Chapter 5
Productivity and Cognitive Skills of Israeli Workers: An International Comparison

- Basic cognitive skills in Israel are generally low, which plays a significant role in explaining the low productivity (per worker GDP) in the country compared to productivity in other advanced economies. This low productivity, in turn, is the main explanation for the relatively low level of wages in Israel compared to those other countries.
- Similar to the international surveys that examined cognitive skills among 15-year-olds in the education system, the PIAAC survey conducted by the OECD in 2014 and 2015 among workers showed that the level of cognitive skills in Israel is lower than the average in the organization's member countries, even though the number of years of formal schooling in Israel is higher than the OECD average.
- If cognitive skills in Israel improve to the OECD average level, it is expected to increase productivity in the country by 2.7–2.9 percent. In 2018 GDP terms, the increase would be about NIS 36–39 billion or about NIS 4,250 per person per year on average. It is reasonable to assume that this is an underestimation, since the estimation does not take into account the inter-relationship between human capital and physical capital, which are complementary means of production.
- If Israel focuses in narrowing the gap between the lowest quintile of cognitive skills and the quintile above it, it is expected to close a significant portion of the productivity gap between Israel and the rest of the OECD. The ultra-Orthodox and the Arabs occupy a portion of the lowest quintile that is larger than their share of the working population.
- In addition to the low level of cognitive skills, there is another explanation for the productivity gap. In Israel, there are many young workers, including soldiers doing compulsory service—a group with particularly low wages. This explains about 40 percent of the gap in reported hourly wages per worker.

1. INTRODUCTION: THE PRODUCTIVITY GAP BETWEEN ISRAEL AND THE OTHER OECD COUNTRIES

Overall GDP in the economy depends on the means of production: labor and capital. Formally written, the equation is:

[E1] $Y = F(A,L,K)$

where L and K are the means of production—labor and physical capital, respectively—and A is total productivity ("the Solow residual"), in other words, the economic factors that change over time and affect both labor output and capital output. Therefore, GDP increases—meaning the economy grows—when one of the means of production increases and/or when overall productivity increases.

In order to continue increasing the standard of living over time, Israel must increase worker output per hour, meaning labor productivity.

The number of work hours (L) is currently high, due to the full employment environment. The unemployment rate is the lowest it has been since the 1970s, and the participation rate—a variable that shows the volume of the labor force—is high and has not increased in recent years. This means that in the near future, the economy will not be able to continue relying on an increasing labor supply—volume of workers or number of hours—in order to maintain rapid growth.[1] Rather, Israel must therefore increase worker output per hour, meaning labor productivity.

Labor productivity in Israel is about 31 percent lower than the average in the advanced economies, and the gaps are not narrowing over time.

It is common to measure labor productivity by the ratio between GDP and total work hours of employees: Y/L. In recent years, labor productivity has grown slowly in many advanced economies[2], but Israel must still cover a lot of ground even to reach those levels: Labor productivity in Israel is about 31 percent lower than the average in the advanced economies (Figure 5.1), and the gaps are not narrowing over time. Even though there are several agency variables between labor productivity and the standard of living (per capita GDP), the correlation between them in the OECD is 90 percent, which shows that an improvement in the standard of living depends on the economy's ability to increase the output of its workers.[3]

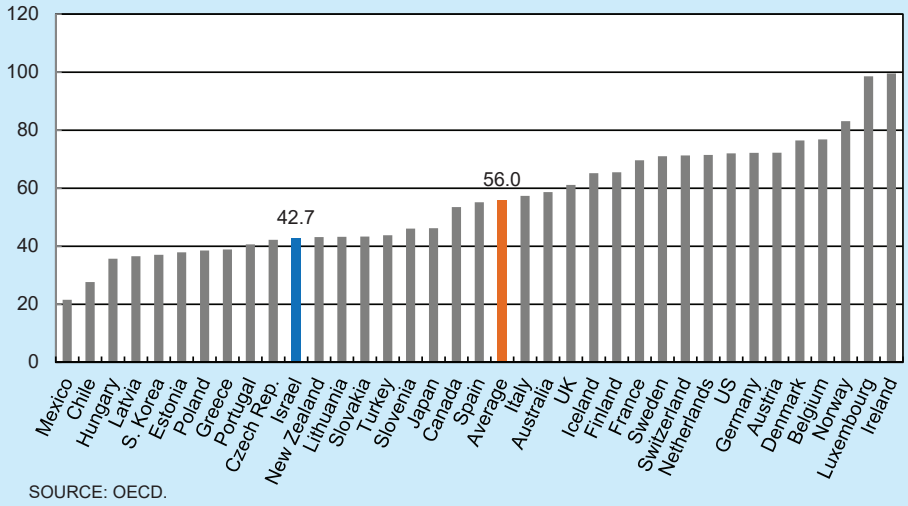
The factors affecting productivity can be divided into two interrelated types. The first includes macro characteristics—the structure of the economy, the quality of its infrastructure, its efficiency in resource allocation, the quality of its regulation, and so forth. These factors explain most of the gap between countries, and improving them has a large potential to influence the gap (see Box 5.1). The second type includes micro characteristics—the characteristics of workers and their skills that are relevant to the modern labor market—which is the focus of this chapter. As explained below, this chapter provides a proximate examination of labor productivity—the wage per hour of labor.

1 For more discussion, see Chapter 1 and 2.

2 For more discussion, see OECD (2015), "The Future of Productivity", and other reports published by the OECD.

3 P. Krugman (1994). *The Age of Diminished Expectations, US Economic Policy in the 1990s*.

Figure 5.1
GDP per Hour of Work (Labor Productivity), Israel and the Other OECD Countries, 2017
(US dollars in PPP terms)



SOURCE: OECD.

Box 5.1
Macroeconomic causes of the productivity gap between Israel and other advanced economies[1]

This box presents a summary of the macro characteristics that explain why productivity in Israel is lower than in other advanced economies. These characteristics are not directly related to the characteristics of individuals—which are broadly analyzed in the body of this chapter—but rather have a mutual effect since they are complementary means of production.

