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Research Article

Agglomeration and Growth in Turkey, 1980-1995

Alpay Filiztekin*

Abstract

This paper examines the extent at which dynamic scale externalities affected employment growth in Turkey during 1980-1995 period, using panel data on manufacturing industry. Localization economies are found to have negative effect on employment growth in the short run but there is evidence in favor of specialization once additional lags are allowed for. The paper finds no evidence in favor of diversity in major industries but for high-tech industry. The results also indicate positive effects of backward- and forward linkages. Moreover, highly dense areas are found to attract firms at the beginning but over time congestion drives firms out of such centers. Finally, the paper reports that the effect of competition is differential depending on the sector. In industries where competition for inputs is crucial, such as heavy industries, it reduces employment growth but in industries that have differentiated products and continuous innovations are important, such as high-tech industries, the effect of competition on growth is positive.

JEL Cods: D62, R12, O53.
Keywords: Agglomeration, industry location, scale externalities, Turkey.

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Türkiye’de Yığınlaşma ve Büyüme, 1980-1995

Öz

Bu çalışma imalat endüstrisi panel verisi kullanarak Türkiye’de 1980-1995 döneminde dinamik ölçek dışsallıklarının istihdam büyümesini ne ölçüde etkilediğini inceliyor. Kısa dönemde yerelleşme gösteren ekonomik faaliyetlerin istihdam büyümesini negatif etkilediği ancak gecikmelere izin verince ihtisaslaşma lehine bulgular olduğu bulunuyor. Çalışma yüksek teknoloji endüstriler hariç büyük endüstrilerdeki çeşitlilik lehine herhangi bir işaret bulamıyor. Bu sonuçlar aynı zamanda ileri ve geri bağlantıların da pozitif etkilerine işaret etmektedir. Bunun ötesinde, yüksek yoğunluktaki alanların başlangıçta firmaları çektiği ancak zaman içinde sıkışıklığın firmaları böyle merkezlerden dışarı attığı sonucuna da varılıyor. Son olarak çalışma rekabetin etkisinin sektöre bağlı olarak farklı olduğunu bulgusuna ulaşıyor. Ağır sanayi gibi girdiler için rekabetin çok önemli olduğu endüstrilerin istihdam büyümesini düşürdüğü ancak farklılaşan ürünlere sahip ve yüksek teknoloji endüstrileri gibi sürekli yeniliklerin önemli olduğu endüstrilerde rekabetin büyüme üzerindeki etkisi ise pozitif olarak kendini göstermektedir.

JEL Kodları: D62, R12, O53

Anahtar Kelimeler: Yığınlaşma, sanayi yer seçim, ölçek dışsallıkları, Türkiye.

1. Introduction

This paper investigates the effects of local scale externalities on employment growth in Turkish private manufacturing industry between 1980 and 1995. Urban and regional economists emphasized the importance of the effects of scale externalities on growth for a long time (Henderson, 1974). Recent models of endogenous economic growth revived the interest in spillovers (Romer, 1986 and Lucas, 1988) and there are an increasing number of studies on economic geography in the last decade (Quigley, 1998). The main question of the existing theoretical research is why industries concentrate on certain locations and they provide a wide variety of explanations for spatial agglomeration based on some form of externalities (Krugman, 1991). The significance of this research lies in the fact that understanding of reasons for spatial agglomeration could lead to resolution of many controversial issues in trade theory or economic growth.

Empirical studies to confirm the theoretical claims are far from being conclusive for a variety of reasons as discussed in Hanson (2000). Most importantly, the lack of appropriate data, or the unobservable characteristics of external economies, makes it very difficult to estimate the effects of agglomeration economies, thus researchers have to rely on indirect inferences about their existence and importance. Consequently, there is an ongoing debate about the relative importance of different types of scale economies. For example, the study by Glaeser et al. (1992) shows that diversity, the existence of urbanization economies, is an important factor for growth of cities in the U.S. for the period 1956-1987. In contrast, Henderson et al. (1995) estimate strong impact of localization economies, that is, specialization in a particular area, using data from the U.S. between 1970 and 1987 and some evidence for diversity only for high-tech industry. Henderson (1999) using production approach for machinery and high-tech industries in the U.S. reaches similar conclusion that localization economies contemporaneously and with a lag enhance growth however he fails to find any correlation between diversity and growth. In contrast to the findings for the American economy, Combes (2000)., using French data, obtained opposite results. He finds that both diversity and specialization reduced growth in French employment zones during the 1984-1993 period.

Equally interesting research question is whether the findings for the developed economies hold as well for developing countries. Empirical research using developing country data are very few. Hanson (1998) examines employment growth in Mexico. He focuses on the effect of trade, particularly the effect of NAFTA, on spatial distribution of industrial activity in Mexico and finds that after Mexico joined NAFTA, there was a strong deconcentration of industry from Mexico City towards the Mexican-American border. Thus, international trade accompanied with transportation costs and increasing returns to scale comes out as a major determinant of location choice of firms and spatial agglomeration in Mexico. He also finds evidence in favor of backward-forward linkages

and weak evidence for diversity but rejects that specialization did improve growth performance of industries.

In another study of spatial agglomeration in developing country framework, Henderson et al. (2001) tests the effects of scale externalities using data from South Korean manufacturing industry. During massive liberalization in Korea between 1983 and 1993 they find that there was a strong tendency for deconcentration of industry from traditional centers, yet reconcentration in other parts of the country. In this process there is evidence in favor of static localization economies but no evidence for dynamic localization and urbanization economies of any kind. Based on their estimates they conclude that the form and magnitude of scale externalities are alike developed countries.

This paper contributes to the same debate in the context of Turkey between 1980 and 1995 and asks the question whether the experience of Mexico and Korea could be expanded to other developing economies. The analysis covers only a limited time scale for two reasons. First, there is a drastic change in data collection methodology. From 2000 onwards Turkish Institute of Statistics changed the unit from establishment to firm level thus making it impossible to identify localization externalities. Second, the last few years of 1990s were inflicted by crises whether domestic or external affecting certain sectors but not others and may have create biases that may not be controlled. Since data are not consistent following this episode, it also does not allow one to study how these shocks have had changed firms' decisions for location choice, an interesting question by itself.

Turkey as its counterparts in the above mentioned studies experienced a trade liberalization in 1980 after two decades of import substituting industrialization. Industry was agglomerated mainly and even more heavily in major traditional centers. However, Turkey differs from the previous examples in that Turkey did not engage in a large scale trade agreement during the period examined, as Mexico did, and the massive deconcentration in Korea was, as the authors suggest, "unlike developing country context" (Henderson et al., 2001: 479), thus it is not observed in to Turkey.

Nevertheless, using a panel data on Turkish private manufacturing industry, the findings of this paper support early research for the U.S. and Korean economies. There is negative effect of localization economies in the short-run, however the effect is positive when medium-run is considered. There is no evidence in favor of diversity except for high-tech industries. The results also indicate existence of other type of externalities. Backward- and forward linkages seems to be a strong determinant of industrial growth in Turkey. Highly dense areas attract firms at the beginning but over time congestion drives firms out of such centers. Moreover, employment growth increases with the average size of firms and finally the effect of competition is differential depending on the sector.

The next section describes the underlying theoretical framework for the estimated equation and data. Section 3 discusses environment in Turkey during the investigation period and discusses the evolution of size distribution of province-industries. Section 4 presents the estimation of agglomeration economies and the results. Finally, Section 5 concludes.

2. Theory and data

This section discusses a simple theoretical framework to estimate agglomeration economies and describes the data and how different externalities are measured.

2.1. Theory

To test the effects of local scale externalities on growth, a profit-function approach is implemented as usually used in the literature. Each firm's employment decision is obtained by maximizing profits:

$$L_{ijt} = -\frac{\partial \Pi_{it}(w_{ijt}, r_{ijt}, a_{ijt})}{\partial w_{ijt}} \quad [1]$$

where L is employment, $\Pi(.)$ is the profit function, w is wage rate, r is the vector of prices of all other inputs, a is overall level of technology which is a function of nationwide technological progress and local technological and market-based externalities, and i indexes industry, j province and t time. To test for dynamic externalities the growth rate of regional labor demand is considered. Furthermore, employment growth in each province-industry is normalized relative to nationwide industrial growth. By assuming that prices of other inputs, especially of capital, same in every province, the relative growth approach allows me to avoid the lack of reliable local price series for other inputs. The relative growth approach also controls for nationwide industry specific shocks. For example, it is possible that opening the economy to free trade may result in specialization in certain products because of comparative advantage of the country in that product and hence, excess growth in areas that specialized in the exported products. Thus, the analysis here, rather than explaining absolute growth, describes the economic structure in which a province-industry grew more rapidly than national industry. Therefore, Equation (1) is specified as:

$$\Delta \ln\left(\frac{L_{ijt}}{L_{it}}\right) = \beta_1 \Delta \ln\left(\frac{w_{ijt}}{\overline{w}_{it}}\right) + \beta_2 \Delta \ln\left(\frac{a_{ijt-1}}{\overline{a}_{it-1}}\right) \quad [2]$$

To estimate the impact of externalities an explicit functional form for relative technology growth has to be specified as well. It is usually assumed that it is a logarithmic function of a set of lagged proxies for external effects, thus the parameters can be interpreted as elasticities:

$$\Delta \ln\left(\frac{a_{ijt}}{\bar{a}_{it}}\right) = a_t + \sum_{k=1}^{K}\sum_{m=1}^{M} \gamma_k \ln\left(\frac{X^k_{ijt-m}}{\bar{X}^k_{it-m}}\right) + (\varepsilon_{ijt} - \bar{\varepsilon}_{it}) \qquad [3]$$

where X^k is the proxy for kth external effect, K is the number of total external factors and M denotes lags. a_t is nationwide shock across all provinces and industries. The last term in Equation (3) denotes idiosyncratic shocks to each province-industry.

Combes (2000) provides a detailed survey of agglomeration and dispersion forces. One can broadly categorize these forces into two groups, information spillovers and market-based externalities. Information spillovers are important when firms do not have complete information, instead each firm possesses different pieces of information. In addition, if information acquiring is costly and distance impedes transmission of information, firms rely on turnover of skilled labor and/or formal and informal contacts to obtain information on demand conditions and on innovations as well as to improve their organization structure. What kind of economic structure, however, enhances information spillovers is an ongoing debate. If there are localization economies, firms prefer to be located near to firms that operate in the same industry as themselves. Consequently, particular regions specialize in one specific industry. On the other hand, if urbanization economies are prevalent, firms prefer to locate in regions where there are many diverse firms. In such an environment innovation in one sector are expected to diffuse easily to other sectors of the economy or provoke innovation in other sectors due to information spillovers.

Similarly, market forces may also induce agglomeration. In the presence of non-negligible transportation costs and increasing returns, firms prefer to locate near large input and output markets. Combes (1997) shows that when firms produce homogeneous goods and face imperfect competition, specialization enhances employment growth. In a different setting, when production contains several intermediate stages each of which is characterized by increasing returns to scale, as in Krugman and Venables (1995), firms prefer locations where they can have a large number of upstream and/or downstream firms. In that case, firms prefer diversity. Conversely, large local economies may also act as dispersion forces. For example, large markets by attracting many firms and therefore increasing competition for demand or for inputs may slow down growth. Moreover, increasing size of an economy may increase congestion in terms of higher rents for land, higher costs due to pollution etc.

The impact of agglomeration forces on employment growth becomes more complicated when they interact with economic structure. For example, the magnitude and quality of information spillovers heavily depends on the size of the economy; until the number of firms reach a critical level, there may not be any significant exchange of ideas. Strategic decisions of firms to locate where there is low degree of competition leads firms choose periphery despite a central location means higher demand for their products. However, decreased competition may also lower potential spillovers. Shumpeterian models emphasize that competition provides incentives for firms to innovate, yet, rapid technological growth reduces the return to innovations and creates a disincentive.

The average size of plants is also an important factor that affects the impact of agglomeration forces on economic growth. In monopolistic competition models with internal scale economies, the larger plants have an advantage, whereas when the externalities are external, large firms are punished. Concerning information spillovers there is an ambiguity with respect to the impact of size. Despite large firms spend more on research and development, some empirical studies show that efficiency of such activities decline with size. On the other hand, small firms usually do not engage in research and development activities and rely on leaders, that is large firms with research output, in industry.

The identification of different agglomeration forces is, thus, not possible because of data limitations. This is a major problem in all existing research about agglomeration and this study is not an exception. Therefore, the estimation results will only shed light on the local economic structure that fosters growth rather than being used to distinguish what kind of forces are prevalent.

2.2. Data

The theory suggests many different elements in a given economic structure that may enhance or lower growth under nonnegligible transportation costs and scale economies. To test what kind of structures are most important in Turkey detailed data on manufacturing industry that are collected by Turkish Institute of Statistics (previously State Institute of Statistics) of Turkey are used. The data is for 1980–1995 period in five-year intervals and obtained by annual surveys of SIS. Firms for which data are collected employ at least ten persons for four-digit ISIC (Rev. 2) and covers all provinces in Turkey[1]. There is also the distinction between state and private enterprises. The paper focuses only on private manufacturing industry because the location decision and employment changes in public sector is arbitrarily made depending on political and

[1] There are 65 provinces in the data. A province is an administrative unit and the number of such entities increased from 67 to 76 from 1990 to 1995. To be consistent over time the provincial territories are reconstructed. In one case three provinces are split into five in later years. By combining them to one unit, we ended up with 65 provinces.

popular pressures on successive governments[2]. The employment is measured as persons engaged in production. The data also has information about gross output and material inputs. However, capital stock data is not available to estimate production functions for each industry as in Henderson et al. (2001).

There are 86 four-digit industries, and therefore 5590 potential observations. However, many industries do not exist in every province, leaving 996, 1201, 1149 and 1369 data points for 1980, 1985, 1990 and 1995, respectively. Three provinces in the eastern Turkey never appeared in any sample, and four four-digit industries did not have any private employment[3].

The following describes the measures of externalities used in the empirical part. Specialization in a local economy is measured as the ratio of share of industry *i* in local economy to the share of the same industry in national economy, as suggested by Glaeser et al. (1992):

$$LE_{ijt} = \ln\left(\frac{L_{ijt} / L_{jt}}{L_{it} / L_{t}}\right) \qquad [4]$$

The diversity is measured as the inverse of a Herfindahl index of industrial concentration as suggested by Henderson et al. (1995):

$$UE_{ijt} = \ln\left(\sum_{n\neq j}\left(L_{nt} /(L_{t} - L_{it})\right)^2\right) - \ln\left(\sum_{n\neq j}\left(L_{njt} /(L_{jt} - L_{ijt})\right)^2\right) \qquad [5]$$

It should be noted that the first term increases with diversity and the measure here is not negatively related to specialization as in Henderson et al. (2001).

Two different variables are used to control for various effects of the size of the economy. Following Hanson (1998), the ratio of total employment in the aggregated industry in which a firm belongs to total local employment is used as the first measure that controls for backward and forward linkages. Two-digit classification is used to measure aggregate industry and four-digit classification is used to depict individual industries.

$$BF_{ijt} = \ln\left(\sum_{m\neq i}(L_{mjt} / L_{jt})^2\right) - \ln\left(\sum_{m\neq i}(L_{mt} / L_{t})^2\right) \qquad [6]$$

[2] At the beginning of the Republican era (1920s and 1930s), the location decisions of state enterprises were quite strategic to establish regional centers. However, this vision is abandoned as Turkey moved from single party regime to democracy in 1950s and populism became more dominant way of central decision making.

[3] These are distilling and blending spirits, refineries, coke and coal production and railroad equipment. During the sample period Turkish law required production of these goods to be controlled by the state.

where *m* is all other industries that belong to the same aggregate industry. The assumption is that aggregate industry combines all firms that have some sort of buyer-seller relationship. As a second measure for local size of the economy, density is used:

$$D_{jt} = \ln\left(L_{jt} / Area_{j}\right) \quad [7]$$

expecting that it will capture congestion costs after backward and forward linkages are controlled for.

To measure competition earlier research use a local Herfindahl index (Combes, 2000) or the ratio of number of workers per establishment (Glaeser et al., 1992 and Hanson, 1998)). The former requires information at the plant level and the interpretation of the later is ambiguous. Instead, the paper employs an industry level markup measure first proposed by Domowitz, Hubbard, and Petersen (1988):

$$MKUP_{ijt} = \ln\left(\frac{(OP_{ijt} + CIS_{ijt} - TP_{ijt} - IP_{ijt})}{(OP_{ijt} + CIS_{ijt})}\right) \quad [8]$$

where *OP*, *CIS*, *TP* and *IP* are output, change in stocks, total wage payments and input, respectively. As the ratio increases, industry *i* in location *j* gets more monopolistic.

Finally, the ratio of total employment to total number of establishments controls for average establishment size:

$$ESTSIZE_{ijt} = \ln\left(L_{ijt} / N_{ijt}\right) - \ln\left(L_{it} / N_{it}\right) \quad [9]$$

where *N* denotes for total number of establishments. Instead of using this variable as a proxy for competition, it is interpreted as a measure of internal scale economies as Combes (2000).

