Economics of Education in Israel: Inputs, Outputs and Performance

Dan Ben-David and Ayal Kimhi*

Abstract
Israel is at a crossroads. It has one of the lowest productivity levels and one of the highest poverty rates in the developed world. With roughly half of its children receiving a Third World education, future economic sustainability is not a foregone conclusion. On the other hand, the country’s leading universities are excellent, and they have been converging with the top American universities. The knowledge needed to raise Israel to viable economic trajectories exists within its borders. But a very inadequate education system is unable to channel this knowledge effectively to the primary and secondary schools, which in turn limits many pupils’ subsequent ability to enter quality institutions of higher learning. This paper highlights aspects of education’s economic impact and focuses on a number of misconceptions about the state of education in Israel. It provides an overview of achievements and failings in Israel’s primary, secondary and higher education systems.

December 2017

* Prof. Dan Ben-David, President, Shoresh Institution for Socioeconomic Research; Department of Public Policy, Tel Aviv University. Prof. Ayal Kimhi, Vice President, Shoresh Institution for Socioeconomic Research, Department of Environmental Economics and Management, Hebrew University. The authors thank Anbar Aizenman, David Caro, Moty Citrin and Michael Crystal for their research assistance.

http://shoresh.institute
Economics of Education in Israel: Inputs, Outputs and Performance

Dan Ben-David and Ayal Kimhi

1. Introduction

Israel’s education system is, in many respects, an enigma. On one hand, it is home to some of the world’s best universities, and it is one of the world leaders in average years of schooling and the share of the population with academic degrees. On the other hand, its primary and secondary school children are doing very poorly on international exams in core fields of study such as reading, mathematics and sciences. This enigma carries over to the labor market. On one hand, Israel’s high-tech sector is one of the world leaders, and large numbers of Israeli experts can be found in any high-tech center, such as Silicon Valley. On the other hand, many of the country’s working-age adults do not have the skills necessary to compete in a modern labor market, and its average labor productivity is not only low, it has been falling further and further behind the most developed countries for decades.

One of the primary roles of a public education system is to provide equal opportunities and reduce the heavy weights created by parental lack of education, which severely constrain their children’s prospects of upward economic mobility as adults. Findings by Chetty, Friedman, Hilger, Saez, Schanzenbach and Yagan (2011) suggest that differences in school quality perpetuate income inequality. Chetty, Friedman and Rockoff (2011) estimate that an elimination of qualitative differences among American schools would reduce the intergenerational correlation of income by about a third.1

The Israeli education system does not seem to perform well on this task. The additional funding that it provides schools in poorer communities is minimal (Blass and Shavit, 2016a).

---

1 Evidence on the role of education in promoting upward mobility in Israel has been discussed by Ayalon and Mcdossi (2016) and by Endeweld and Haya Stier (2017).
Achievement gaps in the international exams are the highest among developed countries, partly because of enormous gaps between pupils in Hebrew-speaking schools. Not surprisingly, Israel is one of the most unequal developed countries, and the share of its population below the poverty line is the highest in the developed world (Ben-David, 2016).

What underlies the Israeli education system’s failure to serve its role? Is it lack of funding? Is it poor physical infrastructure? Is it inadequate teachers? Or is it the system as a whole that is not using its resources productively? This study sheds some light on these questions. It includes a review of existing studies and an empirical investigation of selected issues using macro and micro data.

Section two provides some background and a review of previous studies that have examined the education system in Israel and elsewhere. An analysis of quantitative education measures and their impact on the labor market is provided in section three. The fourth section turns to an examination of the quality of education in Israel and its economic impact. Section five examines the educational inputs in Israel in comparison to other countries. Section six highlights the importance of high-school curriculum and field of academic study to labor market achievements. Section seven examines the country’s higher education system while section eight concludes.

2. Background

Assessing the relationship between output and inputs over time requires an accurate measurement of each, adequately accounting for the endogeneity of the inputs while assuming that the production function does not change over time (except for technological advancement).

