 estimates. In contrast, Guris and Caglayan (2012) find estimates in 2003 and 2006 for females and males much lower than our 2017 estimates. Tansel and Bodur (2012) report similar overall estimates of around 8 percent for 1994 and 2002 which are similar to ours. Tansel and Daoud (2014) also report similar overall estimates for 2004 and 2008, around 12 percent, which are higher than ours. Bakis (2012) reports for 2008 an overall estimate of 10 percent. Mocan (2014) reports a surprising overall estimate of zero percent for men and 14 percent for women.

### **Turkey's 1997 reform-affected returns**

Turkey's 1997 reform of basic education had a forward-looking vision for the education system that defined the kind of citizens that the system would develop:

“To raise individuals of the information age who are devoted to the principles and reforms of Atatürk, whose thinking, perception, and problem-solving capabilities have been developed, who are democratic, devoted to freedom, faithful to moral values, open-minded, and aware of their personal duties and responsibilities...” (8th Five Year Development Plan, paragraph 675).

The Basic Education Law (Law No. 4306) passed in August 1997 mandated eight years of compulsory education. This launched an unprecedented expansion of public primary schooling. The eight-year Basic Education Program involved a broad range of actions. As a result, enrollment in basic education increased by over 1.1 million students, raising the gross enrollment ratio from 85.63 percent in 1997 to 96.30 percent in 2002. Enrollment rates for girls, especially in rural areas, made particularly impressive gains. For example, in the nine provinces in the eastern and southeastern regions of Turkey that had the largest gender disparity, female enrollment increased 160 percent. Using a combination of government and private contributions, the Ministry of National Education built 81,500 new primary-education classrooms during the five-year period 1997–2002, increasing classroom supply by 30 percent (World Bank 2005).

The 1997 reform extended compulsory schooling from grade 5 to grade 8. We use it here as a natural policy experiment in the subsequent analysis. This type of policy-related instrument (based on compulsory schooling) is frequently viewed as an ideal instrument. It provides the return to persons who decide to enroll only because of the policy change. This reform affected 24 percent of the wage earners in the 2017 HLFs survey.

Overall, the reform produced a significantly lower return to schooling for men. This is consistent with a previous study using the same reform, but a different identification study based on an earlier survey (Aydemir and Kirdar 2017). They find that the return from an extra year of schooling is about 8 percent for women and no more than 2.5 percent for men. Torun (2018) also uses the 1997 reform as an instrument and finds small effects on the earnings of men but large positive effects on earnings of women. But lower returns using an IV are not typical in the literature for developing countries (Duflo 2001; Patrinos and Sakellariou 2005), but it is not unheard in developed countries (Pischke and von Wachter 2008 find zero returns to additional schooling in Germany; see also Devereux and Hart 2010; Stephens and Yang 2014). However, Pischke and von Wachter's (2008) results for Germany have been challenged by Cygan-Rehm (2018) who finds that a 1960s compulsory schooling reform had positive effects on earnings in Germany. The low level of the estimates for men is explained by low attainment overall, while the much higher returns for women are because women were more likely to complete high school because of the reform (Aydemir and Kirdar 2017) and move into higher skill and formal sector jobs (Torun 2018).

It is interesting to note that other instruments have been used for Turkey. Ozturk and Tumen (2018) refer to the student protests of the 1970s and the subsequent military coup and the decline in university graduation which compressed wages and use the unexpected decline in educational attainment as an instrument to estimate returns to schooling. They find that the returns to an additional year of schooling range between 11 and 12 percent.

Overall, the results show a decent return to schooling. Women receive considerably higher returns to schooling regardless of the method used to calculate the returns. Table 3 shows the returns, ranging from 8.8 percent overall based on OLS to a high of 13.4 percent for women when corrected for selection. The IV results are a low 6.9 percent for men and a high 10.0 percent for women.

**Table 3: Summary of Returns to Schooling, Turkey 2017 (percent)**

All	Males	Males	Females	Females	Females
OLS	OLS	IV	OLS	Heckman	IV
8.8	8.3	6.9	10.3	13.4	10.0

Source: 2017 HLFS; see Annex Tables A-1, A-2, A-3, A-4

### Cost-benefit estimates

We use a subsample of 97,050 workers aged 15-65 years who had positive earnings from dependent employment. Annual earnings were converted to \$US using the 2017 exchange rate in June, which was equal to 3.52 TL. Table 4 gives their mean earnings by level of education.