The stock of business capital relates to the stock of machinery and equipment, vehicles, structures, infrastructure, and intangible assets in the economy, which is accumulated through investment. Throughout the previous decade, investment in Israel (as a share of GDP) was below the OECD average.[2] Common estimates show that in 2014, the stock of physical capital per worker was less than 60 percent of the average stock in the OECD countries. In this regard, Israel is in the lowest quintile in the organization.

On an industry basis, **the rates of investment** in manufacturing are similar to the rates in other advanced economies, and are even higher in some industries. However, in the nontradable industries

[1] See more discussion in M. Hazan and S. Tsur (2017), *Economic Growth, Productivity, and the Quality of Human Capital in Israel*.

[2] Since the population in Israel is growing more rapidly than in the other countries, Israel must invest a higher share of GDP just to maintain the existing gap in capital per worker.

(construction, trade and hospitality services, business services, and personal and social services) the investment rates are much lower than in the other advanced economies.[3]

The stock of public and civilian capital includes transport infrastructure, among other things, and this is lower in Israel than in other advanced economies, thereby contributing less to labor productivity than it does in those economies. OECD estimates show that in 2015, total public and civilian capital in Israel was 27 percent of GDP, while the OECD average is 60 percent, and the rate of public investment in Israel is too low to narrow that gap.

Competition and openness: The extent of competition in the market has tremendous potential to influence productivity. Regev and Brand (2015)[4] found evidence of this in Israel. They focused on manufacturing, and examined the link between the rate of exposure to competing imports and the increase in productivity since 1995 relative to the OECD average. They found that when industries have little exposure to competing imports, productivity per worker grows at a lower rate than the OECD average, while industries where competition increased showed productivity at a higher rate that was similar to the rates in other OECD countries. The nontradable industries therefore contributed over the years to an increase in the productivity gaps between Israel and the OECD. An analysis of the link between openness to trade and productivity, by examining industries in Israel, shows significant gaps between industries in the stock of physical capital, the quality of human capital, and the level of technology. In other words, there is a two-way relationship between these variables and openness.[5]

The market share of industries with low productivity: GDP per worker in Israel is lower than in the OECD, particularly in nontradable industries[6] that serve the domestic market. In the hospitality and food services industry and in the construction and trade (wholesale and retail) industry), GDP per worker in Israel is 20–35 percent lower than the OECD average.[7] These industries account for a large share of employment in Israel—about one-third of the business sector—, and therefore make the largest contribution to the productivity gap. These industries typical have works with low skill levels, as well as low investment in physical capital.[8]

The business environment: The main international indices of the business environment show that Israel lags behind the OECD. The Doing Business index published by the World Bank places Israel in 29th place out of the 34 OECD countries that were ranked in 2018. Israel ranks particularly low in the area of business registration and tax payments, and in indices that deal with contract

3 See, for instance, Box 2.1 of the Bank of Israel *Annual Report* for 2012.

4 E. Regev and G. Brand (2015). "Causes of the Widening Productivity Gaps between Israel and the OECD: A Multiyear Industry-Level Comparison", *State of the Nation Report*, Taub Center for Social Policy Studies in Israel.

5 For more discussion on the economy's openness, see Chapter 7 of this Report.

6 An industry is considered tradable or nontradable in accordance with the rate of international trade in its products in many countries, and not just in Israel. Therefore, if a particular industry is considered tradable, it doesn't mean that the industry in Israel will succeed in exporting its products.

7 See Box 2.1 in the Bank of Israel *Annual Report* for 2013.

8 See Bank of Israel (2016), "Basic Skills of Workers in Israel and Industrial Productivity", *Fiscal Survey and Selected Research Analyses*, 141.

enforcement and inter-state trade. Studies abroad have found a link between some of the components of this index and labor productivity.[9]

The geopolitical situation may also have an effect on productivity in Israel relative to the OECD. The geopolitical situation influences the risk that capital markets attribute to Israel and to investments in the country, the readiness of businesses to invest in the country, and the volume of its international rate (see Chapter 7). Additional risk increases the interest payments on loans the country takes out. Israel's defense expenses are also much higher than the OECD average—almost 5 percent of GDP compared with 1.6 percent in 2017. Even though defense expenditure partially redounds to the economy, and in particular advances the technological front, these factors essentially reduce the sources available for public civilian investment and/or reducing the tax burden.

[9] See: S. Tsur and E. Argov (2019), "Conditional Convergence and Future TFP Growth in Israel", Bank of Israel Research Department, Discussion Papers Series.

2. MICRO CHARACTERISTICS: HUMAN CAPITAL—QUANTITY OF SCHOOLING VS. QUALITY OF EDUCATION

"Human capital" relates to the personal skills and knowledge that give individuals the ability to do work of economic value, among other things. There is no direct way of measuring human capital in the economy, so it is customary to estimate it indirectly by quantifying formal education through the number of years of schooling, and by assessing its quality through surveys that examine the cognitive skills of individuals in various fields.

The quantity of formal education in Israel is ranked high in the OECD both when examining the prime working-age population and when examining young people only. United Nations data show that Israelis have an average of 13 years of schooling, while the OECD average is 12 years.[4] Moreover, those with higher education constituted 50.9 percent of the prime working-age population in 2017. From that standpoint, Israel is ranked third in the OECD, far above the average of just 36.5 percent.

However, while the quantity of schooling in Israel is high, the quality of education is relatively low, with students in the education system achieving low scores on international tests.[5] Student achievements are reflected later on in their skills in the work place. The PIAAC International Survey of Adult Skills shows that Israeli workers are significantly less fluent than the OECD average in the skills essential for the labor market.

Israeli workers have many years of formal schooling, but the PIAAC international skills survey shows that they are significantly less fluent than the OECD average in the skills essential for the labor market.

[4] This is a macro figure, and relates to all ages. The micro figure based on self-reporting is shown below, and relates to the prime working ages.

[5] The PISA test in mathematics and sciences for 15-year-old students showed in 2015 that Israel is almost at the bottom of the OECD scale, similar to the situation in 2012. Chapter 6 of this Report provides a broader discussion of the achievements in the educational system and the main reforms implemented in the system in recent years.