3. The Environment and Mobility Across Provinces

Turkey, after twenty years of import-substituting industrialization, which came to an end in 1979 in the form of a severe balance of payment crisis, is forced to move to an outward-oriented growth strategy by liberalizing first trade and then the financial system[4]. In January 1980, Turkish government undertook a major devaluation of the currency and used a variety of tools such as tax rebates, credit subsidies and foreign exchange allocations for the imports of intermediate goods to encourage exports. In

[4] The nature and effects of liberalization have been discussed in detail in Aricanli and Rodrik (1990), Senses (1994) and Togan and Balasubramanyam (1996), among others.

1984, an Import Program is initiated[5]. During the same period a significant cut in real wages is also observed. The share of wages in value added fell down to 17% in 1988 from 30 % in 1980. Reduced wages meant cheap inputs for the industry as well as a reduction in domestic absorption, both of which contributed to increase exports.

The first phase of liberalization ended when the distributional issues became a problem in front of fast growth goal. The policies of a few years earlier caused increases in public deficit, inflation and domestic and foreign indebtedness. Consequently, real exchange rate is left to appreciate and capital account is fully liberalized and domestic currency is declared to be convertible. The new policies aimed to increase inflows of funds into the domestic economy in order to ease the financing of public deficit. Coupled with the removal of barriers in political life that were established in 1980 after a coup and strong pressures by trade unions, real wages started to increase and populist pressures on government mounted.

Despite successful and rapid liberalization of trade and capital markets, the macroeconomic stability cannot be established. Inflation fared around 35% in the first few years of reform after it had rose above three-digit level in 1980, and settled at an over 60% plateau after 1988. Fiscal deficit kept increasing and public sector borrowing requirement reached well above 10% in the early years of 1990s.

In terms of regional policy, Turkey has established 'Priority Areas for Development' (PAD) in late sixties as a part of central planning, covering mostly eastern and southeastern provinces. The successive Five-Year Plans acknowledge the differences in terms of development between regions and urges governments to direct sources to PAD. The Plans also suggest provision of investment incentives for private sector in terms of tax deductions. Despite the aims stated in the plans there were no significant effort by any government to support industrialization in low-income regions. Very few of planned state infra- and manufacturing investments are realized. Moreover, almost all governments subsidized agricultural production heavily which has lower productivity compared to other sectors but higher political returns and subsequently these policies slowed down industrialization of these areas. Furthermore, political pressures forced governments to increase the number of provinces in the 'Priority Areas'. At the late seventies the number of such provinces reached 41 from original 22 in 1968 out of 67 provinces. In 1981 an attempt to reduce the numbers to 25 failed and as of 1996 there were 38 provinces classified as PAD. Practically, the entire country is declared as a 'Priority Area' except a few traditional industrial centers and thus the original intent is diluted to a great extent.

[5] With this program quantity restrictions are eliminated significantly (60 percent of 1983 imports are liberalized) and tariffs for majority of imports are reduced by 20 percent (Baysan and Blitzer, 1990). As of 1988, major trade liberalization was already established.

3.1 Concentration of Industries

Throughout the century, Istanbul, Izmir and Ankara were the most populous provinces; the latter is also the capital city of Turkey. Together with Kocaeli as a periphery to Istanbul and Bursa and Adana by inheriting their industrial formation form Ottoman era form the traditional industrial centers in Turkey. In 1980, at the end of import substituting growth period, these six provinces had a share of 74.4% of total industrial employment (Table 1). Although employment in these provinces increased 2.9% per annum, their share in total industrial employment decreased to 68.4% at the end of 1995.

Table 1: Deconcentration of industry in Turkey

	Turkey		Traditional Industrial Centers		Rest of the country	
	1980	Annual growth rate	Share in 1980	Annual growth rate	Share in 1980	Annual growth rate
Traditional	242,432	3.95	68.58	3.50	64.06	4.85
Heavy	161,166	3.12	73.93	2.65	68.94	4.29
Machinery	91,755	2.54	87.84	1.75	78.00	6.49
High-tech	13,108	4.03	94.62	3.58	88.38	9.17
Aggregate	508,461	3.46	74.42	2.90	68.40	4.87

Earlier research indicated that the concentration pattern could be varying for different industries. Following, Henderson et al. (2001), industries are also grouped into four main categories, traditional industries (food processing, beverage, apparel, textiles, manufacture of wood products and paper industry), heavy industries (chemicals, rubber and plastic, non-metallic minerals, metal industries and fabricated metal industry), machinery (machinery, electrical machinery and transportation equipment) and high-tech industries (office, computing machinery, professional and scientific equipment, photographic equipment, watches, jewelry, musical and sporting equipment)[6]. Table 1 also provides deconcentration of employment by major industrial classification. Despite substantial growth differentials in all industries against traditional industrial centers,

[6] Henderson et al. (2001) defines a fifth category, transportation equipment industry. Since in Turkey the number of transportation equipment-producing provinces is very small, they are grouped together with machinery industries.

they still employ a large share of workers. Nevertheless, the figures imply significant amount of deconcentration from old centers to new locations.

The underlying hypothesis in Hanson's (1998) study is that trade changes reference market for the economy. In a closed economy, location choice of firms is arbitrary and once certain locations are established as industrial centers, they persist. However, when the economy is opened to trade, the prediction is that firms will locate in regions that are either closer to exporting countries (as firms in Mexico moved to north, closer to the American border) or to regions that has easy access to ports. It should be noted that, except Ankara, all six traditional centers are port cities and except Ankara and Adana all of them are located in the west of the country (closer to major trading partners of Turkey, namely Europe). The evidence here is that other forces are outweighing the benefits of lower transportation costs to a certain degree. In fact, regions to the west and north west of the country grew as fast as the aggregate or a little higher, but exceptional growth rates are observed for northern and eastern regions that had very small industrial bases at the beginning of sample period.

Deconcentration can also be examined by considering a simplified version of Ellison-Glaser index (Ellison and Glaser, 1997). For industry *i* in time *t*, the index is:

$$GE_{it} = \sum_{j=1}^{J} \left(\frac{L_{ijt}}{L_{it}} - \frac{L_{jt}}{L_t} \right)^2 \qquad [10]$$

where *J* is total number of provinces. The index lies between zero, when there is total deconcentration, and two when an industry is totally concentrated in a particular location. Table 2 provides the index for four major industrial groups. Highest concentration is observed for high-tech industries and then for machinery. Concentration in traditional industries is by far lower than the others. The ordering of industries according to their concentration is very similar to South Korea. Henderson et al. (2001) interpret their finding of higher concentration of modern industries as a consequence of "strong government influence" and "regulation" of these industries. The findings here suggest that the same pattern applies even to the case where government involvement in these industries is not significant. A further observation from the table is that deconcentration occurs much faster for machinery and heavy industries but it is not as dramatic as it happened in Korea.

Table 2: Ellison-Glaeser index of concentration

	1980	1995	Change
Traditional	4.18	3.50	-16.14
Heavy	10.97	7.46	-31.96
Machinery	21.07	12.77	-39.39
High-tech	55.29	46.25	-16.35

3.2 Mobility of Industries

The primacy rates in the first table and concentration indices in the second table describe the extreme ends of the distribution. In the following mobility of industries across provinces is examined using Markov chains. The methodology is also used to examine the evolution of size distribution of cities in the U.S. by Black and Henderson (1999) and the evolution of size distribution of industries across cities in the U.S. by Henderson (1999). The size distribution of province-industries is assumed to follow a first order stationary process. There is continuous entry and exit of province-industries in Turkey. The number of industries increased almost 70% from 1980 to 1995. Among 1369 province-industries in 1995, 40% did not exist in 1980. On the other end, 17.5% of province-industries that existed in 1980 are not observed in 1995. To account for entry and exit, an extended version of Markov chains is used as in Black and Henderson (1999) where they model the evolution of urban system. Let F_t denote the distribution of size. The evolution of the distribution is governed by the following equation of motion:

$$F_t = (1\text{-}e)\, M_t\, F_{t\text{-}1} + e\, E_t \qquad [11]$$

where M_t is the matrix that maps distribution at time *t-1* into distribution at time *t*. E_t is the vector of entrants and e is the net entry rate. The assumption of stationarity and homogeneity of the transition probabilities implies a constant mapping of the distribution over time, that is M is a constant matrix. By assuming that the net entry rate and the vector of entrants are also constant and iterating M forwards one can obtain future cross-section distributions:

$$F_{t+\tau} = (1-e)^{\tau} M^{\tau} F_t + \sum_{s=0}^{\tau-1} (1-e)^{s} M^{s} e E_s \qquad [12]$$

or

$$F_{t+\tau} = (1-e)^{\tau} M^{\tau} F_t + \left[I - (1-e)M\right]^{-1}\left[I - (1-e)^{\tau} M^{\tau}\right] eE \qquad [13]$$

Furthermore letting τ to go infinity, we obtain the implied ergodic distribution (or long-run distribution) of sizes. Then transition probabilities of province-industries from one (in practice, discretized) segment of distribution to another are estimated empirically by counting the number of transitions out of and into each state. Using the transition probabilities from one state to another, one can also calculate how much time is required on average to move up or down in the distribution. The so-called first passage times can be computed as

$$Y_{jk} = \sum_{s=1}^{\infty} s\pi_{jk}^{s} \qquad [14]$$

where Y_{jk} is years required for transition from state j to state k and π_{jk} is the probability of moving from cell j to k.

Table 3: Evolution of province-industry distribution

Transition Matrix					
	0.0	***0.1***	***0.2***	***∞***	***Entry Rate***
0.02	0.6494	0.2778	0.0556	0.0172	0.5035
0.05	0.2277	0.4847	0.2642	0.0234	0.2765
0.18	0.0537	0.2366	0.5652	0.1445	0.1624
∞	0.0103	0.0138	0.1471	0.8287	0.0576

Initial Distribution			
0.2500	0.2500	0.2500	0.2500
Final Distribution			
0.3095	0.2526	0.2409	0.1971
Ergodic Distribution			
0.3239	0.2732	0.2312	0.1717

First Passage Time			
1.5	4.5	7.6	19.2
9.9	2.1	5.6	17.8
13.8	6.8	1.8	14.4
18.5	12.0	6.8	1.2

Table 4: First passage times

	Lowest	*Middle Low*	*Middle Upper*	*Highest*
Traditional Industries				
Lowest	1.5	5.2	8.6	21.1
Middle Low	5.2	2.2	7.5	20.2
Middle Upper	8.7	6.0	2.1	15.8
Highest	12.7	10.2	5.9	1.3
Heavy Industries				
Lowest	1.7	3.9	6.4	18.5
Middle Low	14.0	1.9	4.8	16.9
Middle Upper	18.5	8.0	1.6	13.5
Highest	22.4	13.3	7.0	1.2
Machinery Industries				
Lowest	2.5	3.2	6.8	9.4
Middle Low	19.0	2.3	5.4	8.2
Middle Upper	29.8	13.9	2.2	4.8
Highest	34.1	18.6	7.8	1.2
High-tech Industries				
Lowest	1.9	3.1	7.9	15.5
Middle Low	10.7	2.4	6.6	13.8
Middle Upper	18.7	8.0	1.8	9.9
Highest	23.7	13.0	8.7	1.2

Before estimating the transition matrix, employment in each province-industry is normalized by total industry employment. It is assumed that there are four discrete states and that there are equal numbers of units in each cell at 1980. Table 3 shows the estimation results for all industries. There are significant differences from the pattern observed for developed economies, specifically from the U.S. The diagonal entries in the transition matrix indicate little persistence. The chance to move up and down from the middle-sized province-industries is 50%. Starting with a uniform distribution, we observe that the distribution of province industries is getting skewed towards the lower

end and ergodic distribution implies that as of 1995 the process is not come to an end. This is unlike what Henderson (1999) observed for machinery and high-tech industries in the U.S. The reason for the observed pattern in Turkey is mostly because of high entry at the lowest cell and persistence at the upper end. Nevertheless, the time required to move from lowest cell to highest and from the highest cell to the lowest is not significantly different from each other and around 20 years. Compared to Henderson's (1999) findings for the U.S., it also takes considerably less time for a province-industry to move up and down in the distribution.

It is also important to examine mobility within particular industries. Table 4 provides first passage time estimates for each of the four groups defined earlier. An interesting result that emerges from this table is that moving up in the distribution is considerably shorter for manufacturing and high-tech industries compared to traditional and heavy industries and the time required moving down is also longer for modern industries. The entry rates to higher cells for these industries are also significantly higher than traditional and heavy industries. The analysis of mobility confirms previous findings; modern industries are more concentrated and require higher degrees of scale economies. Nevertheless, these industries seem to be more mobile.

4. Estimating scale economies

In this section the effects of scale economies on employment growth are estimated. The data is in unbalanced panel format. The dependent variable is logarithmic differences of employment growth between 1980-85, 1985-90 and 1990-95, thus constituting a maximum of three observations for each province-industry. In the theoretical model, growth is a function of changes in relative wages, however, to avoid endogeneity initial level of wages are used instead. Furthermore, all scale variables enter in the equation as of the beginning period, assuming five years is long enough for dynamic effects to reveal.

The shocks are allowed to have province, industry and time specific components. Since employment growth is modelled in relative terms, industry and time effects are eliminated. Thus, the estimation equation also includes a set of dummies for each province.

The dataset covers only establishments with at least ten workers therefore the sample is truncated. Moreover, the sample selection rule depends on an unobserved random variable. Following Henderson et al. (2001) and Combes (2000), a generalized Tobit model is used to estimate. To control for the selection rule data from other sources, such as General Population Survey and Production Accounts both conducted and published by the SIS of Turkey are utilized. The variables that enter to the selection equation are density as defined above, distance to nearest large urban center defined as the provincial center with at least 300 thousand residents. When the center lies within a province it is

assumed that the distance is just one kilometer. A third variable that enters in the selection equation is a dummy variable that takes value of one if a state-owned enterprise exists in that province belonging to the two-digit industry classification in which a four-digit private province-industry operates. The share of agricultural output in total gross domestic product in a province is also used to control for selection. Heavy agricultural subsidies are assumed to create disincentives for industrial entrepreneurship. Two other variable controls for social environment. The first one is average years of schooling in that province and the second is the share of young population (people aged less than 25 years) in total.

The estimation equation includes relative wage, indices of localization and urbanization economies, a set of variables that controls for backward and forward linkages, density, competition and average establishment size. An additional variable, the existence of state establishments in the same industry as defined above is also included. Table 5 presents the estimation results.

The first column in the table shows the estimated elasticities for all province-industries, denoted as “all-industries”. All variables in the selection equation are significant and have expected signs. Firms choose to locate highly dense areas and selection probability declines as the province is farther away from any large urban center. The existence of state industry also increases the likelihood of observing private industry in that province indicating that the vision of establishing industrial bases via direct government involvement in production in early Republican era has some merit. However, higher agriculture production prevents formation of industries. As discussed above, by subsidizing agriculture heavily the government reduces incentives for private entrepreneurs to start large scale industrial production. A more educated population is also seen as favorable amenity by the private sector whereas younger population deters entry.

The selection variables have same sign and significance in each and every industry group, except that schooling for machinery and existence of government enterprises for high-tech industry are not significant. An interesting result in this table is that coefficient of schooling variable has highest value for high-tech industries. This is probably high-tech firms have more need for skilled labor in their production.

In none of the equations relative wages are significant. Lower wages throughout the examination period do not induce higher growth. It is possible that low wages also correspond to lower labor productivity.

Table 5: Estimation of scale externalities

	All Industries	*Traditional Industries*	*Heavy Industries*	*Machinery Industries*	*High-tech Industries*
Relative Wage	0.0035	0.0064	0.0054	-0.0418	0.0469
	(0.0071)	(0.0107)	(0.0114)	(0.0262)	(0.0302)
Specialization	-0.0138*	-0.0176*	-0.0199*	-0.1025*	-0.0461**
	(0.0038)	(0.0059)	(0.0070)	(0.0285)	(0.0221)
Diversity	-0.0070	-0.0040	-0.0100	0.0079	0.1254**
	(0.0126)	(0.0154)	(0.0287)	(0.0433)	(0.0603)
B-F. Linkages	0.0186*	0.0128*	0.0145**	-0.0550***	0.0044
	(0.0039)	(0.0061)	(0.0073)	(0.0287)	(0.0205)
Density	-0.0016	0.0002	-0.0053***	-0.0008	0.0042
	(0.0014)	(0.0023)	(0.0027)	(0.0025)	(0.0027)
Competition	-0.0027	0.0116	-0.0233**	-0.0063	0.1821**
	(0.0082)	(0.0118)	(0.0102)	(0.0107)	(0.0814)
Avg. Est. Size	-0.0221*	-0.0231*	-0.0205**	-0.0032	-0.1019*
	(0.0055)	(0.0078)	(0.0100)	(0.0180)	(0.0356)
Gov. Est.	-0.0004	-0.0030	0.0033	-0.0539	0.0622**
	(0.0088)	(0.0130)	(0.0160)	(0.0382)	(0.0287)
Selection Equation					
Density	0.0248*	0.0233*	0.0232*	0.00948*	0.0398*
	(0.0019)	(0.0024)	(0.0043)	(0.0046)	(0.0074)
Distance	-0.0014*	-0.0011*	-0.0015*	-0.0024*	-0.0020*
	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0006)
Gov. Est.	0.4221*	0.4914*	0.4017*	0.1434	0.1288
	(0.0242)	(0.0359)	(0.0436)	(0.0742)	(0.1211)
Sh. of Agr.	-1.1965*	-0.8807*	-1.4142*	-2.2848*	-1.5040*
	(0.1174)	(0.1661)	(0.2117)	(0.3130)	(0.5509)
Schooling	0.2097*	0.2222*	0.2015*	0.0867	0.4450*
	(0.0251)	(0.0364)	(0.0443)	(0.0646)	(0.1185)
Sh. of Young	-0.0238*	-0.0186*	-0.0240*	-0.0326*	-0.0422**
	(0.0038)	(0.0057)	(0.0066)	(0.0087)	(0.0174)

Note: The numbers in parentheses are heteroskedasticity corrected standard errors.
*, ** and *** denote significance at 1%, 5% and 10% confidence interval, respectively.