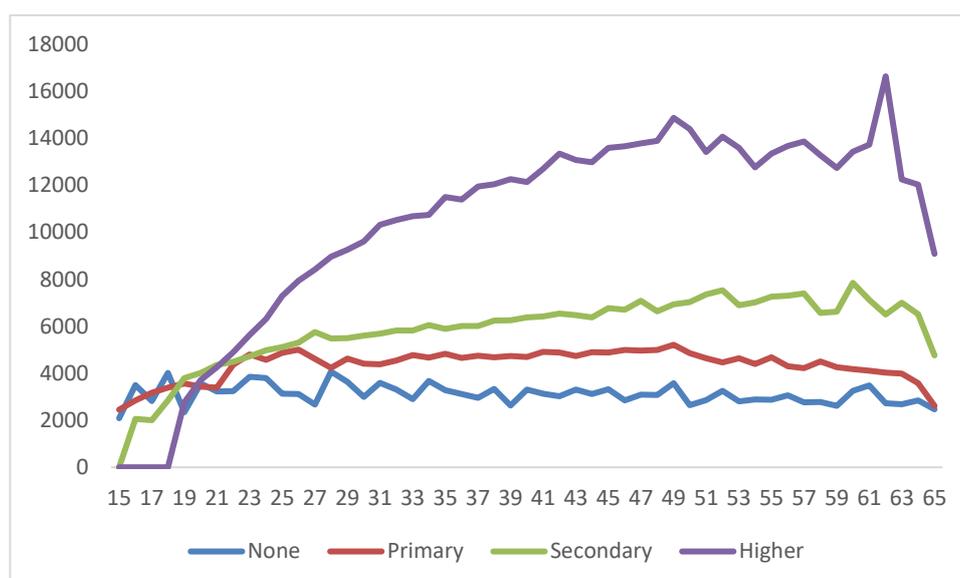
**Table 4: Mean Annual Earnings by Educational Level**

Educational level	Mean annual earnings (\$US)	Number of observations
None	3,714	1,528
Primary	5,278	24,850
Secondary	5,974	38,567
Higher	10,756	32,105
All	7342	97,050

Source: 2017 HLFS

We observe a sharp rise in mean annual earnings for those with higher education. This is consistent with the very high demand for university education as well as the restriction on the university admissions by the highly competitive university entrance examination. There is very high demand for university education for several reasons. First, in addition to high income, the university degree confers a prestigious position in Turkish society. Secondly, men with university education serve in the army with a higher rank. These factors are behind the high demand for higher education. The age-earnings profiles by level of education show a very sharp earnings premium for higher education graduates.

**Figure 1: Age-earnings profiles by level of education**



The discounting formula presented above was applied to the earnings profiles to estimate the returns assuming a 6-6-4 duration of primary, secondary and higher education, and two years of foregone earnings for primary education graduates. The direct resource cost of schooling appears in Table 5. The resulting returns appear in Table 6.

**Table 5: Cost per Student/Year**

Level of Education	Cost 2017 (\$US)
Primary	1,582
Secondary	1998 <sup>a</sup>
Higher	3736

Source: Turkstat (2018) website

a. Average of lower secondary (1,600) and upper secondary upper (2395)

We remark on two noteworthy findings presented in Table 6. First, comparing with Mincerian estimates of the returns to education of the previous section, we observe that the private returns by the discount method are much higher. Second, the private returns are substantially higher than the social returns, which is to be expected since social benefits are not included. The lowest private and social returns are at the secondary education level while highest returns are attained at the higher education level.

**Table 6: Private and Social Returns to Investment in Education by Discount Method (%)**

Educational level	Private	Social
Primary	13.0	6.0
Secondary	11.4	5.2
Higher	15.8	10.4

### Education's Contribution to Economic Growth

The estimated social rates of return can be used to assess the contribution of education to the country's economic growth rate. In Schultz (1961)-type accounting, human capital ( $K_h$ ) is added as an independent variable in the production function, along with physical capital ( $K_p$ ) and the number of people employed:

$$Y = f(L, K_p, K_h)$$

Differentiating with respect to time, to get the growth rate of output ( $g_y$ ), and making elementary substitutions, one gets the estimating expression:

$$g_y = s_l \cdot g_l + \frac{I_p}{Y} r_p + \frac{I_h}{Y} r_h$$

where  $s_l$  is the share of labor in national income,  $g_l$  the rate of growth of the labor force,  $I$  is the investment in physical ( $p$ ) or human ( $h$ ) capital, and  $r$  the rate of return on the respective investment. Therefore,  $r_p$  and  $r_h$  correspond to the return on physical and human capital.