Box 5.2
The PIAAC survey

The Programme for the International Assessment of Adult Competencies (PIAAC) Survey of Adult Skills was conducted in most OECD member countries. It focuses on adults, and looks at cognitive skills that are relevant to the labor market (basic skills), comparing the results in the surveyed countries. Survey participants receive a theory test in three areas of knowledge: (1) Literacy—the ability to understand, evaluate, use, and contend with written text; (2) Numeracy—the ability to use, apply, interpret, and communicate mathematical information and ideas; and (3) Problem-solving in a technology-rich environment—the ability to use technology to solve problems and accomplish complex tasks.

Prior to the test, all survey participants answer background questions regarding their place of work (salary and work hours), formal education, age, gender, and more. They also respond to questions intended to help the surveyors understand how they use the examined skills at work and at home. This provides policy makers, advisors, and academic researchers with essential information, which includes international comparisons and various demographic breakdowns.

The survey covers people aged 16–65, and in each country is provides a reliable representation of the overall population. In Israel, more than 9000 participants were surveyed. The questions are asked in the native language: in Israel—Hebrew and Arabic, with the option of answering in Russian as well. It is worth emphasizing that the same questions are asked and the same tests are conducted in all countries.

Productivity in Israel is low due to the gap in physical capital and the gap in human capital as a result of inferior quality education.

In the past, the gap in GDP per worker was analyzed using the quantity of schooling (the number of years of schooling), and it was found to result from a gap in physical capital and in total productivity (the efficiency of the use of means of production), but not from the gap in human capital. However, research is now identifying the importance of estimating the quality of education in addition to its quantity.[6] Hazan and Tsur (2017)[7] added an index of educational quality to the analysis, which was built based on the PIAAC survey. They concluded that Israel's disadvantage is due to the gap in physical capital and the gap in human capital as a result of inferior quality education. They also examined industries and countries, and found a statistically significant link between the level of physical capital and the level of human capital. This link hints that the implementation of a policy to improve the quality of human capital could help narrow the gap in GDP per worker not only directly, but also indirectly by encouraging investment in physical capital. This is because physical capital and human capital are complementary means of production—increasing the

[6] See, for instance, E. Hanushek, J. Ruhose, and L. Woessmann (2015), "Human Capital Quality and Aggregate Income Differences: Development Accounting for the U.S. States:, NBER WP 21295; and E. Hanushek, G. Schwerdt, S. Wiederhold, and L. Woessmann (2016), "Coping with Change: International Differences in the Returns to Skills", NBER WP 22657.

[7] M. Hazan and S. Tsur (forthcoming). "Economic Growth and Labor Productivity in Israel, 1995–2014", *Lights and Shadows in the Market Economy—the Israeli Economy, 1995–2015*, Falk Institute.

quality of human capital is expected to increase the marginal output of physical capital, and therefore also its quantity.

An analysis conducted by the Bank of Israel found that the cognitive skills of workers in Israel is low mainly in the nontradable industries and in the domestically oriented tradable industries—industries where productivity is significantly lower than in the OECD.[8] The survey found that in these industries, the nature of labor is consistent with a production function that is geared toward unskilled labor, where only a small share of workers are required to deal with complex problems, and workers are required to deal with written instructions only infrequently.

3. BASIC SKILLS AND THE PRODUCTIVITY AND WAGE GAPS

This section estimates the extent to which basic skills and other characteristics of Israeli workers contribute to explaining the productivity gaps between Israel and the other advanced economies.

a. Productivity, hourly wage, and basic skills according to the PIAAC survey

The correlation between labor productivity and hourly wages is 95 percent.

In order to conduct the estimation, we use an approximation of the productivity gap—the gap in the wage per work hour.[9] The transition from hourly productivity to hourly wage is not immediate, but it can be justified both theoretically and empirically. The theory holds that under conditions of perfect competition at equilibrium, a worker's wage is equal to his marginal output, which reflects his contribution to GDP, meaning his productivity. In terms of empirical justification, there is a high correlation between hourly productivity and hourly wage.[10] Figure 5.2 is based on 33 OECD countries[11], and shows that the correlation is 95 percent at the macro level (the State level).[12] Moreover, Israeli is on the regression line in Figure 5.2, meaning that the gap between the hourly wage in Israel and in the OECD as a while (30 percent) is consistent with expectations according to the link between wages and productivity found in all countries.

[8] Bank of Israel (2016). "Basic Skills of Workers in Israel and Industrial Productivity", *Fiscal Survey and Selected Research Analyses*, 141.

[9] Including bonuses, in US dollars, in PPP terms.

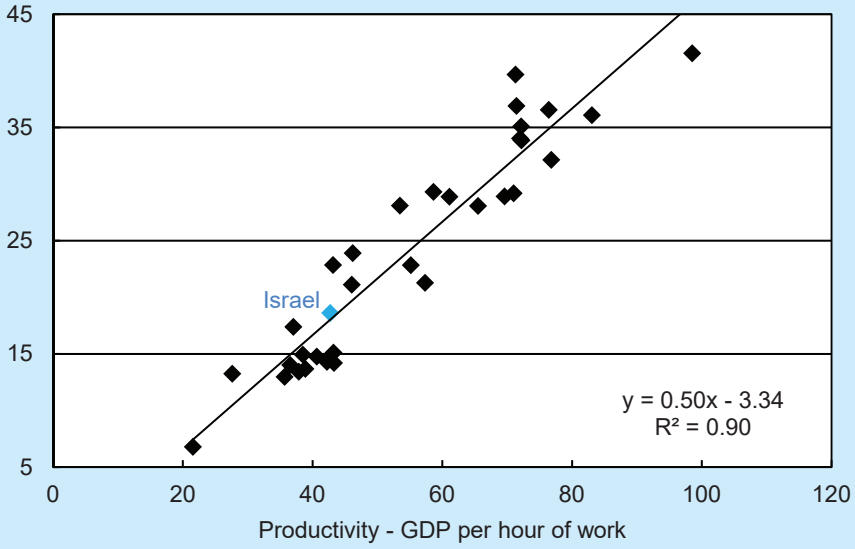
[10] The link between wage and labor productivity is shown, for instance, in the following studies: M. Feldstein (2008). "Did Wages Reflect Growth in Productivity?", *Journal of Policy Modeling*, 30(4): 591–594; P. Seneels (2005). *Do Wages Reflect Productivity?* Global Poverty Research Group; and more.