The results indicate no evidence in favor of localization economies. In fact, specialization slows down employment growth in all equations. Glaeser et al. (1992) find no evidence in favor of localization economies whereas Henderson et al. (1995) report significant and positive effect of specialization for the U.S. Combes (2000) shows

that specialization is negatively correlated with employment growth in France, contrary to the evidence found for the U.S. In developing country studies, Henderson et al. (2001) show that specialization, indeed, is an important element for production in South Korea, whereas Hanson (1998) finds negative effect of specialization to employment growth in Mexico before joining NAFTA and positive but insignificant effect after trade liberalization. The negative finding contradicts the predictions of the theory. One plausible explanation for negative effect of specialization can be cycles in the life of a product (Combes (2000))[7]. Products are first developed in certain locations and then diffuse to other regions.

There is also no evidence in favor of urbanization economies in all industries but high-tech. The coefficient for machinery industry is also positive though not significant. The model that assumes monopolistic competition with differentiated products applies to high-tech industries in Turkey. This finding confirms earlier results obtained by Henderson et al. (1995) for the U.S. economy and Henderson et al. (2001) for South Korea.

The next two variables measure the effect of the size of the local economy. The first variable, backward-forward linkages, measures the demand for the output of a particular industry and/or cheaper inputs for production in that industry. The backward-forward linkages is positive and significant for traditional and heavy industries, as well as in "all-industries" equation. The elasticity estimate indicates that a percent increase in the backward-forward linkage improves employment growth by 1.9%. The coefficient is negative and significant at 10% confidence level for machinery industry and insignificant for high-tech industry. The second variable, density, controls for congestion. The coefficient of density is insignificant in all equations, but negatively significant for heavy industry.

Competition variables is insignificant for "all-industries", traditional and machinery industries. It is negative and significant for heavy industries. Together with the negative effect of density, negative elasticity of competition reflects the fact that heavy industries usually have high fixed costs and competition for inputs lead to congestion. For high-tech industries, the elasticity of competition is positive and around 18%. The nature of high-tech firms that they have to innovate continuously requires an environment where they can enjoy higher markups in the spirit of new endogenous growth models.

Average establishment size has a negative impact in all equations, but insignificant only in manufacturing industry. The magnitude is similar for traditional and heavy industries but much higher for high-tech industry. This is very likely because small firms

[7] Combes (1999) provides an explanation why estimated specialization coefficient for the U.S. economy can be upward biased. He shows that including sectoral employment level in the estimating equation makes is hard to interpret the coefficient in front of the specialization index.

enjoy information spillovers more than the large ones. A different explanation could be that small firms are more flexible and adjust to new conditions more easily than others.

Finally, the existence of state-owned enterprise in the same industry does not affect employment growth in all but high-tech industries. In Turkey, state firms usually spend more money on training their workers compared to private firms, and existence of skilled worker is more important for industries that use more advanced technology.

Lag structure of dynamic externalities

Another interesting question is related about how long it takes for economic structure to affect growth. New locations may not be preferred by firms just because they do not have enough stock of information and thus the longer externalities persist the more firms agglomerate in that region. Henderson (1997) using a panel data estimates the lag structure of dynamic externalities and shows that localization economies affect level of employment in five to six years whereas urbanization economies take a little longer. Exploiting the panel structure of Turkish data, the model is re-estimated by including one lag of all externalities, that is values of ten years ago are included in the estimation equation at a cost of loosing one of three observations for each province-industry.

Table 6 presents the results. While the general conclusions of the previous analysis hold, there are some differences. Especially, lagged specialization has positive effect in all equations despite specialization at the beginning of the period still has negative coefficients. Dynamic externalities are indeed important; however, firms benefit more from specialization the longer they persist, that is dynamic stock of 'local trade secrets' is very important as conjectured in Henderson (1997). The negative impact in the short-run indicates that once products are well-developed, production diffuse to other areas.

For other variables, controlling lagged levels wipes out the significance of backward and forward linkages, but ten years is a long time for transportation technology to change, especially in a developing country. The density variable is now significantly negative for "all-industries" and traditional industries as well as heavy industry. The lagged density variable for all-industries and heavy industries are positive and significant, indicating that initially large markets improve growth but congestion effect sets in as time passes. Competition variable became also significant in this set of regressions, nevertheless the positive coefficient for high-tech industries is unaltered. In fact, persistently high markups in this industry enhances growth more.

Table 6: Dynamic structure of scale externalities

	All Industries	*Traditional Industries*	*Heavy Industries*	*Machinery Industries*	*High-tech Industries*
Relative Wage at (t-1)	0.0066 (0.0104)	0.0339 (0.0177)	-0.0189 (0.0128)	-0.0679 (0.0349)	-0.0406 (0.0840)
Relative Wage at (t-2)	-0.0021 (0.0087)	-0.0055 (0.0140)	0.0118 (0.0124)	-0.0138 (0.0362)	0.0304 (0.0483)
Specialization at (t-1)	-0.0486* (0.0115)	-0.0473** (0.0191)	-0.0503* (0.0172)	-0.1588** (0.0669)	-0.1183** (0.0464)
Specialization at (t-2)	0.0422* (0.0118)	0.0344*** (0.0189)	0.0478* (0.0177)	0.1579* (0.0473)	0.1629* (0.0577)
Diversity at (t-1)	-0.0082 (0.0204)	-0.0421 (0.0290)	-0.0071 (0.0370)	-0.0488 (0.0717)	0.2557** (0.1013)
Diversity at (t-2)	-0.0010 (0.0192)	0.0190 (0.0241)	-0.0492 (0.0439)	-0.1156 (0.1028)	0.1096 (0.1472)
B-F. Linkages at (t-1)	0.0254** (0.0103)	0.0183 (0.0166)	0.0193 (0.0157)	-0.1012 (0.0662)	0.0222 (0.0370)
B-F. Linkages at (t-2)	0.0013 (0.0107)	-0.0006 (0.0159)	0.0165 (0.0178)	0.1240** (0.0478)	0.0590 (0.0556)
Density at (t-1)	-0.1103* (0.0324)	-0.0783*** (0.0433)	-0.1300* (0.0501)	-0.0859 (0.1161)	-0.0314 (0.1892)
Density at (t-2)	0.0759* (0.0244)	0.0493 (0.0327)	0.0909** (0.0378)	0.0573 (0.0875)	0.0286 (0.1424)
Competition at (t-1)	-0.0144** (0.0068)	0.0227 (0.0407)	-0.0236** (0.0108)	-0.0199** (0.0093)	0.2701*** (0.1519)
Competition at (t-2)	0.0000 (0.0130)	-0.0068 (0.0189)	0.0014 (0.0277)	-0.0172 (0.0237)	0.2947** (0.1457)
Avg. Est. Size at (t-1)	0.0132 (0.0116)	-0.0042 (0.0186)	-0.0057 (0.0188)	0.0233 (0.0312)	-0.0448*** (0.0682)
Avg. Est. Size at (t-2)	-0.0256** (0.0111)	-0.0197 (0.0177)	-0.0016 (0.0186)	-0.0222 (0.0310)	-0.1702 (0.0991)
Gov. Est. at (t-1)	-0.0324*** (0.0192)	-0.0255 (0.0327)	-0.0375 (0.0318v	0.0332 (0.1680)	0.0845 (0.0812)
Gov. Est. at (t-2)	-0.0209 (0.0171)	-0.0027 (0.0304)	-0.0193 (0.0246)	-0.0371 (0.0556)	-0.0681 (0.0856)

Table 6 (cont'd): Dynamic structure of scale externalities

	All Industries	*Traditional Industries*	*Heavy Industries*	*Machinery Industries*	*High-tech Industries*
Selection Equation					
Density	0.0131*	0.0156*	0.0066***	0.0094**	0.0349*
	(0.0021)	(0.0027)	(0.0037)	(0.0045)	(0.0061)
Distance	-0.0014*	-0.0012*	-0.0015*	-0.0023*	-0.0018**
	(0.0001)	(0.0001)	(0.0002)	(0.0004)	(0.0008)
Gov. Est.	0.3884*	0.4525*	0.3925*	0.0784	0.0690
	(0.0307)	(0.0455)	(0.0539)	(0.0916)	(0.1596)
Sh. of Agr.	-0.8695*	-0.4596**	-1.1987*	-2.0298*	-1.1800
	(0.1561)	(0.2245)	(0.2764)	(0.3903)	(0.8075)
Schooling	0.6209*	0.6393*	0.5837*	0.5407*	0.8968*
	(0.0308)	(0.0458)	(0.0498)	(0.0776)	(0.1754)
Sh. of Young	-0.0082*	-0.0015	-0.0059	-0.0187	-0.0297
	(0.0040)	(0.0062)	(0.0061)	(0.0110)	(0.0210)

Note: The numbers in parentheses are heteroskedasticity corrected standard errors.
*, ** and *** denote significance at 1%, 5% and 10% confidence interval, respectively.

5. Conclusion

This study investigates the effects of local scale externalities on employment growth in Turkish private manufacturing industry. In 1980 Turkey switched from import substituting industrialization to export oriented growth and liberalized its economy. These changes are expected to have some significant effects not only on the aggregate economy but also on the regional distribution of production. While there are no large changes in this distribution as observed in other developing economies, such as Mexico and South Korea, there is some significant deconcentration of industry from historical industrial bases.

The paper finds that localization economies have negative impact on employment growth in the short run, however, there is positive effect of specialization on growth once extra lags are allowed for. The paper also finds evidence in favor of urbanization economies for high-tech industries. This shows that diversity attracts high-tech firms whereas the same cannot be said for other industries. Another important factor for growth is the existence of backward and forward linkages. Firms develop much faster in provinces where they have upstream and/or downstream firms. Competition affects employment growth differently depending on the industry. In heavy industries it reduces growth, but firms in high-tech industries benefit from decreased competition. The

findings emphasize the importance of dynamic scale externalities in a developing country context and confirms, in general, the findings for developed economies.

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Research Article

A Brief Assessment of Adult Skills in Turkey: Results from Survey of Adult Skills (PIAAC)

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Abstract

In this study, we compare the adults' proficiency in key information-processing skills in Turkey with the rest of the OECD countries using the results of OECD Programme for the International Assessment of Adult Competencies (PIAAC) survey. Several key observations can be summarized as follows; While the performance of adults in OECD countries are mostly grouped at intermediate levels, adults in Turkey are concentrated at elementary levels. Both in literacy and numeracy skills, individuals with tertiary education in Turkey perform the same as individuals with secondary education in the OECD countries. We observe that low level of skill use in the labor market might also reflects poor skill returns; thereby individuals prefer not to invest heavily in those skills. Findings of the PIAAC survey reveal that the improvement in quantity should be complemented with progress in quality in Turkey. Moreover, low returns to skills put more emphasis on institutional issues concerning the structure of labor demand. Lack of incentives in firms could be a factor restricting skill development of workers and could lead to low investment in skill upgrading. We complement our comparison by providing some evidence from other data sources and underline the importance of skill development for growth.

JEL Codes: J24, J21, I25, I26

Keywords: Skill, human capital, productivity, labor force.

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Türkiye'de Yetişkin Becerilerinin Kısa Bir Değerlendirmesi:

Yetişkin Yeterlilikleri Anketinden (PIAAC) Çıkarsamalar

Öz

Bu çalışmada, OECD Uluslararası Yetişkin Yeterlilikleri Değerlendirmesi (PIAAC) anketinin sonuçlarını kullanarak yetişkinlerin Türkiye'deki temel bilgi işleme becerilerindeki yeterliliğini diğer OECD ülkeleriyle karşılaştırıyoruz. Çalışmamızdan çıkan birkaç önemli gözlem şöyle özetlenebilir; OECD ülkelerindeki yetişkinlerin performansı çoğunlukla orta düzeylerde gruplandırılırken, Türkiye'deki yetişkinler temel düzeylerde yoğunlaşmıştır. Türkiye'de yükseköğretime sahip bireyler, hem okuryazarlık hem de matematik becerilerinde, OECD ülkelerindeki orta öğretim seviyesindeki bireylerle aynı performansı göstermektedir. PIAAC sonuçları Türkiye eğitim sisteminde nicel olarak sağlanan başarının niteliksel gelişme ile tamamlanması ihtiyacını ortaya koymaktadır. Öte yandan işgücü piyasasında, sayısal ve sözel becerilerin getirisinin düşük olması işgücü talebinin yapısına ilişkin başka kurumsal sorunların altını çizmektedir. Firmaların yarattığı teşviklerin yetersiz oluşu, beceri gelişimi önünde kısıtlayıcı bir engel olarak ortaya çıkmakta ve becerilere yapılan yatırımın düşük kalmasına sebep olmaktadır. Karşılaştırmamızı diğer veri kaynaklarından derlediğimiz bazı olguları ortaya koyarak ve büyüme için beceri geliştirmenin önemini vurgulayarak tamamlıyoruz.

JEL Kodları: J24, J21, I25, I26

Anahtar kelimeler: Beceri, beşeri sermaye, verimlilik, işgücü, eğitimin getirisi.

1. Introduction

International Assessment of Adult Competencies (PIAAC) is conducted by OECD in order to assess adult proficiency in information-processing skills. These skills, namely literacy [2], numeracy [3] and problem solving [4] in technology-rich environments are measured in order to provide better insight to policy makers in evaluating the labor market outcome of national education and training programmes. The survey also integrates the use of these skills at work and at daily life and offer further information on the individual perception of workers for their skill and qualification matches. For example, Jimeno et al. (2016) discuss that firm specific experience is correlated with skills measured by PIAAC, particularly for low educated workers. They argue that using skills at work increases numeracy score performance for these workers.

There is a growing literature on how problem-solving skills contribute to individual and social welfare. Broecke et al. (2017) discuss the role of skills in explaining the wage inequality across countries using decomposition analysis. Stijepic (2018) indicates that improvement in numeracy skills increase the likeliness of being employed with respect to other labor status such as unemployed or non-participant. Their results suggest that the employment effect of skills favor female workers more than male workers. Hanushek et al. (2015) finds higher returns to skill across countries an discusses the role of labor market institutions in rewarding skills. Hidalgo-Cabrillana et al. (2017) show that including broad aggregate skill indicators significantly improves standard development accounting model. There is a considerable number of studies focusing on skill performance and education system. Liu (2018) compares skill performance across countries having different education systems and reforms and argue that strong orientation towards vocational training have an advantage over high level of early tracking [5] when numeracy and literacy performances are considered. Several studies compare vocational and general programmes and conclude that lower mismatch advantage of vocational education at early stage of work-life can disappear over time

2 Definition of literacy proficiency is given as “The ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one’s goals, and to develop one’s knowledge and potential.”, OECD (2016b: 90).

3 Definition of numeracy proficiency is given as” The ability to access, use, interpret and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life.”, OECD (2016b: 91).

4 Definition of problem solving is given as “The ability to use digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks. The assessment focuses on the ability to solve problems for personal, work and civic purposes by setting up appropriate goals and plans and accessing and making use of information through computers and computer networks.”, OECD (2016b: 93).

5 Based on the classification described in Bol and Van de Werfhorst (2013), Liu (2018) notes that” Scandinavian countries follow the pattern of a high level of vocational education orientation and a low level of tracking. Education systems in Chile, Turkey and Korea provide examples of low orientation of vocational education yet high level of tracking.”

and general qualifications seems to favor workplace learning more than vocational programmes, (Verhaest et al., 2018, Hampf and Woessmann, 2017).

In this study, we will solely focus on those dimensions where Turkey differs from other OECD countries in the PIAAC survey. We will further limit our scope with literacy and numeracy proficiency in information-processing skills and exclude the section on problem solving in technology-rich environments.[6] The first round of PIAAC survey covers 24 countries/economies and Turkey was included later on the second round along with eight other countries. We will also restrict our comparison with OECD countries/economies that are part of this assessment and leave partner countries out.[7] We will first give a short general overview of adults' skills and the position of Turkey among OECD countries. We will later focus on skill use in the workplace and in everyday life. A section on labor market outcome of PIACC skills will follow. We discuss and conclude our observations by providing some complementary facts related to labor market particularities of Turkey.