The ratio last term in the above expression gives the percentage growth points contribution of education investment to the rate of growth of the economy,

$$[(I_h/Y) r_h]$$

This term can be further disaggregated into the contribution of each level of education to the rate of growth of the economy.

$$[(I_p/Y) r_p] / g_Y + [(I_s/Y) r_s] / g_Y + [(I_u/Y) r_u] / g_Y$$

where subscripts p, s and u refer to primary, secondary and university education.

Education investment in Turkey has averaged 4.4 percent of GDP, nearly one-half of it spent on secondary education (see Table 7).

**Table 7: Education Investment as Percent of GDP**

Level	Education expenditure as % of GDP
Primary	1.1
Secondary	2.0
Higher	1.3
All levels	4.4

Source: OECD (2018)

Therefore, the contribution of education to growth has been  $4.4\% \times 7.2 = 0.32$  percentage points, or about one-third of a growth point. Among the three levels of education, higher education has contributed the most (see Table 8).

**Table 8: The Contribution of Education to Growth**

Educational level	Social rate of return (%)	Education expenditure as % of GDP	Percentage points contribution to economic growth rate
Primary	6.0	1.1	0.07
Secondary	5.2	2.0	0.10
Higher	10.4	1.3	0.14
Overall	7.2	4.4	0.32

## Conclusion

While Turkey has had the highest growth in the respective region in recent years and aspires to become a high-income economy in the next decade, the country has witnessed a slowdown in economic growth since 2011, as private investment and productivity stagnated. This was in marked contrast to the previous decade, when total factor productivity growth made a considerable contribution to GDP growth. Therefore, productivity dynamics deserve attention

from researchers and policy makers searching for reasons for the growth slowdown and ways to reverse it (World Bank 2016). Turkey faces downside risks if structural changes—in the education and training system, and the economy more broadly—are not made to ensure that contributions to economic growth come from improvements in productivity (Del Carpio 2018).

High returns to education, and especially to higher education, have been estimated for the case of Turkey since the 1960s. The returns explain the high demand for education in Turkey. The educational achievement of Turkey's population has increased many times in the past few decades. From only 1.1 years of schooling on average in 1950 to 3.6 years in 1980 to more than 7 years by 2010. Other aspects of educational development include the improvement in performance in terms of student performance and reduced inequality.

Using a variety of estimation methods and the latest survey, we find the average rate of return to schooling to be 8.8 percent, which puts it at just about the global average. Women receive higher returns to schooling compared to men, at least two percentage points higher. This, too, is in line with global findings. The returns to schooling are high for women even when we control for selection. We used the number of children under 15 years of age living in the household as an exclusion restriction frequently invoked in the female labor force participation decision. This is similar to the studies by Martins (2001), Chang (2011) and Huber and Mellace (2014). This variable potentially impacts the caregiving activities of women but does not affect earnings.

We use the 1997 education reform to instrument schooling. We find that the reform was associated with a higher return for women than for men. This is consistent with previous findings. The instrumental variable's sharp increase of returns for women is *prima facie* evidence of the productive, rather than screening, function of education. It also demonstrates the causal impact of schooling in Turkey, and the fact that schooling is an excellent policy for encouraging the educational and economic performance of women.

Surprisingly, the average rate of return to schooling is higher in the public sector at 7.9 percent, compared to 6.5 percent in the private sector. Also, the private return to vocational secondary education is higher than general secondary education, 6.5% vs. 5.7, respectively.

Using the full discounting method, we estimate the private and social returns to education. Private returns are highest at the tertiary level and the lowest private returns are for secondary education. This is in line with recent global trends. This justifies cost-sharing at the tertiary level, as this level of schooling needs to continue to expand. However, social returns are low for primary and secondary schooling, but high at the higher education level. This demonstrates the need for further expansion of higher education and justifies some level of public subsidy.

The size of the returns is much higher than any reasonable alternative private social discount rate, pointing to the need for higher investment in education. The size of the private returns to higher education suggests the need for selective cost-recovery, while the social returns suggest some level of public subsidy is warranted, especially through student loans for efficiency and equity.