[11] All except for Turkey (missing data), Iceland (missing data), and Ireland (unique characteristics of the economy: GDP includes the profits of many multinational companies, meaning profits originating with nonresidents, but GNP does not include them, leading to an outlier ratio between GDP per worker and wages).

[12] The hourly wage is equal to the result obtained by dividing the average annual wage by the number of annual work hours per worker. Data are taken from the OECD.

The econometric analysis in this section is based on data on the individuals surveyed in the PIAAC survey, and due to data considerations, it only includes some OECD countries other than Israel.[13] According to the macro data, the wage gap between Israel and the average of the other countries is 30 percent, and the productivity gap is 37 percent. According to the micro data (the PIAAC survey), the wage gap is 19.4 percent.

Figure 5.2
Wage per Hour of Work and Hourly Productivity, Israel and the Other OECD Countries, 2017 (US dollars in PPP terms)



SOURCE: OECD.

A significant portion of the wage and productivity gaps between Israel and the OECD comes from the young age group—those aged 16–24—because military service directly and indirectly affects the measurement in Israel.

A significant portion of the wage and productivity gaps between Israel and the OECD is due to the young age group—16–24—because military service affects the measurement in Israel. First, the Central Bureau of Statistics and the PIAAC view soldiers in compulsory service as workers whose wage is equal to their military salary. Second, due to their military service, young people in Israel begin their post-secondary studies at a higher average age than in other countries, which also delays their full entry into the labor market. (Most of those between the ages of 21 and 24 work in

[13] Belgium, Czech Republic, Denmark, Spain, Estonia, Finland, France, UK, Greece, Ireland, Italy, Japan, South Korea, Netherlands, Norway, Poland, and Slovakia.

parallel to their studies, at jobs that are not consistent with their abilities.)[14] Since the wage and productivity gaps measured in the entire economy include workers aged 16 and over, and since many of these workers in other countries—particularly those aged over 21—are already working full time, there is a bias in this age group in analyzing the effect of skills on the wage gaps. Such an analysis therefore contributes little to understanding the gaps in the rest of the population. However, when focusing on the prime working ages—those between 25 and 64—the wage gaps according to the micro data narrow from 19.4 percent to just 13.3 percent. This effect is due to the fact that those aged 16–24 account for 18.5 percent of all employed persons in Israel[15] and just 10.4 percent of all employed persons in the comparison countries (Table 5.1). Moreover, the reported wage of young people in Israel (including soldiers in compulsory service) is about 40 percent lower than the wages of their peers in the comparison countries. It is important to note that among young people in Israel as well, the level of skills is significantly lower than the level in the comparison countries—about 0.4 standard deviations. Therefore, the skill gap would not have been eliminated even had we included them in the analysis, even adjusted for the existing differences in population share and military service between them and young people in other countries.

Table 5.1
Young working population (16–24) compared to prime working age individuals (25–64), Israel and comparison countries

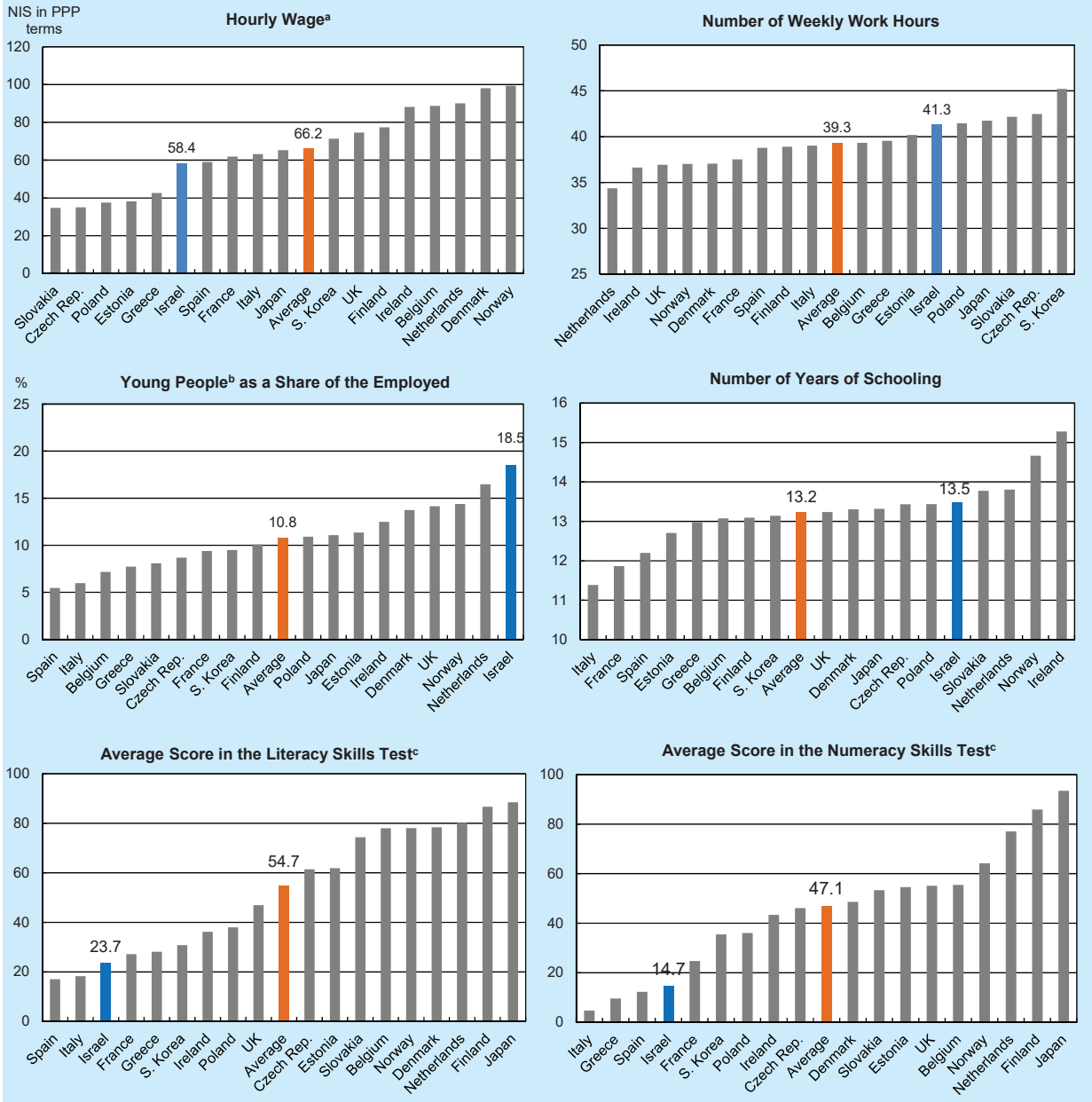
	Percentage of young people	Hourly wage (NIS, PPP adjusted)			Work hours		Skills (standard deviation)	
		Aged 16–24	Aged 25–64	Aged 16–64	Aged 16–24	Aged 25–64	Aged 16–24	Aged 25–64
Israel	18.5	30.6	58.4	53.3	35.4	41.3	-0.47	-0.26
Average in comparison countries	10.4	43.3	66.2	63.6	31.6	39.3	-0.04	0.05
Difference (percent)	-8.1[a]	41.5	13.3	19.4	-10.8	-4.7	0.43[b]	0.31[b]