2. An Overview of Adults' Proficiency in Key Information-Processing Skills

We begin with a general comparison among OECD countries undertaking this survey. Table 1 and 2 provide summary of performances of OECD countries for literacy and numeracy skills on a 500-point scale and levels of difficulty of tasks performed within these ranges. [8]For Turkey, both skill levels are substantially lower than other OECD countries. Among OECD countries involved in PIAAC, Turkey ranks second last, with the lowest score after Chile. The distribution of competencies according to sophistication of tasks can help to obtain an more accurate picture. Literacy skill levels 1 and 2 have the highest frequencies, (33.1% and 40.2%, respectively), meaning that skills requiring complicated tasks such as understanding rhetorical structures, interpreting or synthesizing information from complex or long texts (which correspond to levels 3-5) are lacking. Most workers remain within basic skills levels (1 and 2), whereas OECD countries have workers grouped mostly at levels 2 and 3 (33.9 and 35.4%, respectively) on average. As for numeracy skills, only around 15% of adults in Turkey perform at and

[6] Many adults in all countries have no experience with computer use, extremely limited ICT skills, or low proficiency of problem solving in technology-rich environments (OECD, 2016a: 24). Furthermore, some adults who are less proficient or feel less confident in their computer use skills opt out or fail ICT core or have no computer use (OECD, 2016a: 55), thus average scores in the domain of problem solving in technology-rich environments can bias comparisons among countries due to selective participation.

[7] Partner countries are Cyprus, Jakarta (Indonesia), Lithuania, Russian Federation and Singapore.

[8] Each of the two proficiency scales was divided into proficiency levels, defined by particular score-point ranges and the level of difficulty of the tasks within these ranges. Table 1 and 2 provide descriptive summary of the types of tasks that can be successfully completed by adults with proficiency scores in a particular range. In other words, they suggest what adults with particular proficiency scores in a particular skills domain can do. Six proficiency levels are defined for literacy Adults' proficiency in key information-processing skills and numeracy (Levels 1 through 5 plus below Level 1), OECD (2016a: 37-38).

above level 3, and more than 60% of adults are grouped at level 1 (30%) and 2 (33.3%). The OECD average has more than two fifths of adults (43.1%) scoring at and above level 3.

Table 1: Performance of OECD Countries in Information-Processing Skills - Literacy Proficiency

	Mean score	Below Level 1	Level 1	Level 2	Level 3	Level 4	Level 5	Missing
		Below 176 points	176-126 pt.	226-276 pt.	276-326 pt.	326-376 pt.	376 pt. and above	
		%	%	%	%	%	%	%
Turkey	227	12.7	33.1	40.2	11.5	0.5	c	2
OECD average	268	4.5	14.4	33.9	35.4	10	0.7	1.4

Retrieved from OECD,2016a. Annex A, Ch2, Table A2.3 and A2.5).
http://dx.doi.org/10.1787/888933366458

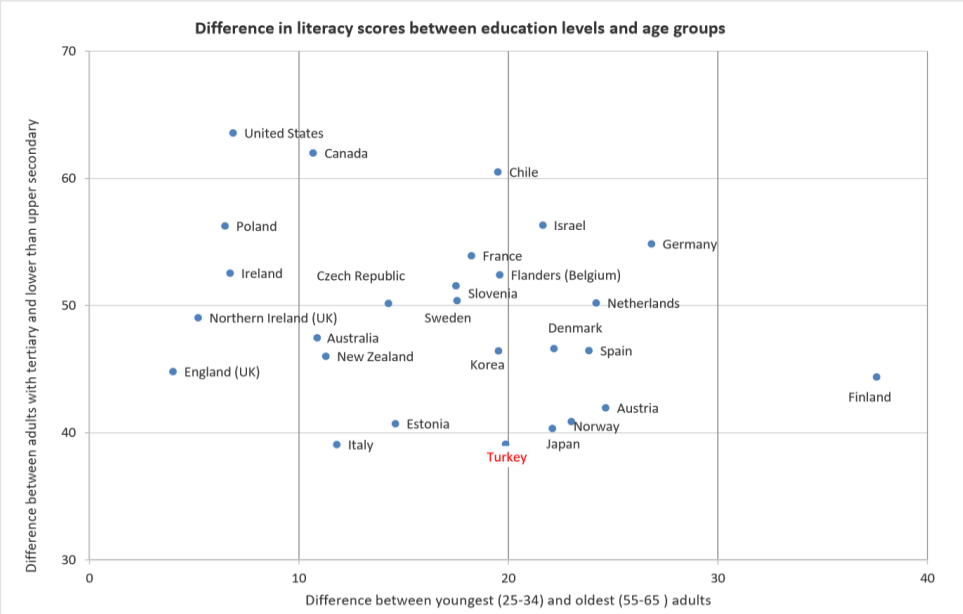
Table 2: Performance of OECD Countries in Information-Processing Skills - Numeracy Proficiency

	Mean score	Below Level 1	Level 1	Level 2	Level 3	Level 4	Level 5	Missing
		Below 176 points	176-126 pt.	226-276 pt.	276-326 pt.	326-376 pt.	376 pt. and above	
		%	%	%	%	%	%	%
Turkey	219	20.2	30	33.3	13	1.4	c	2
OECD average	**263**	**6.7**	**16**	**33**	**31.8**	**10.2**	**1**	**1.4**

Retrieved from OECD (2016a: Annex A, Ch2, Table A2.3 and TablA2.5)
http://dx.doi.org/10.1787/888933366458

It would be informative to see how skills are distributed according to age and education levels. Figure 1 gives skill level differences between age groups and educational attainment. In terms of literacy skills, differences between age groups are not so high, while the difference in education level between tertiary and lower than upper secondary is quite small compared to other countries. Given the low level of literacy, it is striking to observe that higher education does not add to skill proficiency. As for numeracy (Figure 2), Turkey is situated fairly well in terms of educational difference among OECD countries, but the difference among generations is quite high.

Figure 1: Literacy skill differences between age groups and education levels.



Retrieved from OECD (2016a: Annex A, Ch 3, Table A3.1 (L)) List of tables available online. http://dx.doi.org/10.1787/888933366463

Figure 2: Numeracy skill differences between age groups and education levels.

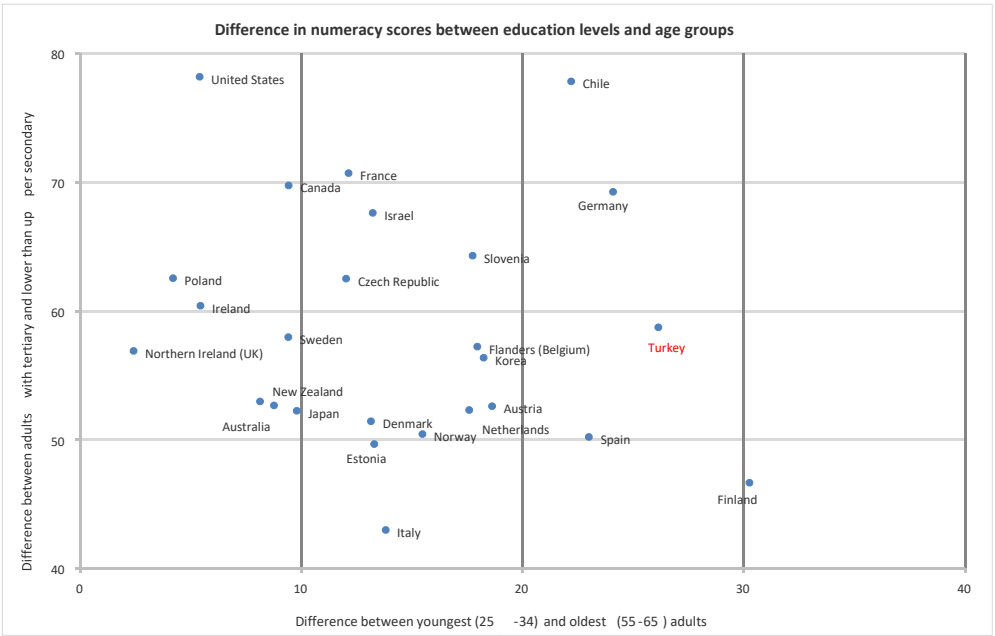


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Figure 3: Mean literacy skill proficiency, by educational attainment

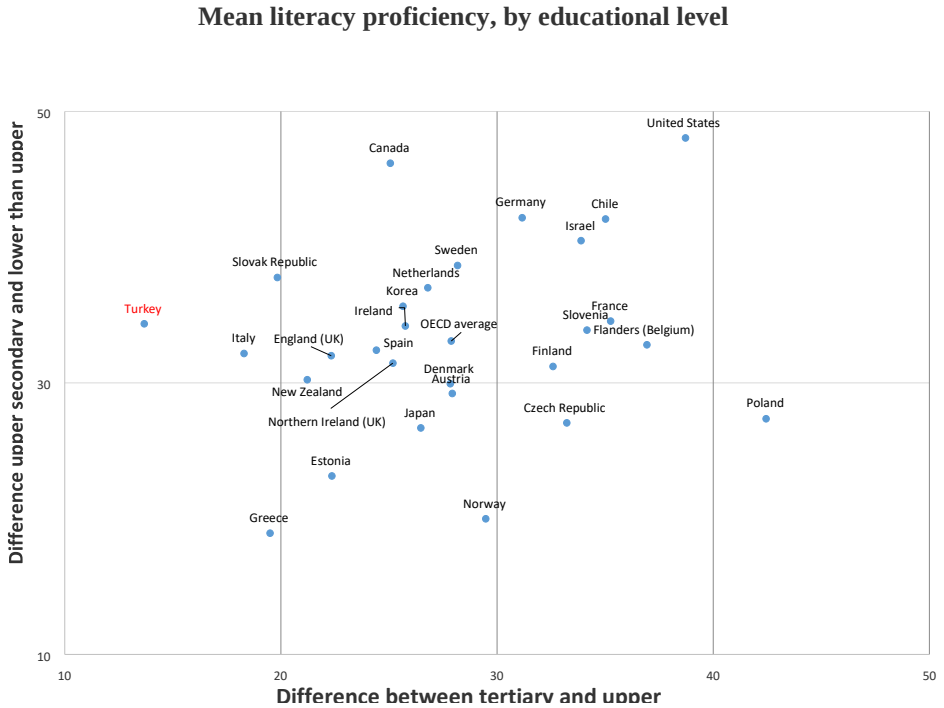

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Figure 4: Mean numeracy skill proficiency, by educational attainment.

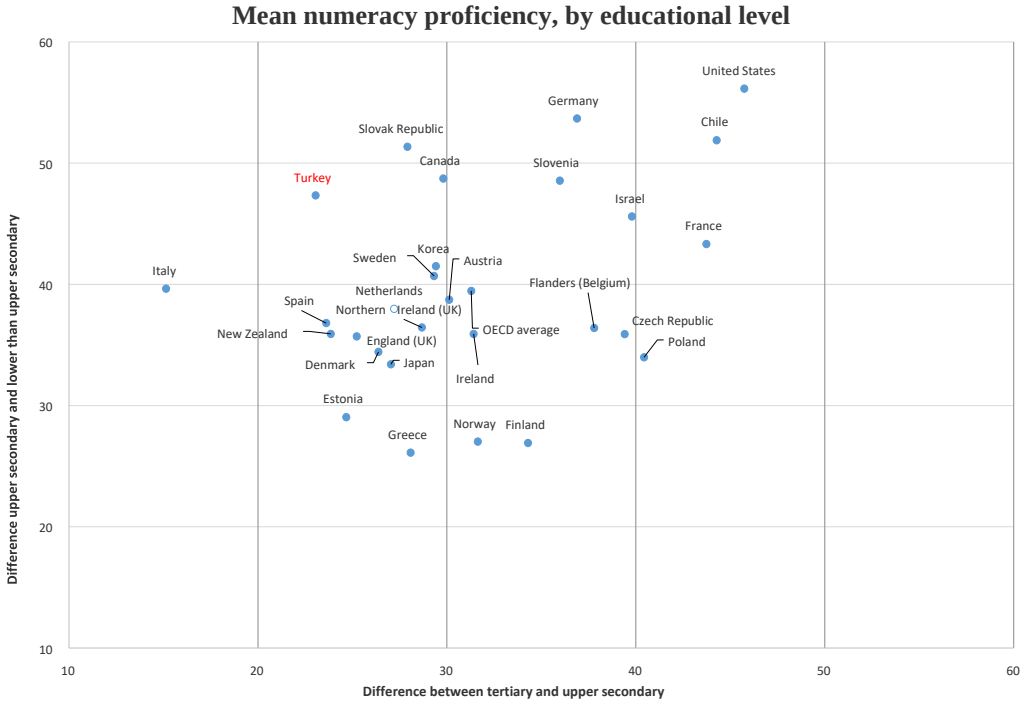

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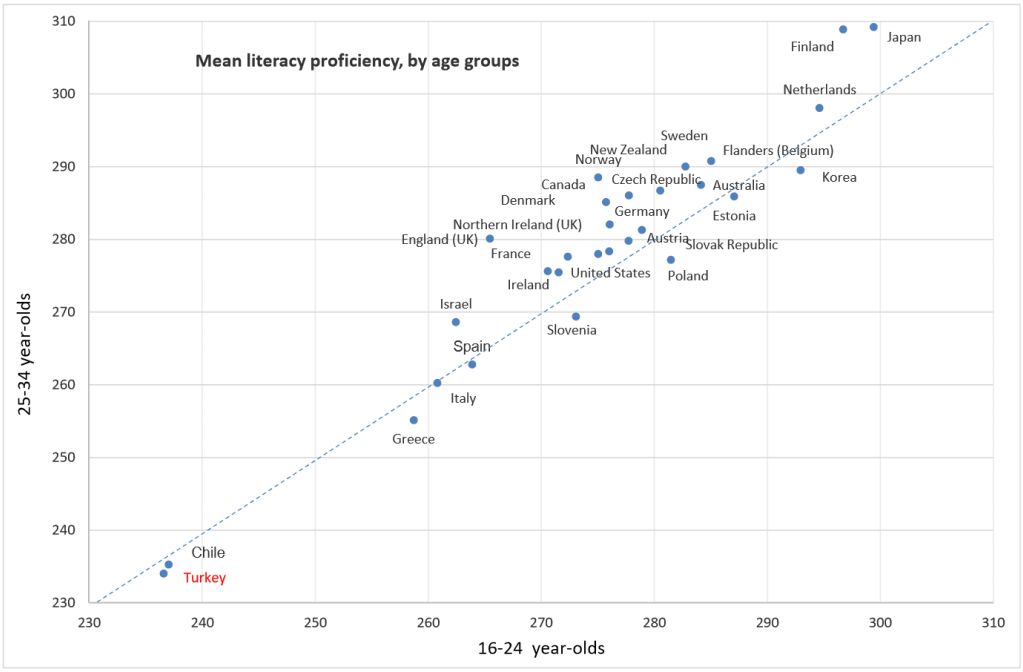
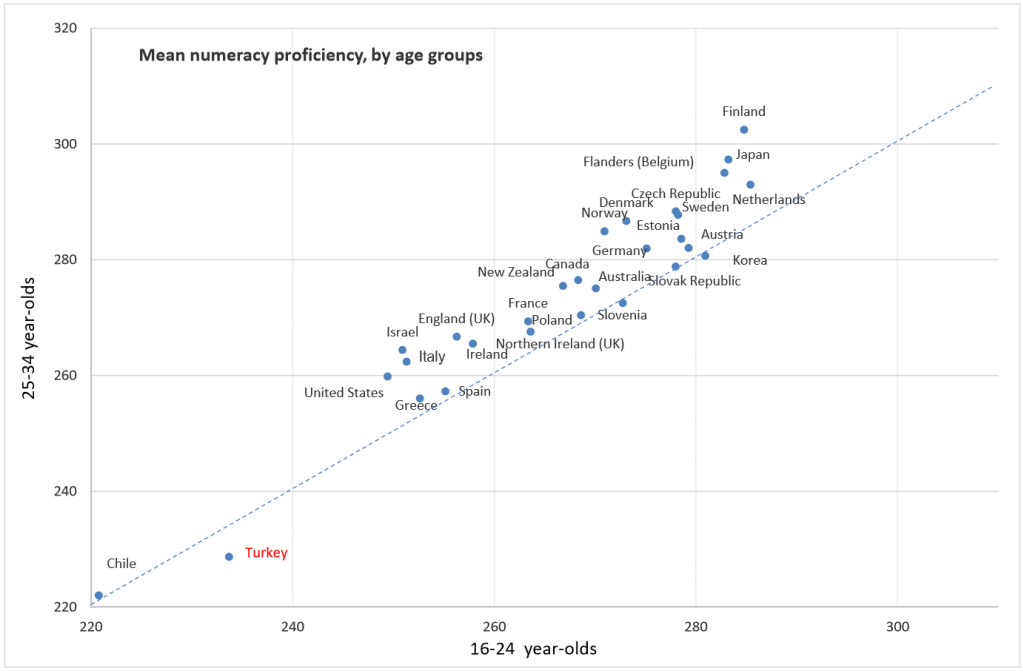
Figure 5: Mean literacy proficiency, by age groups



Retrieved from OECD (2016a: Annex A, Ch. 3, Table 3.5 (L)). List of tables available online, http://dx.doi.org/10.1787/888933366463.

Figure 6: Mean numeracy proficiency, by age groups



Retrieved from OECD (2016a: Annex A, Ch 3, Table 3.5 (N)). List of tables available online, http://dx.doi.org/10.1787/888933366463.