The challenge of correctly defining inputs and output makes this task particularly complex when the focus turns to education. Can the size of the education budget represent an input? Since the vast majority of the education budget goes toward teacher salaries, do teacher salaries in a public education system, characterized by rigid labor relations, reflect the quality of the teaching force? Can teaching force quality be measured in other ways? To what extent does the number of pupils per class (which is affected by both wage spending and physical
infrastructure) affect the quality of teaching? And how can an education system’s output be measured? Are quantitative indices, such as high school graduation rates, matriculation rates, and the percentage of persons with academic degrees sufficiently reliable, or should one also look at the skills and level of knowledge of the system’s graduates? Alternatively, should the education system’s output be measured indirectly via macroeconomic indices such as growth and equality?

These and other questions have preoccupied economists for years. They have generated an extensive literature on the importance of human capital, beginning with early studies of Mincer (1958), Schultz (1961) and Becker (1962), who coined the term, and those of Griliches (e.g., 1960) who showed the role of education in agricultural productivity growth. These were followed by analyses showing the importance of human capital to economic growth (e.g. Lucas, 1988, Romer, 1990; Mankiw, Romer and Weil, 1992; Hall and Jones, 1999), and continuing with research by Barro (2001), Heckman (2007), and Hanushek (2016), who focused on the distinction between quantity and quality of human capital, and on effective methods for skill creation.

In Israel, Helpman (1999) found that that an increase in the average number of school years accounted for 29% of the growth in the Israeli business sector’s total factor productivity between 1971 and 1990. Bregman and Marom (2005) assessed the contribution of human capital to output via the production function approach, focusing on a panel of economic industries in the years 1970-1999. They found that a single additional year of schooling increased GDP and productivity by seven to eight percent. Also finding that academic schooling has an even greater effect on output and productivity, they recommended strengthening the Israeli higher education system. Argov (2016) utilized the growth accounting procedure to find that increased schooling since the 1970s has contributed one-third to one half of Israel’s per capita GDP growth.

However, many studies have found that educational quality contributes no less, and possibly more, than does educational quantity (e.g. Barro, 2001; Hanushek and Woessmann, 2015). Studies on the importance of human capital to worker income at the individual level
also increasingly emphasize educational quality over educational quantity (e.g.: Chetty et al., 2011).  Academic institution quality (Weisbrod and Karpoff, 1968) and the field of study chosen (Leimieux, 2014; Kirkeboen, Leuven and Mogstad, 2016; Naylor, Smith and Telhaj, 2016; Rodriguez, Urzua and Reyes, 2016), school track choice (Dustmann, 2004; Brunello and Rocco, 2017; Hampf and Woessmann, 2017), subjects studied in high school (Altonji, 1995; Levine and Zimmerman, 1995; Rose and Betts, 2004; Morin, 2013; French et al., 2015), and preschool enrichment or early intervention programs (Crocker, Thomas, and Currie, 2002; Heckman, 2006; Elango et al., 2016; Garcia et al., 2017) – were all found to have a significant impact on labor market achievements.

Several studies have been carried out in Israel on the relationship between educational quality and labor market achievements. Shwed and Shavit (2006) found occupational and income differences between graduates from Israel’s research universities and non-research colleges, even after controlling for field of study. Zussman, Furman, Kaplan and Romanov (2009) found that the salaries of Israeli university graduates are higher than those of Israeli college graduates, for most study disciplines. Krill, Geva and Aloni (2017) discovered that the choice of academic field of study explains one-fifth of subsequent wage variability. Zussman and Tsur (2010) showed that graduates of high school vocational tracks have lower labor market achievements than do graduates of academic tracks. Kimhi and Horovitz (2015) found that upgrading high school math study from four to five units increases future wages by about eight percent.

The importance of educational quality raises the question of how countries can upgrade it. While there is some evidence that larger school budgets improve pupil long-run achievements (Jackson, Johnson and Persico, 2016; Lafortune, Rothstein and Whitmore Schanzenbach, 2016), Hanushek and Kimko (2000) and Hanushek and Woessman (2008) found no such relationship between international exam achievements and the resources available to the relevant education systems during the years preceding the tests. Jensen, Reichl and Kemp (2011) documented a decline in student performance in Australia during a period in which school funding increased considerably. Ben-David (2003, 2011) also demonstrated a
similar lack of such a relationship with regard to Israel, finding relatively low levels of pupil achievements in comparison with other developed countries alongside relatively high education expenditures per pupil.