[a] The difference is in percentage points.
[b] The difference is in standard deviations.
SOURCE: Based on PIAAC survey and OECD.

[14] This is reflected, for instance, in the fact that many young people in Israel, apparently students pursuing their degrees, work in hospitality and restaurants, where wages are relatively low. See Bank of Israel (2016), "Basic Skills of Workers in Israel and Industrial Productivity", *Fiscal Survey and Selected Research Analyses*, 141.

[15] This rate is higher than all the comparison countries.

Figure 5.3
Labor Market Characteristics in Israel and the Comparison Countries, Workers at Prime Working Ages (25–64)



[a] The dollar wage is converted to NIS based on the average exchange rate for 2015—NIS 3.88 / $1
[b] Those aged 16–24 who participated in the survey and received a positive wage, including soldiers in compulsory service.
[c] Skills are presented in terms of standard scores. (We calculated the average and standard deviation of all observations, deducated the general average from the score of each observation, and divided the result by the standard deviation. We then added 0.5 and multiplied the result by 100 for easy presentation.)

SOURCE: Based on the PIAAC skills survey conducted by the OECD.

Since the young age group in Israel is by nature an exception, this analysis focuses on employees in the prime working ages, where the wage gap between Israel and the comparison countries is, as mentioned, 13.3 percent. The analysis relates to all ages in order to examine the robustness of the results.

As such, Figure 5.3 relates to employees in the prime working ages in Israel and in the comparison countries, and presents basic data that it is reasonable to assume are in line with wages. The Figure shows that in Israel, people work many hours per week, and have a high number of years of formal schooling, but have very low achievement levels in the PIAAC surveys, in both the numeracy and literacy areas. The estimation in the next section focuses on the question of how these characteristics are connected to the productivity gaps between Israel and the other countries, assuming that the gaps are reflected in the hourly wage. This estimation is intended to assess how improved schools can affect the gaps between groups in Israel and the gaps between Israel and other advanced economies.

b. Estimating the contribution of the individual's characteristics

The basic econometric model that we use to estimate the contribution of the individual's characteristics in Israel to the hourly wage gap between countries is as follows:

[E2] $w_i = Country_i + \beta X_i + u_i$

where w_i is the dependent variable and represents the log of individual i's hourly wage, $Country_i$ represents the economic characteristics of each country or the averages of the individuals' characteristics in a country that are not included in the estimation, X_i represents a vector of the individual's variables for individual i, β represents a vector of estimations for each of the variables, and u_i represents the unexplained residual of each observation in the model. The vector of explanatory variables, X, includes gender, number of weekly work hours, employment experience[16] and employment experience squared, family status (does the individual live with a spouse), and the number of years of formal schooling. In addition, the vector includes the score in the numeracy part of the PIAAC survey. We chose to view this score as a standard because it was previously found that numeracy skills have more of an effect on wages than other skills, and that there is a high correlation (more than 85 percent) between them and verbal skills.[17] We use the literacy score and the literacy and numeracy scores combined to check for robustness.

Productivity is affected by the observed characteristics of the individual that are included in the estimation, but also by other characteristics of the individual and of the economy. These are inter-related, and the model therefore underestimates the role of the observed individual characteristics in explaining the productivity gaps.

As stated, in this model, $Country_i$ represents the cross-section of each of the countries, meaning the residual wage gap between the countries that is not explained by the individual's characteristics included in the estimation. This residual includes

[16] Employment experience—the cumulative number of years in which the individual received a positive wage.

[17] In many countries, there is no score on the test of problem solving in a technological environment, so we did not include it in the analysis.

economic characteristics reviewed in Box 5.1 and individual's characteristics that are not included in the estimation. It is reasonable to assume that both these types together lead to an underestimation of the individual characteristics' share in explaining the wage gaps: the economic characteristics indirectly, due to the inter-releationships between them and the characteristics of individuals, and the unobserved individual characteristics directly.