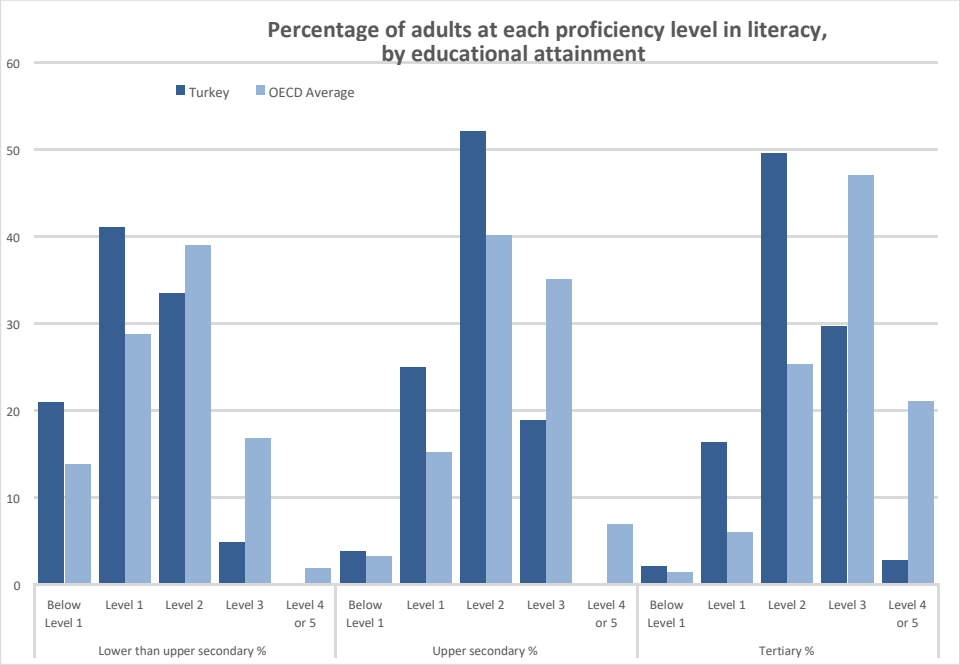
Taking a close look at differences among education level, it is striking to see that in terms of literacy skills (Figure 3), *marginal improvement* of tertiary level in Turkey is smaller compared to other OECD countries. The literacy skill scores only increase by an average of 13.7 between upper secondary and higher education (tertiary). Contrasting Turkey's position on numeracy (Figure 4), it seems that the difference is again quite low, as is the case in literacy skill, but now the educational gap is closer to the OECD average. It is worth noting that in relative terms, tertiary education can upgrade numeracy skills but not literacy skills in Turkey, which is rather intuitive, given the fact that numeracy is regarded as a key element in student assessment at all education levels in Turkey.

We complement this observation with age group differences in skill levels. In Turkey, educational attainment has dramatically changed across generations due to the extension of compulsory schooling (8 years), starting from 1998. It would be revealing to see the impact of education for the more educated generation. Figure 5 gives literacy proficiency levels of age groups. It seems that age group 16-24 performs slightly better than age group 25-34. However, the gap between OECD averages seems to hold even for the more educated generations. Note that compulsory schooling was extended to 8 years in 1998 and this reform has affected these age groups. A similar observation can be made for numeracy skills (Figure 6), with the younger generation (16-24) seeming to perform better than the elder one.

The overall observation suggests that although educational attainment has increased in Turkey, the skill gap with OECD countries has not decreased as one would have expected. In other words, extended years of education is not the remedy to upgrade skills; probably it is the quality of education that matters most. Looking closely at the distribution of skills across levels, which provides better insight in understanding the performance of adults, we see Turkey's pattern differs considerably from that of the OECD averages.

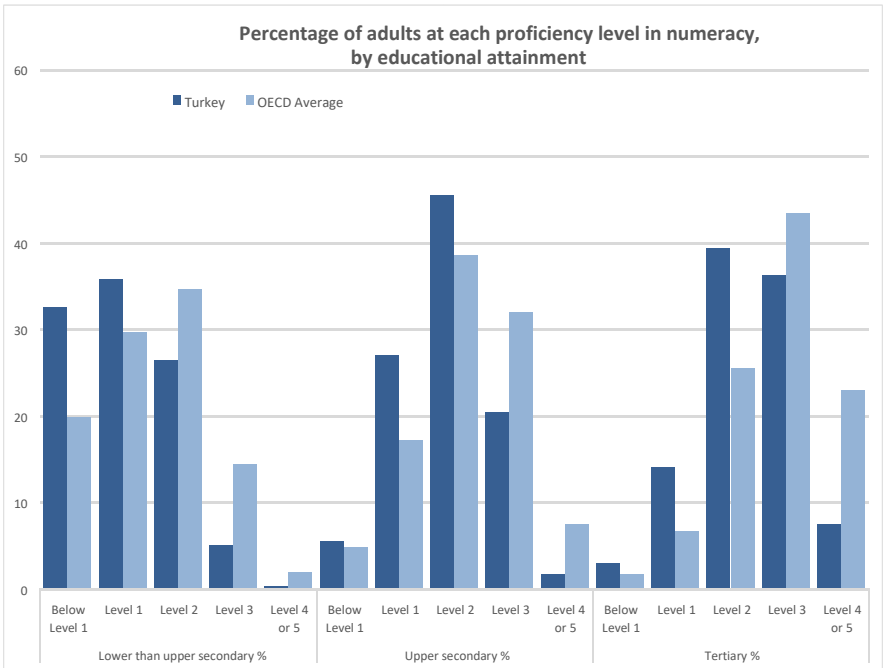
Figures 7 and 8 indicate that only a limited percentage of adults with secondary and tertiary education level can perform beyond level 2. Only a negligible number of adults reaches level 4. At tertiary education level, level 3 has the highest frequency in OECD countries where individuals are sorted. In terms of distribution across skill levels, it seems that in Turkey, adults with tertiary education perform the same as the secondary level of OECD countries in both literacy and numeracy skills. We have to underline that we do not know the composition of open and distance post-secondary graduates in this tertiary education group. Note that starting from 2006, Turkey has seen an expansion in tertiary education, and access to higher education has dramatically increased, (Polat, 2017). The fact that tertiary graduates have on average, the skill proficiency of secondary education level of average OECD countries raises the issue of quality versus quantity. Expanding higher education can increase access but does not guarantee quality and skill upgrading.

Figure 7: Percentage of adults at each proficiency level in literacy by educational attainment



Retrieved from OECD (2016a. Annex A, Ch. 3, TableA3.3 (L)).
http://dx.doi.org/10.1787/888933366463

Figure 8: Percentage of adults at each proficiency level in numeracy by educational attainment



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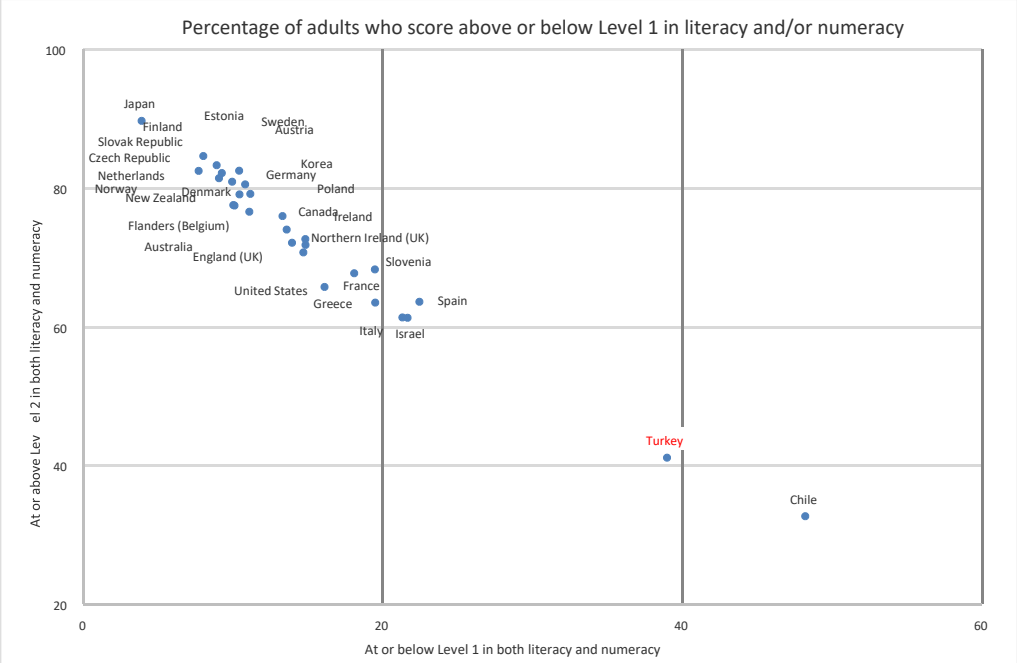
http://dx.doi.org/10.1787/888933366463

Figure 9: Percentage of adults who score at or below Level 1 in literacy and/or numeracy



Retrieved from OECD (2016a: Annex A, Ch. 3, Table A3.16). List of tables available online. http://dx.doi.org/10.1787/ 888933366463.

Another important issue for policy makers would be the evaluation of low performers in both skills. Grouping countries in terms of low performers, we see a striking distinction between Turkey and OECD countries. Figure 9 show that nearly 40 % of adults perform at or below level 1 in both literacy and numeracy, whereas only 40% of them have proficiency at level 2 or above in both skills. Given that level 2 distinguishes basic competencies such as paraphrasing and making low-level inferences, having a such a high share of poor performers needs more consideration by the policy makers.

Table 3: Mean literacy proficiency, by gender

	Literacy		**Numeracy**	
	Men	Women	Men	Women
	Mean	Mean	Mean	Mean
Turkey	232	220.9	232.6	205.7
OECD average	268.7	266.6	269.2	256.9

Retrieved from OECD (2016a: Annex A, Ch.3, Table A3.9 (L)). http://dx. doi.org/10.1787/888933366463

Figure 10: Mean literacy proficiency, by age and gender

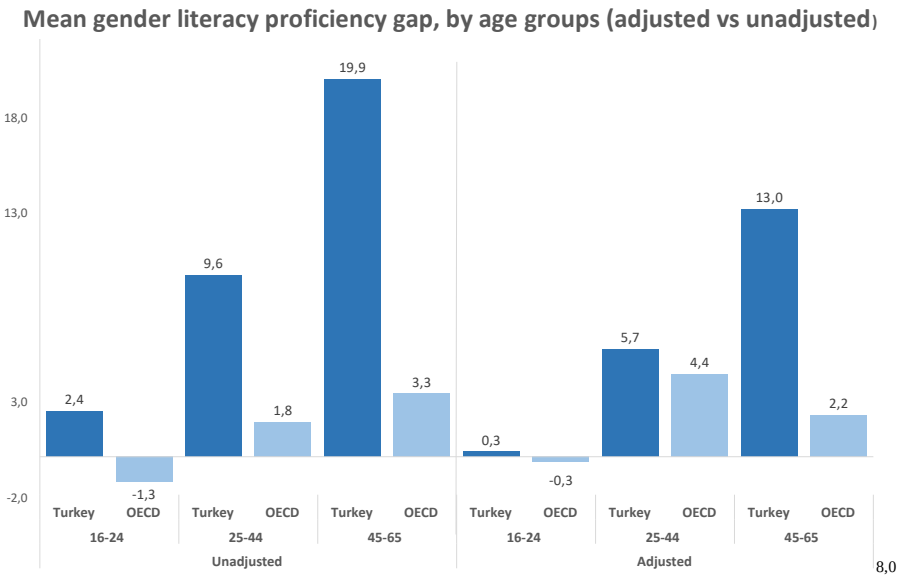


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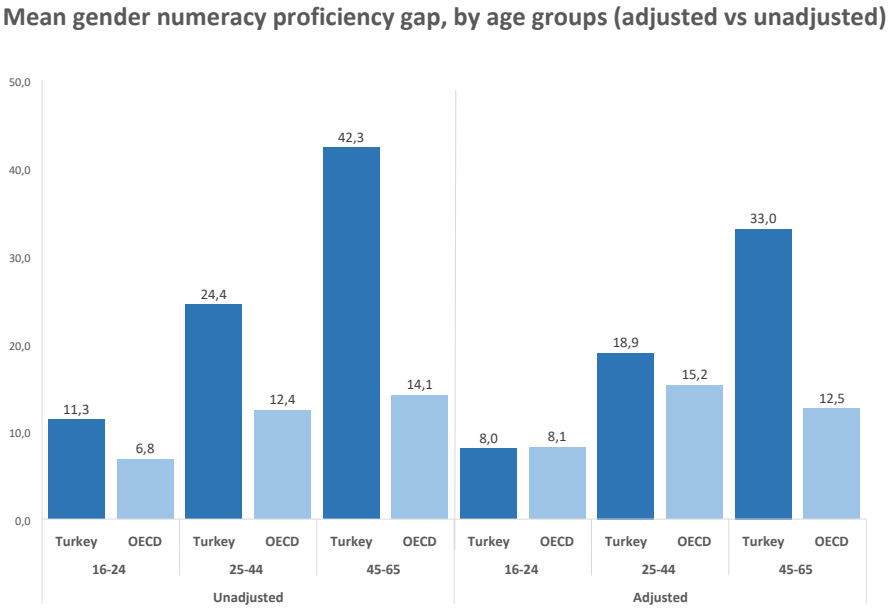
Figure 11: Mean numeracy proficiency, by age and gender



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Gender is another important issue that needs to be addressed. Turkey has relatively high gender differences in skills (Table 3). Considering the fact that there is an

educational gender gap, and that it is significantly decreasing among the younger population, it will be more informative to compare each age groups. Figures 10 and 11 give raw (unadjusted) and adjusted differences after controlling for educational attainment. Raw differences are substantial, but the good news is that adjusted differences are rather low. Besides, the gender gap becomes almost negligible for literacy skills among younger generations (16-24). As for numeracy skills, it still holds, but in terms of level it converges towards OECD averages when scores are adjusted. It seems that educational gap which is significant higher for older generations is responsible for the bulk of gender gap in Turkey.

3. Skills Use in the Workplace and in Everyday Life

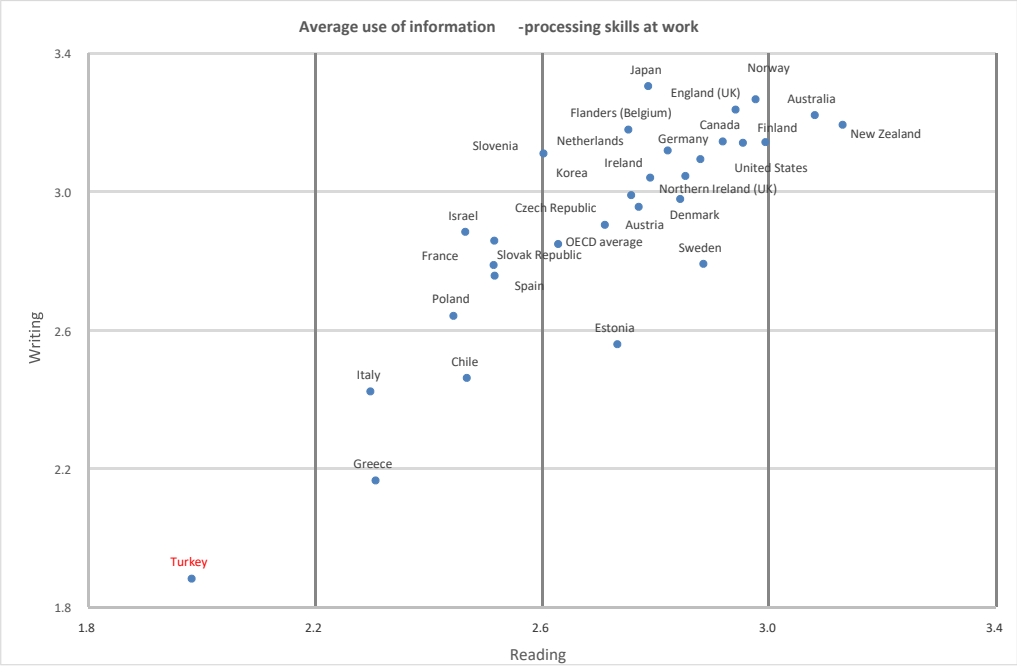
In addition to skill proficiency, the PIAAC survey also aims to measure how often adults use information-processing skills at work and in daily life. More specifically, in the three basic fields of reading, writing and numeracy, respondents are asked to assess how frequent they perform certain tasks when doing their job or in their everyday life.[9] The scale of skill use ranges between 1 to 5, depending on the frequency of performing certain tasks related to the above fields. Scores between 1 and 2 mean that skills are performed rarely, ranges between never to less than once a month. Scores between 2 and 3 indicate that usage lies between once a month and less than once a week. Using skills more than once a week takes the value of more than 3 points.[10] Note that scores show average frequency of use and the distance between levels is not linear.

Results of skill use show that adults in Turkey perform both reading and writing skill with a limited frequency (less than once a month on average). Figure 12 shows that among OECD countries, Turkey is the only country having an average score of less than 2 points. Regarding using writing skills, while most countries have average scores well above 2.5 and some of them have scores even above 3 (more than once a month or at least once a week), adults in Turkey have a very low frequency, below 2 points. As for numeracy skill use, Turkey has a better score with more than 2 points (Figure 13), but again ranks as the lowest performer among OECD countries. In terms of ICT skill use, the frequency is very low, again less than 2 points. This very limited use (less than once a month on average) is striking, since questions on ICT use are addressed only to respondents who report using computer at work.