## References

- Aydemir, A. and M.G. Kirdar. 2017. "Low wage returns to schooling in a developing country: Evidence from a major policy reform in Turkey." *Oxford Bulletin of Economics and Statistics* 79 (6): 1046-1086.
- Bakis, O. 2012. Türkiye’de eğitimin bireysel getirisi: 1988-2008. *TUSIAD-Sabancı*.
- Becker, G.S. 1964. *Human capital theory*. New York: Columbia.
- Chang, S. K. 2011. "Simulation estimation of two-tiered dynamic panel Tobit models with an application to the labor supply of married women." *Journal of Applied Econometrics*, 26 (5): 854-871.
- Cygan-Rehm, K. 2018. "Is Additional Schooling Worthless? Revising the Zero Returns to Compulsory Schooling in Germany." CESifo Working Paper Series No. 7191.
- Del Carpio, X. 2018. "How Low Human Capital Can Limit Productivity Improvements. Examples from Turkey and Peru". <http://blogs.worldbank.org/education/how-low-human-capital-can-limit-productivity-improvements-examples-turkey-and-peru>
- Devereux, P. J. and R.A. Hart. 2010. "Forced to be rich? Returns to compulsory schooling in Britain." *Economic Journal* 120: 1345–1364.

- Di Paolo, A. and A. Tansel. 2017. "Analyzing Wage Differentials by Fields of Study: Evidence from Turkey." July 2017, IZA Discussion Paper No. 10915.
- Dougherty, C. 2005. "Why Are the Returns to Schooling Higher for Women Than for Men?" *The Journal of Human Resources* 40 (4): 969-988.
- DuFlo, E. 2001. "Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment." *American Economic Review* 91 (4): 795-813.
- Güriş, S. and E. Çağlayan. 2012. "Returns to education and wages in Turkey: Robust and resistant regression." *Quality & Quantity* 46 (5): 1407-1416.
- Huber, M. and G. Mellace. 2014. "Testing exclusion restrictions and additive separability in sample selection models." *Empirical Economics* 47 (1): 75-92.
- Kara, O. 2008. "Comparing Two Approaches to the Rate of Return to Investment in Education." *Education Economics* 18 (2): 153-165.
- Karatas, H.M. 2018. "The returns to formal schooling in Turkey using pseudo-panel data." *Giresun Üniversitesi İktisadi ve İdari Bilimler Dergisi* Yıl.4. Sayı. 8, ss. 13-33.
- Krueger, A.O. 1972. "Rates of Return to Turkish Higher Education." *Journal of Human Resources* 7 (4): 482-99.
- Martins, M.F.O. 2001. "Parametric and semiparametric estimation of sample selection models: an empirical application to the female labour force in Portugal." *Journal of Applied Econometrics* 16 (1): 23-39.
- Mincer, J. 1974. *Schooling, Experience and Earnings*. New York: Columbia University Press.

- Mocan, L. 2014. "The Impact of Education on Wages: Analysis of an Education Reform in Turkey." Koç University-TUSIAD Economic Research Forum Working Papers Working Paper No. 1424.
- Montenegro, C.E. and H.A. Patrinos. 2014. "Comparable Estimates of Returns to Schooling Around the World." World Bank Policy Research Working Paper No. 7020.
- OECD. 2018. *Education as a Glance*. Paris: OECD.
- Ozelli, M.T. 1970. "The Estimates of Private Internal Rates of Return on Educational Investment in the First Turkish Republic, 1923-1960." *International Journal of Middle East Studies* 1 (2): 154-176.
- Ozturk, A. and S. Tumen. 2018. "Education and Labor Market Consequences of Student Protests in Late 1970s and the Subsequent Military Coup in Turkey." IZA Discussion Papers No. 11733, Institute of Labor Economics (IZA), Bonn.
- Patrinos, H.A. and C. Sakellariou. 2005. "Schooling and Labor Market Impacts of a Natural Policy Experiment." *Labour* 19 (4): 705-719.
- Pischke, J.-S. and T. von Wachter. 2008. "Zero returns to compulsory schooling in Germany: evidence and interpretation." *Review of Economics and Statistics* 90: 592–598.
- Psacharopoulos, G. and H.A. Patrinos. 2018. "Returns to Investment in Education: A Decennial Review of the Global Literature." *Education Economic*, 26 (5): .445-458.
- Salehi-Isfahani, D., I. Tunali and R. Assaad. 2009. "A Comparative Study of Returns to Education of Urban Men in Egypt, Iran, And Turkey." *Middle East Development Journal* 1 (2): 145-187.
- Schultz, T.W. 1961. "Education and economic growth," in *Social Forces Influencing American Education*. Chicago: National Society for the Study of Education.
- Stephens M. and D. Yang. 2014. "Compulsory education and the benefits of schooling." *American Economic Review* 104: 1777–1792.