The following uses the decomposition method developed by Oaxaca (1973)[18] to assess the extent to which each variable contributes to the wage gap, and answers the question of what the wage in Israel would be had the average of a particular characteristic been equal to the average in the comparison countries:

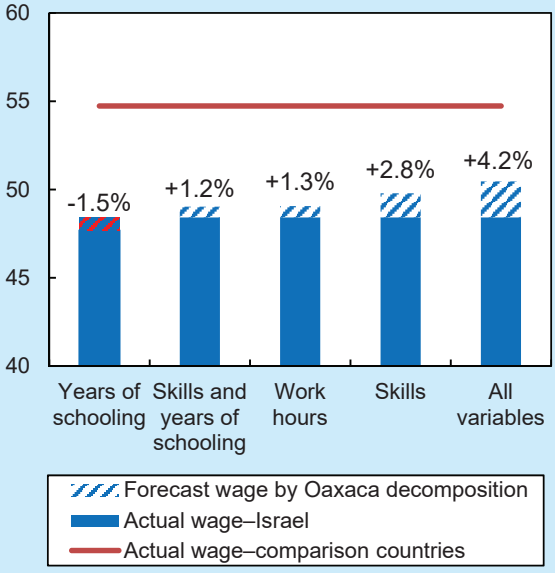
[E3] $$\widehat{w'_{israel}} = \widehat{w_{israel}} + \beta_{World}(\overline{x_{world}} - \overline{x_{israel}})$$

c. Findings of the regressions

The basic model [E2] explains 44.0 percent of the wage variance between individuals, which is a higher explanatory capability than normal in Mincerian wage equations.[19] According to the estimations of the various coefficients, the projected wage gap between Israel and the comparison countries is about 13.0 percent, meaning that the actual gap (13.3 percent) is 0.3 percentage points higher than the model's forecast.

Figure 5.4—the main figure in the chapter—shows the Oaxaca decomposition (Equation [E3]) for selected variables in the basic model. This model includes all those surveyed in the prime working ages. Each column presents the change in wage in Israel should

Figure 5.4
Forecast Hourly Wage in Israel[a] According to the Averages of the Variables in the Comparison Countries (NIS in PPP terms)



[a] The percentages denote the forecast change relative to actual wage. The Figure relates to the prime working ages (25–64).

SOURCE: Based on the PIAAC skills survey conducted by the OECD.

[18] Ronald Oaxaca (1973). "Male-Female Wage Differentials in Urban Labor Markets", *International Economic Review*, 14(3): 693–709.

[19] Equations that try to explain wage differences between individuals using their observed characteristics.

the average of the variable in Israel be equalized with the average in the comparison countries. The column on the right relates to all of the individual's characteristics for which the estimation controls, and shows how the wage would change if the average of all of the variables in Israel were equal to the average of all of them in the other countries. The column shows that wages would increase by 4.2 percent—about one-third of the estimated gap (13.0 percent). In other words, most of the wage gap is explained by (1) the residual, meaning economic variables; (2) the individual's characteristics that are not included in the estimation; and (3) other factors. However, the individual's characteristics that are included in the estimation do make a significant contribution to the explanation.

Years of schooling and skills

This section focuses on the level of human capital as reflected in formal schooling and in the score on the numeracy section of the PIAAC survey. In Israel, the average number of years of schooling (13.6) is slightly higher than the average in the other countries (13.2). If Israel were to be equal to the other countries in this aspect, wages in Israel would decline by about 1.5 percent, since the quantity of education has a positive impact on wages (Figure 5.4).

In contrast to the quantity of education, the level of basic skills in Israel is significantly lower than in the comparison countries. If the level of numeracy skills would be equal to the average in the other countries—an additional one-third of a standard deviation—the hourly wage in Israel would increase by 2.8 percent (between 2.65 percent and 2.96 percent with a confidence interval of 95 percent).[20] If the numeracy score is replaced with the literacy score, the improvement in wages is 2.6 percent. When both scores are included in the estimation, the hourly wage increases by 3.0 percent.

If the level of numeracy skills would be equal to the average in the other countries the hourly wage in Israel would increase by 2.8 percent. Such an increase is expected to add about NIS 4,000 and 4,500 in per capita GDP per year.

Since the hourly wage reflects labor productivity, this is a very valuable contribution to productivity. Such an increase in labor productivity would permanently increase GDP by a similar extent, meaning an addition of between NIS 35 and 39 billion per year (every 1 percent of GDP in 2018 is equal in value to NIS 13.2 billion), or an addition of between NIS 4,000 and 4,500 in per capita GDP.[21]

The quantity of formal schooling in Israel does not narrow the wage gaps because education in the country contributes little to skills. In other words, the quantity of education in Israel is high, but its quality is insufficient in regard to workers' skills. As Figure 5.5 shows, there is a very low correlation in Israel between the quantity of

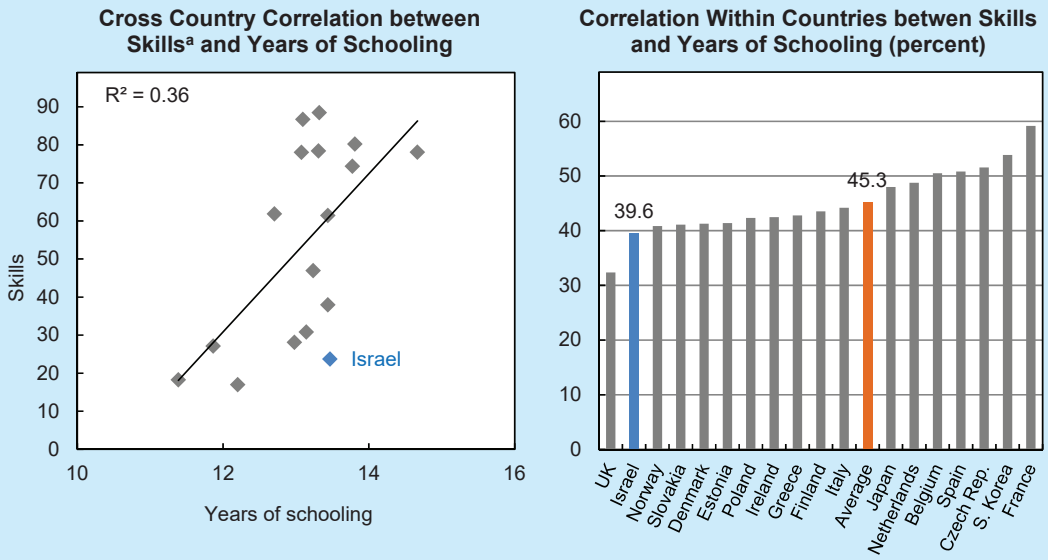
The high number of years of schooling in Israel is not reflected in the skills level.