For all OECD countries included in the survey, literacy proficiency level and use of reading at work seem to have a strong correlation (Figure 14). Chile stands as an outlier with the lowest skill level but has a moderately higher skill use at work. For use of numeracy skill at work, the correlation is weaker. Some countries with higher average scores can have less frequent use at work than others (Figure 15).

[9] PIAAC does not include any direct assessment of writing skills.
[10] For tables 7 and 8, providing more detailed information, see appendix.

Figure 12: Average use of reading and writing skills at work



Retrieved from OECD (2016a: Annex A, Ch. 4, Table A4.1). List of tables available online, http://dx.doi.org/10.1787/ 888933366479.

Figure 13: Average use of ICT and numeracy skills at work

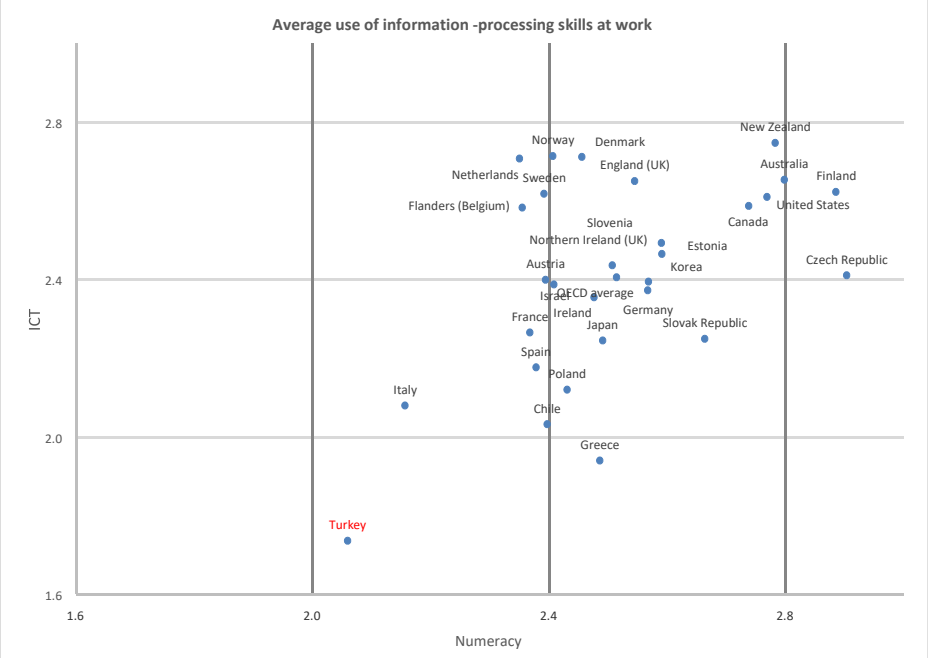


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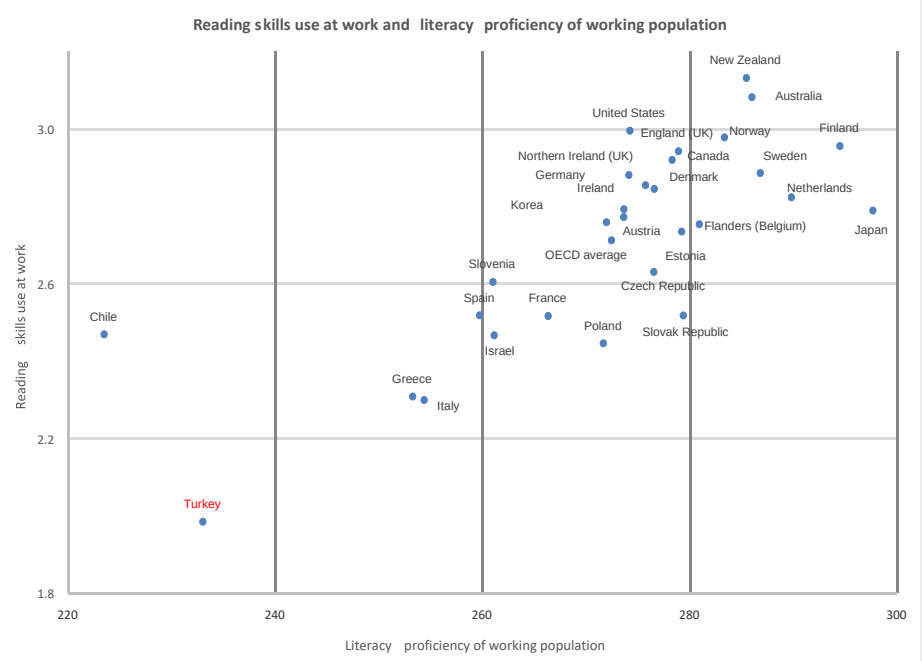
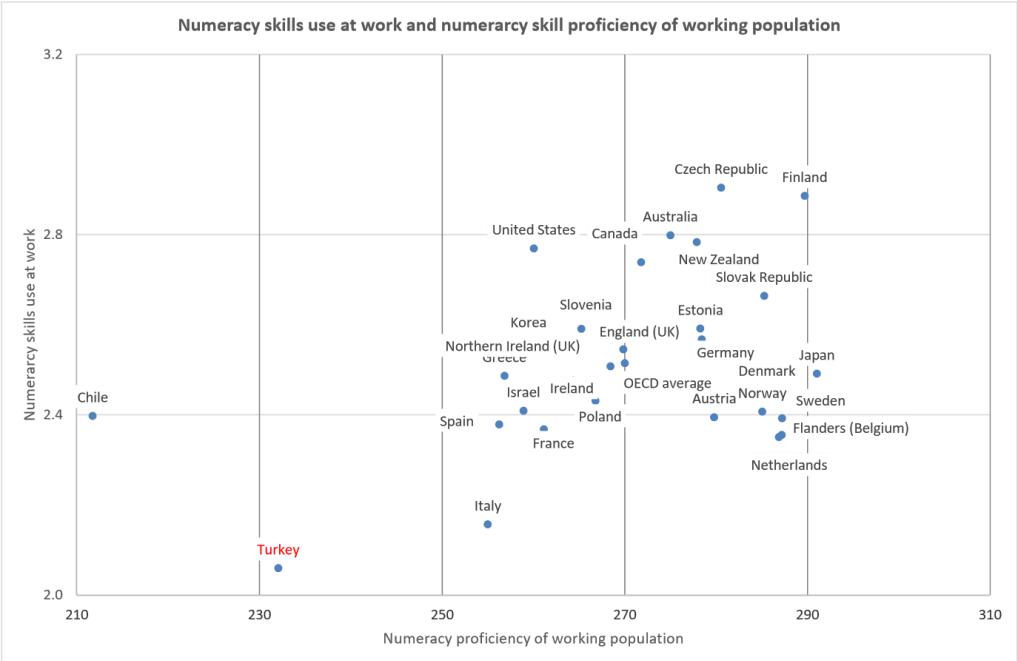
Figure 14: Literacy skill use at work and skill proficiency of working population



Retrieved from OECD (2016a: Annex A, Ch. 4, Table A4.4).
http://dx.doi.org/10.1787/888933366479.

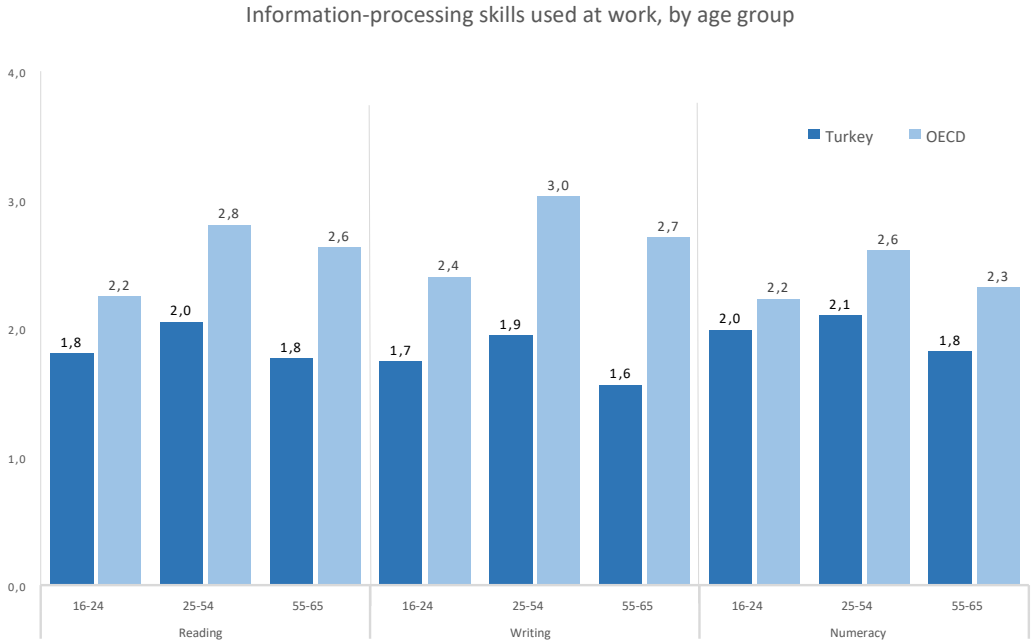
Figure 15: Numeracy skill use at work and skill proficiency of working population



Retrieved from OECD (2016a: Annex A, Ch. 4, Table A4.4).
http://dx.doi.org/10.1787/888933366479.

The fact that adults in Turkey have significantly lower level of skill use at work needs further clarification. Several factors can be at play. One candidate is the generational and educational differences. Labor market dynamics may also account for the outcome. It is possible that production technologies, work organization and job requirements are not so demanding for such skills, hence labor market offers less incentive for workers to use their skills. It is very likely that low labor demand requirements and low skill supply reinforce each other and generate a feedback mechanism. Using less skills (tasks including writing and reading reports, memos etc. at work) implies lower levels of cooperation and coordination at work place. These skill levels and their frequency of use at work are closely related to a firm's inner organization. Learning through interaction in the workplace is an important aspect of skill development, Eraut (2007). There are several studies showing that trust, cooperation and collaboration have close correlation with learning at the workplace (Steensma, 1996) and (Dodgson, 1993). Higher level of cooperation among co-workers and better coordination of teamwork require frequent use of writing and reading skills. When skill use at work yields less generous returns, also reflecting the demand side of the labor market, then it is optimal for individuals not to invest heavily in those skills.

Figure 16: Information-processing skills used at work, by age group



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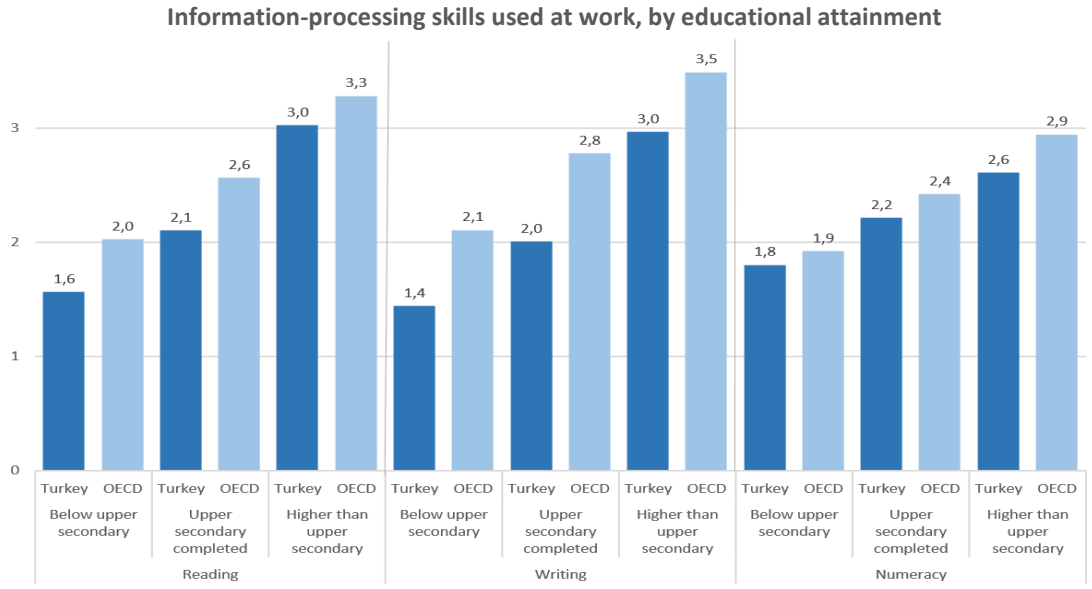
We will further compare the performance of subgroups with respect to OECD averages. Figure 16 displays use of skills at work for broad age groups. While the oldest (55–65 year-olds) generation has very low scores compared to OECD averages for

numeracy skill use at work, the youngest generation (16–25 year-olds) performs relatively better. As for writing skill use at work, differences among generations do not change much and the gap with OECD average is still very substantial. As for the use of reading skill at work, the performance of younger generation is close to OECD averages, but still very low in terms of frequency. Considering that the younger generations have higher education attainment, we may argue that increased access to education has increased reading and numeracy skills, but not enough to close the gap. It seems that the performance of younger generations in terms of skill proficiency is not enough to catch-up with their peers in developed countries.

Figure 17: Information-processing skills used at work, by educational attainment



Retrieved from OECD (2016a: Annex A, Ch 4, Table A4.9a).
http://dx.doi.org/10.1787/888933366479.

Breakdown by broad education level can provide more insight on how labor demand can promote skill use at work (Figure 17) in Turkey. It is interesting that numeracy skill use gap varies much with educational attainment; in fact, we can say that the gap becomes even slightly larger as education attainment increases. For writing skill use, we observe that higher than upper secondary level in Turkey is just above the level of upper secondary completed level of OECD averages. Adults with upper secondary level have a frequency of use less than below secondary level of OECD averages. It is probable that generational difference in skill use boosts the existing gap in use of writing skill further. For reading, again, adults with upper secondary level have nearly the same frequency of

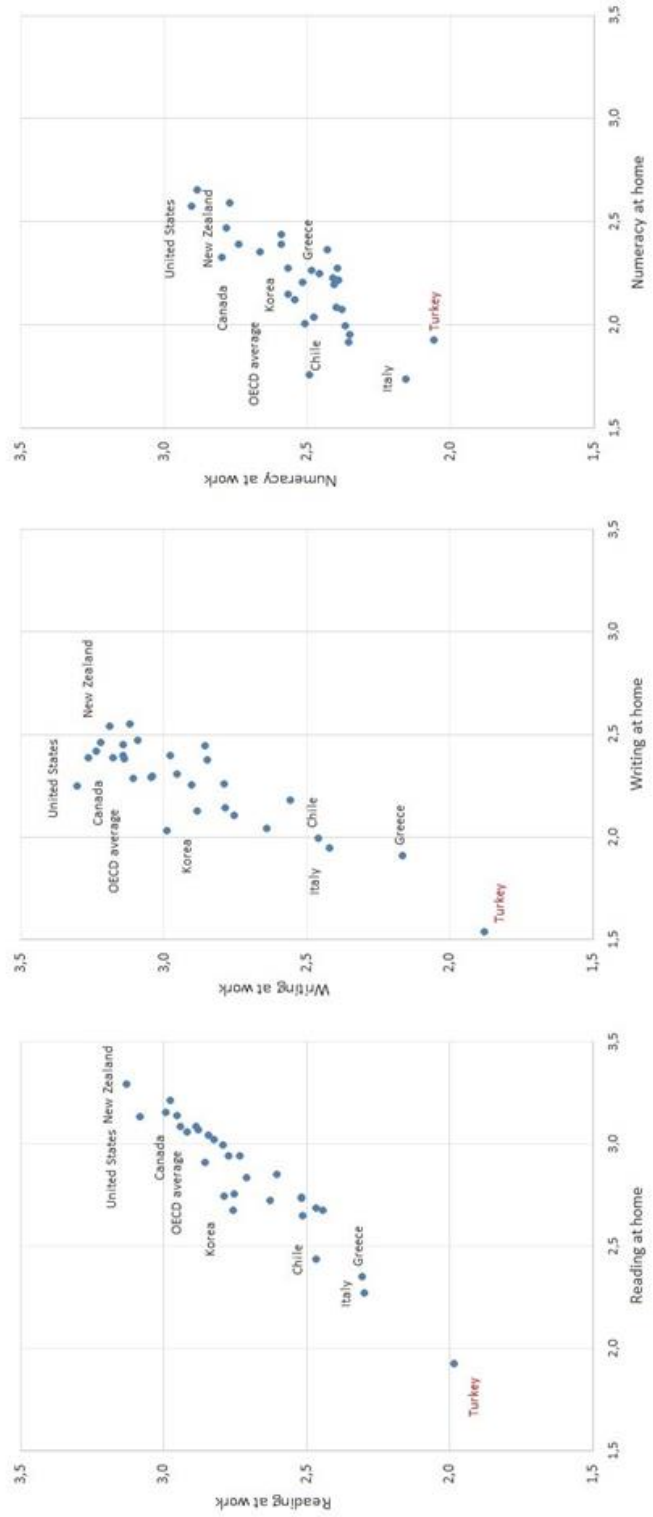
use as the adults with below secondary education level of OECD countries. Recent studies suggest that significant share of workers graduated from vocational high school have job that require basic education and cannot use their formal training at work, Aydede and Orbay (2016).