- Tansel, A. 1994. "Wage employment, earnings and returns to schooling for men and women in Turkey." *Economics of Education Review* 13 (4): 305-320.
- Tansel, A. 2000. "Formal and Informal Sector Choice of Wage Earners and their Wages in Turkey," in *Informal Sector I*, ed. by Tuncer Bulutay, State Institute of Statistics, 2000, Ankara. pp.125-150.
- Tansel, A. 2001. "Self-Employment, Wage-Employment, and Returns to Schooling by Gender in Turkey," in *Labor and Human Capital in the Middle East: Studies of Markets and Household Behavior*, ed. by Djavad Salehi-Isfahani, Ithaca Press, 2001, Reading, UK. pp.637-667.
- Tansel, A. 2005. "Public-Private Employment Choice, Wage Differentials and Gender in Turkey." *Economic Development and Cultural Change* 53 (2): 453-477.
- Tansel, A. 2010. "Changing Returns to Education for Men and Women in a Developing Country: Turkey, 1994-2005." Paper presented at the ESPE conference, June 18-21, 2008, in London, ECOMOD conference, July 2-4, 2008 in Berlin, MEEA conference, March 20-23, 2009 in Nice, France and ICE-TEA conference, September 1-3, 2010 in Girne, Republic of Northern Cyprus.
- Tansel, A. 2017. "Returns to education in turkey: IV estimates from a developing country." Paper presented at the Economic Research Forum (ERF) 23<sup>rd</sup> Annual Conference, 18-20 March 2017, Amman, Jordan.
- Tansel, A. and F.B. Bodur. 2012. "Wage inequality and returns to education in Turkey: A quantile regression analysis." *Review of Development Economics* 16 (1): 107-121.
- Tansel, A. and Y. Daoud. 2014. "Comparative Essay for Returns to Education in Palestine and Turkey." *Perspectives on Global Development and Technology* 13: 347-378.
- Tansel A. and E. Ö. Kan. 2016. "The Formal/Informal Employment Earnings Gap: Evidence from Turkey." *Research On Economic Inequality*, Volume, F24. Editors: John A. Bishop and Juan Gabriel Rodriguez. (pp. 123-156). ISSN: 1049-2585.

Torun, H. 2018. "Compulsory schooling and early labor market outcomes in a middle-income country." *Journal of Labor Research* 39 (3): 277-305.

TURKSTAT (Turkish Statistical Institute) (2018) Education Expenditure Statistics web page accessed in January 2019. [www.tuik.gov.tr](http://www.tuik.gov.tr)

Vural, B.M. and Y. Gülcan. 2008. "Impact of education on individual earnings in Turkey". *International Journal of Economic Perspectives* 2(3): 124-132.

World Bank. 2016. *Productivity dynamics in Turkey: evidence from firm-level data*. Turkey focus note. Washington, D.C.: World Bank.

World Bank. 2013. *Promoting excellence in Turkey's schools*. Washington D.C.: World Bank.

World Bank. 2005. *Turkey: Education Sector Study: Sustainable Pathways to an Effective, Equitable and Efficient Education System for Preschool through Secondary School Education*. Washington, D.C.: World Bank.