[20] This calculation was made in comparison to the simple average of the skills averages in the other countries. If we compare the average of individuals in Israel to the average of individuals in the other countries, the gap is similar.

[21] When using a broad model that allows for each country to arrive at different returns on each of the variables, and taking into account the standard deviations of the estimation, we find that the projected improvement in wages in Israel ranges from 3 to 4.2 percent with a confidence interval of 95 percent. This is because the returns in Israel are higher than in the other countries.

education and numeracy skills, with only the UK having a lower correlation. Given the quantity of formal education in Israel, we should have seen numeracy skills that are about 0.4 standard deviations higher—the predicted value according to the

Figure 5.5
Years of Schooling and Numeracy Skills in the Comparison Countries



[a] Skills are presented in terms of standard scores. (We calculated the average and standard deviation of all observations, deducated the general average from the score of each observation, and divided the result by the standard deviation. We then added 0.5 and multiplied the result by 100 for easy presentation.)
SOURCE: Based on the PIAAC skills survey conducted by the OECD.

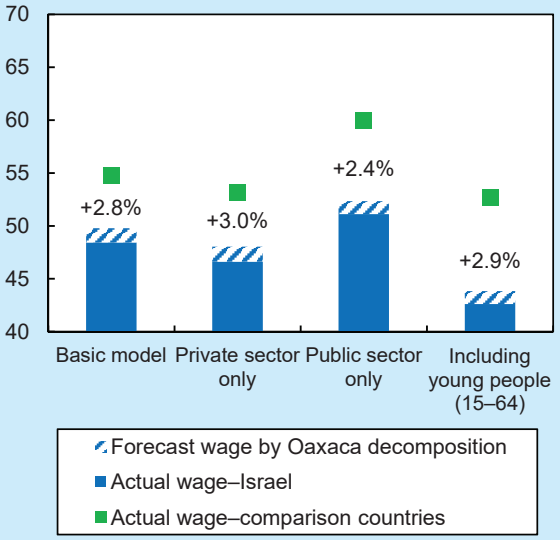
regression line in Figure 5.5. The model's estimation shows that this would increase hourly wages by 3.4 percent.

Although the skills gap exists both among those with a high school education (up to 12 years of schooling) and among those with post-secondary education (15 years of schooling or more), it is higher in the former group—0.37 standard deviations, compared with 0.24 standard deviations in the latter group. However, notwithstanding this difference, equalizing the skills would contribute similarly to wages in both groups—close to 3 percent—since the return on skills is higher among those with higher education.

The results—meaning the extent of the effect of the skill level in Israel on hourly wages—were found to be robust when estimating the model in relation to various groups in the labor market (Figure 5.6). There are different skill and wage gaps in each group, but the results remain robust in all cases: Skills explain the same portion of the wage gaps.

To illustrate, if we expand the age range from the prime working ages (25–64) to the working ages (15–64[22]) and assume that the skills level in Israel is equal to the level in the other countries, the contribution made by skills to explaining the gap increases from 2.8 percent in the basic model to 2.9 percent. If we estimate the business sector separately, skills contribute 3 percent to explaining the gap. In the public sector, the skills gap between Israel and the other countries is higher than in the business sector, but even so, equalizing the skills using the Oaxaca method contributes just 2.4 percent to wages, since in all countries, the return on skills in the public sector is lower than it is in the business sector.[23,24]

Figure 5.6
Forecast Hourly Wage in Israel[a] According to the Averages of the Variables in the Comparison Countries: Breakdown by Labor Market Group (NIS in PPP terms)



[a] The percentages denote the forecast change relative to actual wage. The Figure relates to the prime working ages (25–64).

SOURCE: Based on the PIAAC skills survey conducted by the OECD.

The productivity gap due to low skill levels is consistent in both the private and public sectors.

Skills among population groups in Israel

There are a number of population groups in Israel with low socioeconomic status, which is consistent with their low skill level and reflected in a low hourly wage. We examined how wages would be affected by equalizing the skill level of these population groups with the skill level of the general non-ultra-Orthodox Jewish population.[25]

[22] In practice, the survey does not include 15-year-olds, but starts at age 16.

[23] Y. Mazar (2018). "Differences in Skill Levels of Educated Workers Between the Public and Private Sectors, the Return to Skills and the Connection Between Them: Evidence from the PIAAC Surveys", Bank of Israel Research Department, Discussion Paper 2018.01.

[24] The results of the estimation were found to be robust even when the estimation included the industry in which the individual works. For a given industry in which the individual works, equalizing the skills level raises wages by about 2.6 percent. The contribution made by the market share of the various industries to the productivity gap is discussed in Bank of Israel (2016), "Basic Skills of Workers in Israel and Industrial Productivity", *Fiscal Survey and Selected Research Analyses*, 141.

[25] It was previously found that the skills gaps explain the vast majority of the wage gaps between Arabs and the ultra-Orthodox on the one hand and the non-ultra-Orthodox Jewish population on the other (after controlling for age, education, family status, and so forth). See Bank of Israel (2017), "The Contribution of Human Capital to Explaining the Standard of Living and Inequality in Israel", *Annual Report*, 2016, Chapter 1.

Table 5.2 presents the findings. When the skill level of Arab workers is equalized (an improvement on the order of about 0.7 standard deviations), the average hourly wage in Israel increases by about 0.8–0.9 percent. This increase is the equivalent of a permanent addition to GDP of more than NIS 10 billion per year. Moreover, the calculation is based on Arab workers' current share of employment—only about 12 percent—even though they make up 18 percent of the working-age population. An increase in skills and in potential wages should also affect the employment rate in that population group, making an additional contribution to increased GDP.