Another dimension which might help understand why use at work is quite low for Turkey, is the skill use at home. Figure 18 puts three type of skills at work and at home together. It is quite revealing that writing and numeracy skills are more frequently used at work rather than at home for OECD countries. It is possible that these activities are mostly job related and used to fulfil job requirements. Either it is the workplace organization that promotes frequent use of these skills, or it is the relative returns in using these skills that motivate workers. Reading skill is an exception. Adults, nearly in all OECD countries perform reading skills at home as often as they do at work. Turkey, in addition to less frequent use of reading skill at home (below level 2 - less than once a month on average), is one of the very few exceptions where reading at work is higher than reading at home. This observation also lends support to our previous argument that structural factors are at play. Performing less sophisticated tasks (basic use) at work is related to labor demand dynamics and the organization of work within the firm. Furthermore, Hamalainen et al. (2019) draw attention to the close relation between skill use at home and at work. They find that adults showing low performance in problem solving skills tend to use less of their skills both at work and at home.

We need to discuss briefly the structural factors that are likely to explain the low use of skills in Turkey. One main factor could be the composition of employment status in Turkey. Compared to OECD countries, the share of paid work is still low (67.0%) in Turkey and that of self-employed and unpaid family workers are relatively high, (16.8% and 11.8%, respectively as of the PIAAC survey year 2015).[11] It is possible that paid employment requires more use of skills such as writing and reading at work than other labor status like self-employment. Although we observe a significant structural transformation (Figure 19), the share of "market labor" is still not so high and educational attainment for wage earners is low. We observe that educational gap between different employment status remains significant throughout the period. Average years of schooling of non-market labor is now around 6 which does not even reach to 8-year primary school attainment.

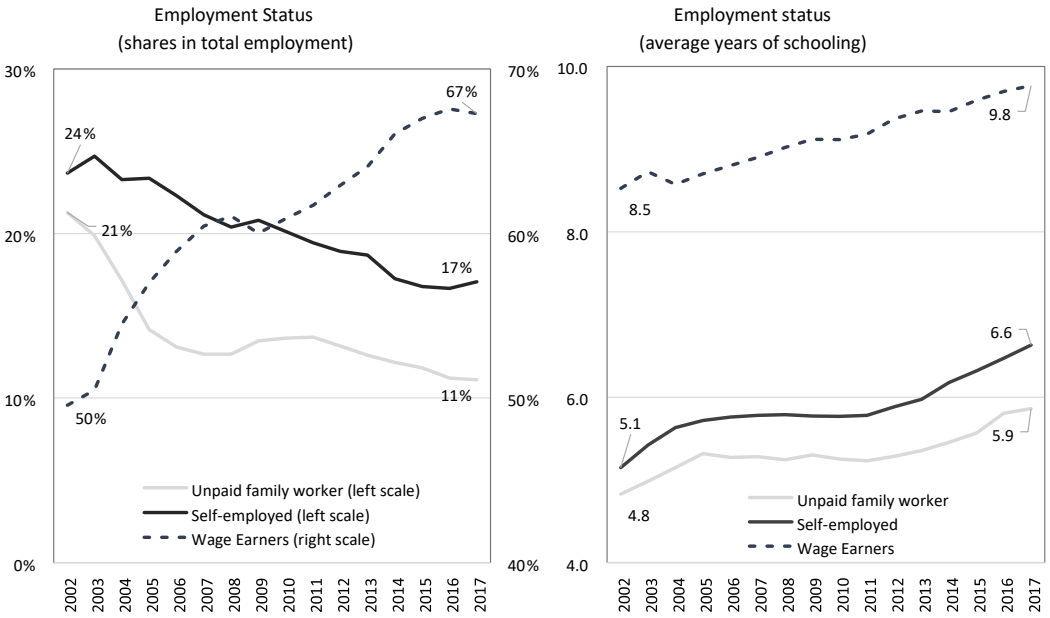
[11] As of 2015, the share of self-employment in total employment is 32.86%. Self-employment is defined by OECD as the employment of employers, workers who work for themselves, members of producer co-operatives, and unpaid family workers. OECD (2018), Self-employment rate (indicator): http://dx.doi:10.1787/fb58715e-en (Accessed on 08 December 2018).

Figure 18: Average use of information-processing skills at work and in everyday life



Retrieved from OECD (2016a: Annex A, Ch. 4, Table A4.2). http://dx.doi.org/10.1787/888933366479.

Figure 19: Evolution of main types of employment status in Turkey



Data: Turkish Household Labor Force Surveys (2002-17), authors own calculations.

It seems that adults use numeracy skills relatively more at work, probably for practical reasons. Another factor which could explain lower skill demand in Turkey is the higher share of small firms in employment. To make a comparison, the share of small firms (1-19 employees) is around 40.8%.[12]) It would be reasonable to assume that as the size of firm grows, the division of labor and complexity of task needs more communication in order to sustain coordination and cooperation.[13] We should also underline that among OECD countries, the lowest use of writing and reading skills are mostly concentrated in sectors like construction, food and beverage service activities, food products and wearing apparel.[14] These are the sectors that mostly attract less qualified workers in Turkey due to structural factors. Moreover, in terms of international trade, Turkey has a comparative advantage in sectors like manufacture of wearing apparel. We could say that the low skill use at work partly reflects sectoral composition in Turkey.

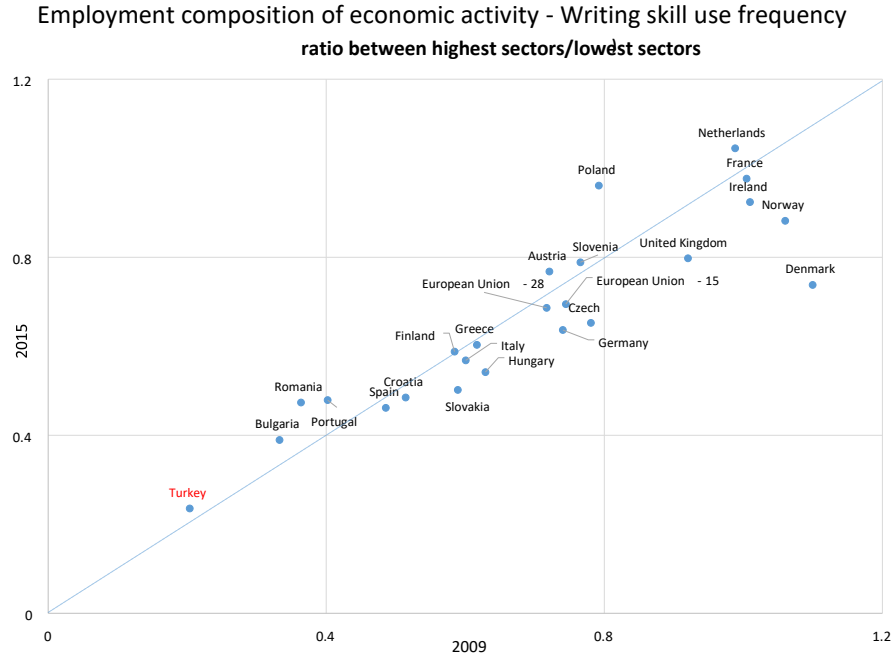
[12] OECD (2017: 44) http://dx.doi.org/10.1787/888933565013
[13] OECD (2016a) also documents that skill use increases as the size of the firm grows for average OECD countries. See OECD (2016a: 111, Figure 4.11)
[14] OECD (2016a: 109, Table 4.2)

Figure 20: Employment composition of economic activity - Reading skill use frequency

(ratio between highest sectors/lowest sectors)

Data source: Eurostat (based on EU Labour Force Survey data) Employment of population 15 years or over. Further information: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egan22d&lang=en

Figure 21: Employment composition of economic activity - Writing skill use frequency



Data source: Eurostat (based on EU Labour Force Survey data) Employment of population 15 years or over. Further information: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egan22d&lang=en

Using the ranking of OECD (2016a)[15] which documents how skill use varies across sectors, we calculated share of highest skill use with respect to lowest use. Figure 20 and 21 show how Turkey fits into with respect to European countries. Turkey has the lowest employment ratio among European countries, when sectors are grouped according to highest and lowest skill use in reading and writing. Although the share of highest use sectors in employment has increased compared to 2009, the relative position of Turkey remained intact since employment of highest use sectors have increased for other countries as well.

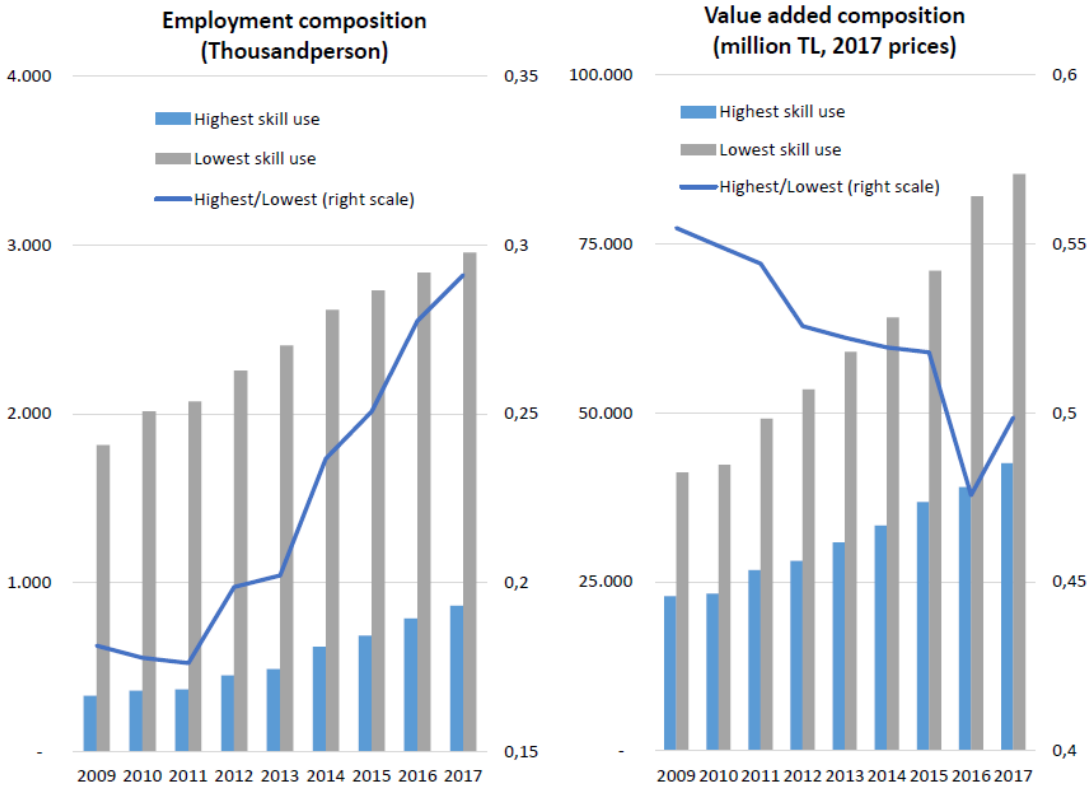
Comparing value-added in factor prices of these sectors might be useful to understand how production evolved throughout 2009-17. When we calculate the value-added ratio of these sectors, we can see that while relative employment share has increased across years, value added share witnesses a decline (Figure 22). It is hard to speculate whether there is productivity difference, but inverse correlation suggests at least a weak output growth for highest use sectors. When we compare employment share of age groups (figure 23), employment of highest use sectors has increased in 25-34 year-olds but less so for the 35-44 year-olds which probably reflects the generational educational gap mentioned above.

4. Labor Market Outcomes and Skills

The observation that the level of literacy and numeracy skill proficiencies are relatively low and their use at work are very limited raises the question whether these skills are sufficiently rewarded at the labor market. Low returns to skills can be a reason why individuals do not invest in skill development during formal education or training at workplace in Turkey. It is possible that skill proficiencies serve as a signal in the labor market and might hence increase the employability of adults. Table 4 gives the marginal effect of education and skill proficiency on the likelihood of being employed for each OECD country. It is interesting to see that although educational attainment increases the likelihood of being employed in most countries, formal education level does not have a positive and significant effect for Turkey. Numeracy skill, on the other hand, has a positive and significant impact, and apparently gives more information/signal on the quality of workers.

[15] See OECD (2016a: 109)

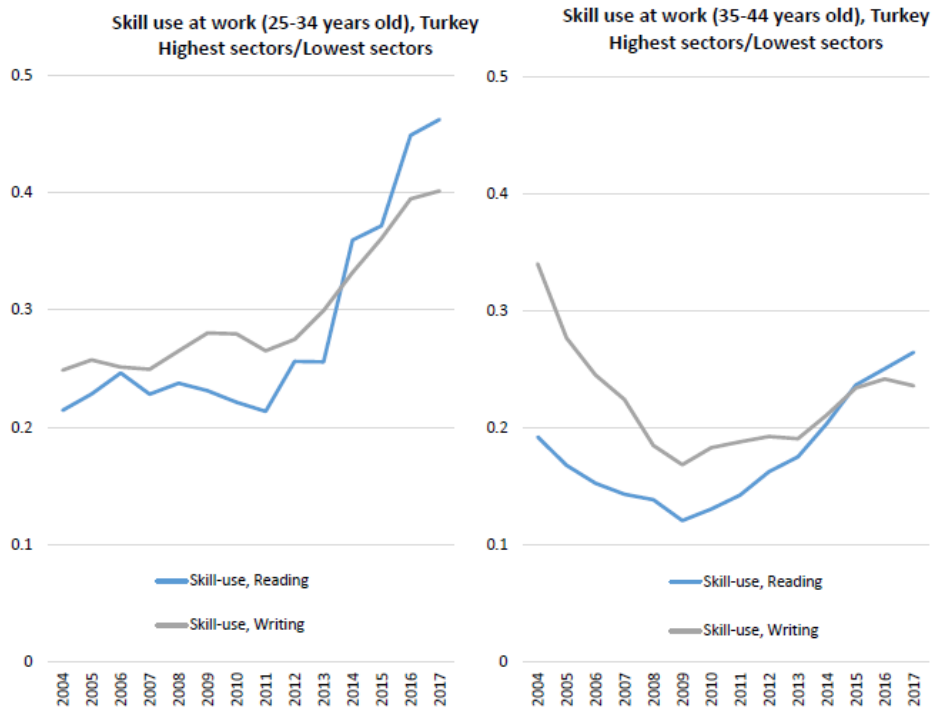
Figure 22: Employment and value-added in high and low use of information-processing skills at work



Data: Turkish Household Labor Force Surveys (2002-17) and authors own calculations are based on OECD (2016a).

Note: For skill use in reading, OECD (2016a) report sectors (ISIC 2-digit code) with highest use as 62, 69, 71, 72 and 70 and for lowest skill use as 10, 15, 38, 56 and 81. For skill use in writing, OECD (2016a) report sectors with highest use as 61, 64, 65, 69 and 70 and for lowest skill use as14, 15, 56, 81 and 96.

Figure 23: Employment in high and low use of information-processing skills at work (age categories)



Data: Turkish Household Labor Force Surveys (2002-17), authors own calculations are based on OECD (2016a).
Note: For skill use in reading, OECD (2016a) report sectors (ISIC 2-digit code) with highest use as 62, 69, 71, 72 and 70 and for lowest skill use as 10, 15, 38, 56 and 81. For skill use in writing, OECD (2016a) report sectors with highest use as 61, 64, 65, 69 and 70 and for lowest skill use as14, 15, 56, 81 and 96.

Table 4: Effect of education and skill proficiency on the likelihood of being employed

	Dependent variable: Employed							
	Years of education		Proficiency (literacy)		Years of education		Proficiency (numeracy)	
	Marg. Prob	p-value	Marg. Prob.	p-value	Marg. Prob.	p-value	Marg. Prob.	p-value
Turkey	-0.135	0.855	1.601	0.119	-0.339	0.657	1.735	0.055
OECD Average	3.131	0.000	0.836	0.062	2.699	0.000	1.681	0.002

Retrieved from OECD (2016a: Chapter 5, Table A5.2 (N) and Table A5.2 (L)).
http://dx.doi.org/10.1787/888933366489
Marginal effects (as percentage-point change) of education and numeracy on the likelihood of being employed among adults not in formal education.

Another outcome of labor market where skills may have a significant impact is the hourly wages. OECD (2016a) report (chapter 5) provides wage regressions at the country level, estimating the contribution of skills after controlling for major determinants such as education, experience and tenure. Wage regressions indicate that education seems to

serve as a better predictor of ability than skills do, since returns to education (years of schooling) are well above OECD averages, while skill returns are not statistically significant in the regressions.[16]One other way to understand the impact of skill on wages is to look at the variation of wages. OECD (2016a) study also provides regression-based decompositions (Table 5), which can explain the effect of endowments (education, experience, skill proficiencies) and other factors for each country. Results show that, compared to other countries, literacy and numeracy skills in Turkey have a relatively small and statistically insignificant impact. Major human capital proxies like education, experience and field of study could account for more than 25% of total variation in adults' hourly wage in Turkey. As far as PIAAC sample of Turkey, we can can argue that only numeracy skills can be signal for employability but do not overall effect of skills on labor market outcomes is not significant.