**Annex Table A-1: A Sampling of Previous Findings**

Year	Level	Rate of return (%)		Method/sample	Source
		Private	Social		
1960	Secondary	19.0	14.0	Full discounting	Ozelli (1970)
	Higher	2.5	1.5		
1968	Sec-Gen	24.0	8.5	Full discounting	Krueger (1972)
	Sec-Voc	22.0			
	Higher	26.0			
1987	Primary	1.9		Mincerian, men, OLS	Tansel (1994)
	Middle	8.6			
	Sec-Gen	8.6			
	Sec-Voc	11.0			
	Higher	13.0			
1988	Overall	6.5		Mincerian, men	Salehi et al (2009)
1994		9.6			
2003		12.4			
1994	Males	9.0		Mincerian	Vural and Gulcan (2008)
	Females	8.0			
2004	Males	10.0			
	Females	14.0			
2003	Males	4.1		Mincerian	Guris and Caglayan (2012)
	Females	5.2			
2006	Males	2.5		Mincerian	
	Females	2.4			
1989	Primary	1.7		Mincerian, men, OLS	Tansel (2001)
	Middle	7.2			
	Sec-Gen	10.1			
	Sec-Voc	13.0			
	Higher	16.9			
1994	Primary	24.6		Full discounting, men	Kara (2008)
	Sec-Gen	13.6			
	Sec-Voc	11.3			
	Higher	13.2			
1994	Primary	6.0		Mincerian	Kara (2008)
	Sec-Gen	12.0			
	Sec-Voc	13.9			
	Higher	10.8			
1994	Primary	2.4		Mincerian, private sector, men	Tansel (2005)
	Middle	6.3			
	Sec-gen	13.3			
	Sec-voc	16.2			
	Higher	19.0			
1994	Overall	7.7		Mincerian	Tansel and Bodur (2012)
	Primary	4.4			
	Middle	4.1			
	Sec-gen	8.5			
	Sec-voc	13.3			
	Higher	14.0			
2002	Overall	7.6		Mincerian	Tansel and Bodur (2012)
	Primary	3.6			

	Middle	3.2			
	Sec-gen	7.1			
	Sec-voc	9.8			
	Higher	13.1			
2004	Overall	11.7		Mincerian	Tansel and Daoud (2014)
2008		11.8			
2008	Overall	10.0		Mincerian	Bakis (2012)
2011-12	Overall	0.0		Mincerian, men	Mocan (2014)
		14.0		Mincerian, women	
2009-14	Overall	9.0		Mincerian	Karatas (2018)
	Primary	2.6			
	Middle	3.9			
	Sec-gen	6.1			
	Sec-voc	7.3			
	Higher	16.0			
2015	Higher	31.0	9.0	Full discounting, men	OECD (2018)

**Annex Table A-2: Earnings Function Estimates**

Variable	All	Males	Females	
	OLS	OLS	OLS	Heckman <sup>a</sup>
Constant	7.257	7.315	7.057	6.095
Schooling	0.088	0.831	0.103	0.134
Experience	0.049	0.054	0.381	0.054
Experience <sup>2</sup>	-0.009	0	0	-0.001
NKIDS				-0.119
Constant				-2.168
S				0.106
EX				0.056
EX <sup>2</sup>				-0.001
Lamda				0.382
Rho				0.627
R <sup>2</sup>	0.37	0.39	0.39	

N	97,050	68,726	28,324	28,324
---	--------	--------	--------	--------

---

Dependent variable is the natural logarithm of annual earnings in \$US

All coefficients are statistically significant at the 1% level or better

a. STATA run on the women sub-sample: `heckman ylog s ex exsq, select(nunder15 s ex exsq) twostep`

**Annex Table A-3: OLS Estimates of Earnings Functions by  
Sector of Employment and Secondary School Curriculum**

Variable	Sector of employment	
	Public	Private
Constant	7.612	7.512
<b>S</b>	<b>0.079</b>	<b>0.065</b>
EX	0.048	0.042
EX <sup>2</sup>	-0.001	-0.000
R <sup>2</sup>	0.35	0.28
N	22,876	74,176

Source: 2017 HLFS

**Annex Table A-4: Returns to Education from IV using 1997 Reform: Turkey 2017**

	Females	Males
Constant	7.098 (230.0)	7.495 (466.4)
Schooling	0.100 (49.3)	0.069 (59.3)
Experience	0.038 (51.3)	0.052 (114.0)
Experience-squared	-0.0005 (36.6)	-0.0008 (95.9)
R2	0.395	0.379
N	28,324	68,726
Wald chi2(3)	6,065.52	13560.71
Prob > chi2	0.000	0.000
Root MSE	0.514	0.428

Source: 2017 HLFS

Notes: z-values in parentheses

**Annex Table A-5: Extended Earnings Function**

Variable	Coefficient
Constant	7.743
<i>Educational level:</i>	
Primary	0.145
Middle	0.291
Secondary-general	0.487

Secondary-vocational	0.535
University-short	0.781
University-4 years	1.065
Masters/PhD	1.504
Experience	0.041
Experience-squared	-0.001
R <sup>2</sup>	0.430
N	97,050

---

Source: 2017 HLFS

Notes: Dependent variable is log earnings; omitted education dummy is those with less than primary; all coefficients are statistically significant at the 1% level or better