Table 5.2
Improved skills of ultra-Orthodox and Arabs in Israel

	Ultra-Orthodox	Arabs	Ultra-Orthodox and Arabs
Skills gap (standard deviation) compared with non-ultra-Orthodox Jews	0.16	0.70	0.52
Projected wage increase compared to the non-ultra-Orthodox Jewish population (percent)	0.09	0.77	0.86

SOURCE: Based on PIAAC survey and OECD.

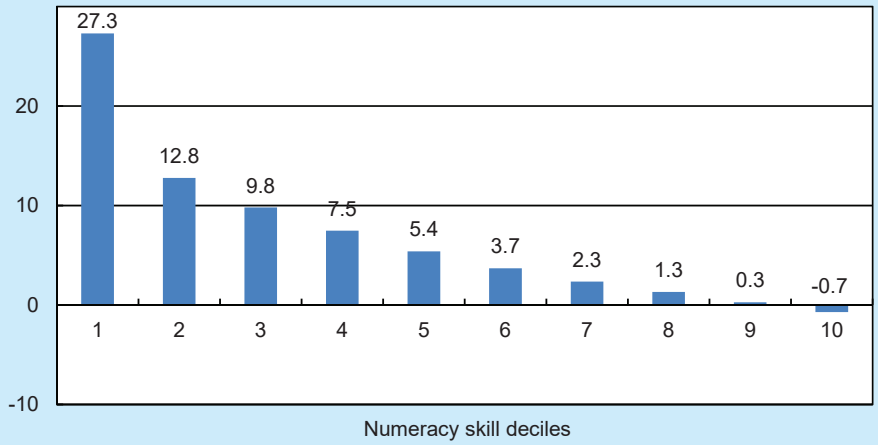
Equalizing the skill level of the ultra-Orthodox with the level among the non-ultra-Orthodox Jewish population results in a low contribution, both because ultra-Orthodox workers account for a small share of the population and because their achievements on numeracy skill tests are similar to those of the rest of the surveyed population. However, it is important to remember that, as in the previous case, the estimation is based only on workers among the ultra-Orthodox population. Moreover, the ultra-Orthodox are expected to significantly increase their share of the working-age population in the coming decades, and the Bank of Israel has previous found that there is a large gap in skill level between the young ultra-Orthodox and the young non-ultra-Orthodox.[26] Therefore, improving skills among the ultra-Orthodox community can make a significant contribution to GDP, and the potential contribution is expected to increase in the coming years. In contrast, if skills in the ultra-Orthodox community remain at their current levels, the resulting productivity gap is expected to grow with the community's share of the population.

If the ultra-Orthodox and Arab workers reach the average skill level of the non-ultra-Orthodox Jewish population, it is expected to increase wages by about 0.9 percent, almost one-third of the total gap between Israel and the comparison countries.

If the ultra-Orthodox and Arab workers reach the average skill level of the non-ultra-Orthodox Jewish population, it is expected to increase wages by about 0.9 percent. Since equalizing skills in Israel to those of other countries can increase wages by 2.8 percent over all, this accounts for almost one-third of the gap, even though the ultra-

[26] Bank of Israel (2016). "Basic Skills of Workers in Israel and Industrial Productivity", *Fiscal Survey and Selected Research Analyses*, 141.

Figure 5.7
The Gap in Numeracy Skills between Israel and the Comparison Countries, by Decile, Prime Working Ages (25–64) (Percent)



SOURCE: Based on the PIAAC skills survey conducted by the OECD.

Orthodox and Arabs make up just 20 percent of workers and about 27 percent of the prime working age population.

To further illustrate the importance of narrowing the skills gap, Figure 5.7 presents the gaps by decile, meaning the gap between the lowest skills decile in Israel and its parallel in the comparison countries, and so on. It should be noted that the ultra-Orthodox and Arabs account for a disproportionately large percentage of the lower deciles. The gap is very large in these deciles, while it narrows in the higher deciles and even reverses in Israel's favor at the upper end.

If we manage to equalize the lowest achievement quintile in the PIAAC survey to the average in the quintile above it, the hourly wage in the economy as a whole will increase considerably—by about 2.2 percent.[27] Since equalizing skills in Israel to those in the other countries can increase wages by about 2.8 percent overall, this is a significant portion of the wage gaps between Israel and the other countries, and reflects the significant role that skills inequality in Israel plays in creating the overall gap between Israel and the comparison countries.

If we manage to equalize the skills in the lowest quintile to the skills in the quintile above it, the hourly wage in the economy as a whole will increase by 2.2 percent. This reflects the significant role that skills inequality in Israel plays in creating the overall gap between Israel and the comparison countries.

* * * *

[27] Hanushek and others analyzed a similar policy process and found that policy that achieves such a result should contribute even more to the narrowing of gaps. See E. Hanushek, J. Ruhose, and L. Woessmann (2015), "Human Capital Quality and Aggregate Income Differences: Development Accounting for the U.S. States:, NBER WP 21295; and E. Hanushek, G. Schwerdt, S. Wiederhold, and L. Woessmann (2016), "Coping with Change: International Differences in the Returns to Skills", NBER WP 22657.

The skills level of Israeli workers is responsible for a significant portion of the productivity gap between Israel and other OECD countries, to the extent that they are reflected in hourly wage gaps.

The analysis in this chapter found that the skills level of Israeli workers is responsible for a significant portion of the productivity gap between Israel and other OECD countries, to the extent that they are reflected in hourly wage gaps. The low skill level of Israeli workers is consistent with the low international test achievements of Israeli pupils, and with the large achievement gaps between different population groups. The skills survey shows that there are particularly large skills gaps between Arab society and young ultra-Orthodox men on the one hand and the rest of the population on the other, but the rest of the population also does not have higher skill levels than the other countries.[28]

This chapter examined the extent to which the skills gap impairs the economy, and found that the gap between Israel and the comparison countries "costs" the economy about NIS 40 billion, and that most of this cost is due to the low skills groups—i.e. the weaker groups in Israel are weaker than the parallel groups in other advanced economies. Ultra-Orthodox and Arab workers account for a larger proportion of these groups than of the general working population.

[28] Chapter 6 of this report discusses the link between the quality of human capital, the quality of teaching, and the education budget.