Table 5: Contribution of education, literacy and numeracy to the variation in hourly wages

	Proficiency (literacy and numeracy)	Education	Field of study	Experience	Individual characteristics
	% explained	% explained	% explained	% explained	% explained
Turkey	1.1	11.5	4.2	11.6	0.3
OECD Average	**4.8**	**12.5**	**1.4**	**8.8**	**4.2**

Contribution of each factor to the percentage of the explained variance (R-squared) in hourly wages.
Retrieved from OECD (2016a: Chapter 5, Table A5.5). http://dx.doi.org/10.1787/888933366489

Lastly, we will briefly discuss workers' mismatch of skills and qualifications based on the methodology used in OECD (2016a) report. Qualification mismatch is defined in terms of subjective assessment of each worker for his/her job requirements (educational attainment level). [17] Workers are classified as overqualified if their self-reported educational attainment level is higher than their own evaluation specific for their job. Skill mismatch refers to a classification based on the ranges of skill levels measured in that job. A worker is qualified as under-skilled (over-skilled) if his/her skill proficiency is below (above) the minimum (maximum) value measured. [18] The last mismatch is related to fields of study, and arises when workers are employed in a different field from the education they received. It seems that mismatch ratios are very close to OECD

[16] OECD (2016a: Chapter 5, Table A5.4).
[17] Related question is "If applying today, what would be the usual qualifications, if any, that someone would need to get this type of job?"
[18] The survey asked workers whether they feel they "have the skills to cope with more demanding duties than those they are required to perform in their current job" and whether they feel they "need further training in order to cope well with their present duties". According to the survey's measure of skills mismatch, workers are classified as well-matched in a domain if their proficiency score in that domain is between the minimum and maximum score observed among workers who answered "no" to both questions in the same occupation and country. Quintini (2014: 41-42).

averages and there is no apparent dissimilarity specific to job-matching in Turkey (Table 6). Given the low level of skill proficiency, the moderate level of under-qualification raises the question of low labor demand requirements. OECD (2016a) study documents lower or sometimes insignificant variation with respect to age-groups and firm-size.

Table 6: Qualification, literacy and field-of-study mismatch (% of mismatched workers, by type of mismatch)

	Qualification mismatch			Skills mismatch						Field-of-study mismatch	
				Litearcy			Numeracy				
	Well-matched	Over-qualified	Under-qualified	Well-matched	Over-qualified	Under-qualified	Well-matched	Over-qualified	Under-qualified	Well-matched	Mismatched
Turkey	75.5	11.6	12.9	84.7	12.8	2.5	87.5	6.1	6.4	56.2	43.8
OECD average	65.6	21.7	12.7	85.4	10.8	3.8	85.6	10.5	3.9	60.4	39.6

Source: OECD (2016a: Chapter 5, Table A5.7).

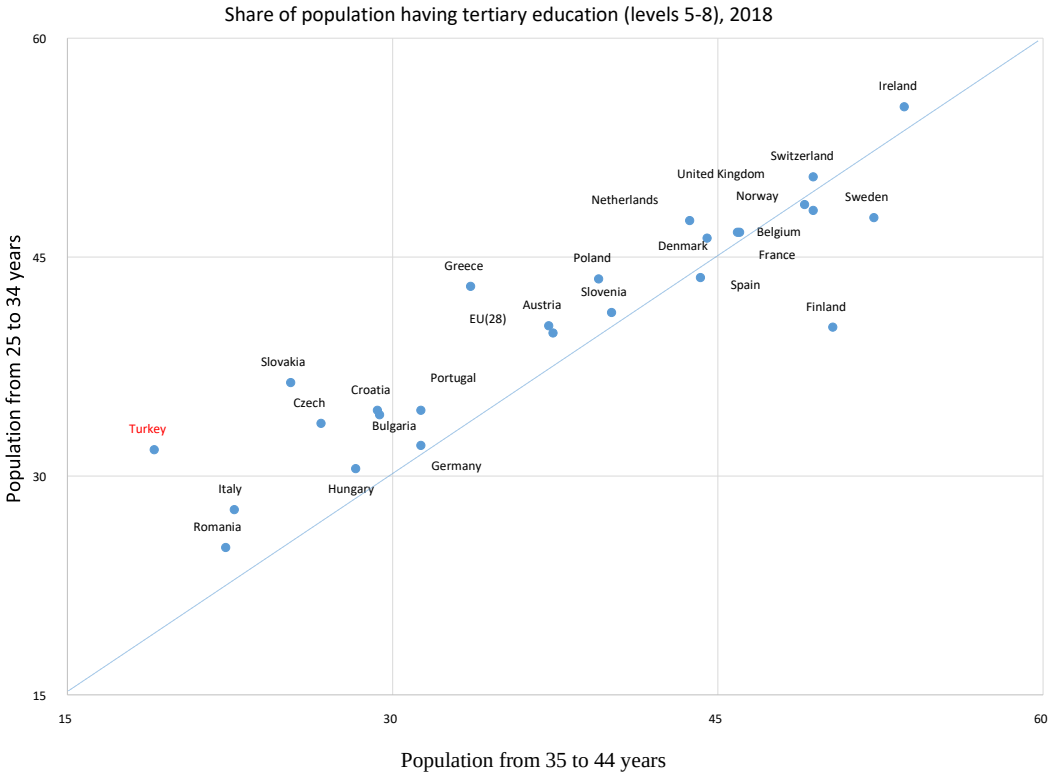
5. Discussion

The picture emerging from Adults' skill survey show that Turkey cannot provide enough quality education and training for adults. It is clear that Turkey is lagging far behind most OECD countries in almost all aspect of skill proficiency. Besides skill supply, there is also the issue of demand for such skills. If labor market does not sufficiently reward skill use, it would not induce workers to invest in skill promotion. From this perspective, it is not a coincidence that we observe low levels of skill proficiencies and skill use at work in all three domains (reading, writing and numeracy) in Turkey. The fact that there is so little improvement in years of schooling put into question the funding of education. Compared to OECD countries and Euro (22), it is apparent that Turkey is spending not less in terms of its GDP. However, the composition of spending suggest that tertiary education has a priority. Obviously, this is the result of ongoing expansion in higher education that started in 2006. We can detect the expansion effect between age groups (Figure 24). Compared to age group 34-44 year-olds, younger generation is significantly more educated. The share of tertiary graduates exceeds 30%, nearly catches that of Germany.

When we discuss PIAAC results in terms of education level, we underline the fact that average proficiency level of a tertiary graduate in Turkey is equivalent to secondary education level of average OECD countries. The picture hardly changes even when we compare younger age groups which supposedly have higher education than older ones. Figure 25 show that much of the tertiary expansion has increased the share of shorter cycle (2-years vocational) higher education. It is likely that the quality of these short-cycle vocational institutions is very limited in improving skill proficiency.

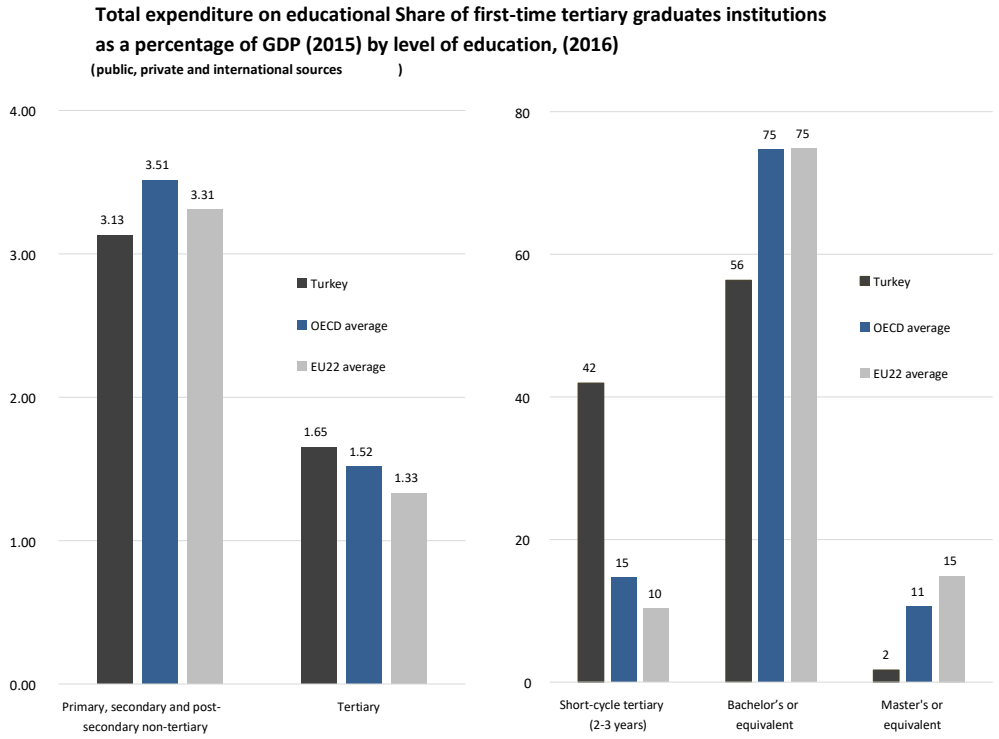
Unfortunately, because the household labor force surveys do not provide any distinction within tertiary education level, we do not have any information on wage premiums.

Figure 24: Share of tertiary graduates by age groups



Data source: Eurostat (based on EU Labour Force Survey data)
Note: Level-5-8 cover respectively, short-cycle tertiary education, bachelor's or equivalent level, master's or equivalent level and doctoral or equivalent level. Further information: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=edat_ lfse_03&lang=eng

Figure 25: Total expenditure on educational institutions and composition of tertiary graduates

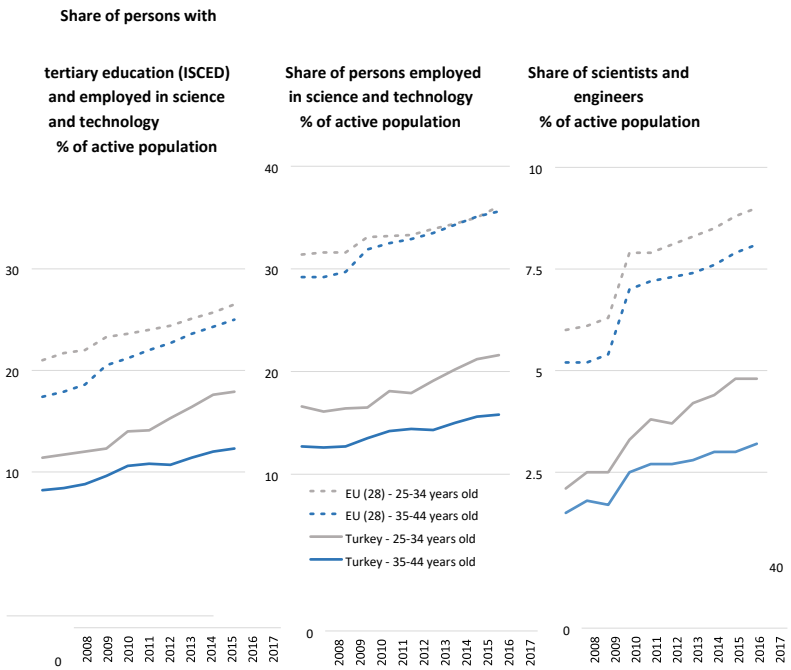


Data source: OECD (2018). Further information.
https://www.oecd-ilibrary.org/education/education-at-a-glance-2018_ eag-2018-en

The supply side is relatively easy to detect, however skill demand and labor market rewards are hard to measure. We will present two complementary observations from different classifications of skill demand. Figure 26 compares Turkey with European Union (28 countries) according to three indicators of human resources in science and technology.[19] In order to differentiate the generational trends, three indicators are regrouped for relatively younger age-groups. The gap in human resources is quite huge for Turkey. Average employment share of EU(28) are almost doubling that of Turkey. However, the expansion in higher education which started in 2006 seems to change the trend in a positive way. It is good news that younger generation (25–34 year-olds) performs better than older generation (34–45 year-olds). While It seems that there is a convergence for age-groups in EU in recent years, there is a divergence for Turkey.

[19] This indicator is based on occupational classification. See the notes in below the figure

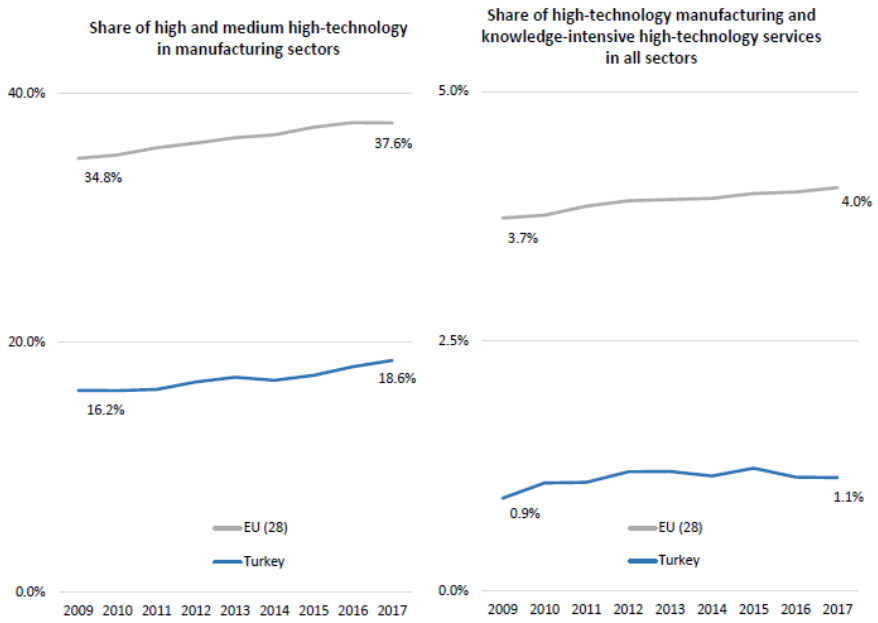
Figure 26: Human Resources in Science & Technology



Data source: Eurostat (based on EU Labour Force Survey data)
Note: Human resources in science and technology by occupation include ISCO-08 major groups 2 and 3; Scientists and engineers include people who work in ISCO-08 groups 21 Science and engineering professionals, 22 Health professionals, 25 Information and communications technology professionals
further information:
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=hrst_st_ncat&lang= en

The last indicator of skill demand is the employment shares of technology and knowledge intensive sectors. Figure 27 displays the comparison of Turkey with respect to EU(28). It is evident that the structural gap between EU(28) and Turkey did not change across years. High and medium technology sectors have a relatively less weight in the manufacturing sector and knowledge intensive sectors have much less share in the total sectoral composition. There is almost no convergence in sectoral employment shares when we take into account the knowledge content in total output. Note that knowledge intensive distinction is important for service sectors particularly in term of service exports in EU(28) countries. Figure 27 certainly reflects relatively poor performance of service exports in Turkey, compared to other developed countries.

Figure 27: Employment in technology and knowledge-intensive sectors



Data source: Eurostat

Note: High and medium technology sectors include in NACE Rev.2 (2-digit) 21, 26, 20, 27, 28, 29, 30, 19, 22, 23, 24, 25, 33. Knowledge-intensive services sectors include in NACE Rev.2 (2-digit) 59, 60,61,62,63,72. Further information: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=htec_emp_nisced2&lang= en

6. Conclusion

Our assessment of PIAAC results for Turkey remains within the limits of OECD (2016a) report. Despite this limitation, there are several key points worth emphasizing, particularly for public policy. We observe that adults in Turkey lack the skill proficiency required for sophisticated information processing tasks (level 3) and can only perform basic tasks on average with low skill level for literacy and numeracy (level 2). The use of skills at work or in everyday life has a frequency of less than once a month. Moreover, we repeatedly observe that the educational system has a limited capacity to upgrade skill proficiency, with labor market dynamics not encouraging their use. Although access to education has considerably increased (8 years of compulsory schooling in 1998, higher education expansion since 2006), the younger population's performance does not get close to their peers' in other OECD countries. The performance gap remains substantial. Turkey's education system has to shift focus from quantity to quality and prioritize skill upgrading at work as well as at formal education. Low returns to skill is another institutional issue which probably reflects the structure of the economy and labor demand dynamics. Lack of incentives in the labor market restricts skill development of workers and leads to low investment in skill upgrading. We think that increases in product sophistication require enhanced proficiency in reading and writing so as to

coordinate division of labor and sustain cooperation within the firm. It seems that this challenge needs further institutional elaboration for Turkey at all levels of skill development.

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Appendix

Table A1: Measuring the use of information-processing skills (Survey of Adult Skills)

Value	Frequency
1	”Never carried out”
2	”Less than once in a month”
3	”Less than once a week but at least once a month”
4	”At least once a week”
5	”Every day”

Source: OECD (2016a: 97, Ch. 4, Box 4.1).

Table A2: Group of tasks measured for each skill

Skills put to use at work/everyday life	Group of tasks measured in the survey
Reading	Reading documents (directions, instructions letters, memos, e-mails, articles, books, manuals, bills, invoices, diagrams, maps
Writing	Writing documents (letters, memos, e-mails, articles, reports, forms)
Numeracy	Calculating prices, costs or budgets; using fractions, decimals or percentages; using calculators; preparing graphs or tables; using algebra or formulas; using advanced mathematics or statistics (calculus, trigonometry, regressions)
ICT Skills	Using e-mail, Internet, spreadsheets, word processors, programming languages; conducting transactions on line, participating in online discussions (conferences, chats)

Source: OECD (2016a: 97, Ch. 4, Box 4.1).