Lavy (2015a) found a positive relationship between instructional hours and pupil achievements on the PISA exams at the country level. Moreover, this relationship was stronger in countries that delegated greater degrees of administrative responsibility to the schools. In Israel, however, Ben-David (2012) showed that despite the fact that Israeli pupils receive more annual instructional hours than pupils in the majority of OECD countries, their achievements in international exam are below most these same OECD countries.

Most of the growth in Israel’s education budget since 2007 has been channeled to teacher salary increases within the framework of new comprehensive wage bargaining agreements (Taub Center, 2015), but pupil performance on the international exams has improved minimally, if at all (Ben-David, 2015). Feniger and Shavit (2011) found that gaps in per pupil spending do not explain achievement gaps between Israeli pupils and their peers in other countries; rather, they link Israel’s poor achievements to its larger class sizes.

By contrast, Victor Lavy (1998) showed that funding gaps between Jewish and Arab schools were responsible for a major portion of the disparity in achievements in primary school math between Jewish and Arab pupils in 1991-1992. Budgetary gaps and socioeconomic differences explain 60% of math achievement gaps and exam failure rates during those years. Specifically, per pupil budgets, the number of instructional hours per pupil, and the share of certified teachers had a substantial impact on pupil achievements. In another study, Lavy (2012) used a 2004 change in school funding rules to quantify the impact of the per pupil budget on pupil achievements. He showed that the higher budget led to an extended school week and more instructional time in the core subjects of mathematics, science, English and Hebrew languages. This teaching upgrade resulted in improved pupil achievements in the relevant subjects. He also found that the additional instructional hours increased the amount of time that pupils spent on homework, without reducing their satisfaction levels or negatively affecting their behavior. In contrast, Angrist and Lavy (2002) found that introducing computers
into primary and lower secondary classrooms during the 1990s, another way of using a higher budget, did not improve pupil achievements in math.

Teacher quality is a very important factor in pupil achievement levels (Navon and Shavit, 2012). Chetty, Friedman, Hilger, Saez, Schanzenbach and Yagan (2011) found that pupils who studied with more experienced preschool teachers reached higher income levels at age 27. Gerritsen, Plug and Webbink (2017) found that teacher experience affects student achievements in the short run and in the long run, and that the effect is particularly strong in earlier grades. Angrist and Lavy (2001) showed that a training program for primary school teachers in Jerusalem, in language and math skills, led to improved pupil achievements in secular schools.

Financial incentives for teachers might be assumed to improve instructional quality, but research in this sphere has produced no unequivocal conclusions. Gamoran (2012) reviewed a number of American studies and concluded that financial incentives for teachers do not lead to better pupil performance. By contrast, a series of studies by Lavy attributed improved Israeli pupil achievements to teacher incentives. A program providing financial rewards to all teachers in schools with substantially improved pupil achievements led to a rise in the number of units studied for matriculation, higher matriculation exam scores, and higher matriculation eligibility rates, as well as lower drop-out rates (Lavy, 2002). Another program, rewarding English and math teachers whose pupils’ matriculation exam achievements improved substantially, was found to have produced higher matriculation exam-taking rates, higher passing rates, and higher exam scores (Lavy, 2009). It was also found that this change was facilitated by different teaching methods, additional tutoring hours, and closer attention to pupils’ individual needs. A follow-up study (Lavy, 2015b) showed that the incentives’ impact persisted over the long term, as reflected in higher rates of academic study, higher employment, and higher wages.

Other studies have looked at financial incentives for school principals and for the pupils themselves. Lavy (2008) found that wage increases for principals led to improved matriculation exam achievements. Angrist and Lavy (2009) showed that financial incentives for pupils led to improved matriculation achievements for girls, but not for boys. Some of the
improvement was due to the allocation of more study time to matriculation exam preparation. Abramitzky and Lavy (2014) found that structural changes in the kibbutzim, which strengthened the connection between human capital and income, created incentives for kibbutz members to invest more in schooling.

A discussion about improved instructional quality needs to also include the issue of class size. Smaller class sizes enable teachers to devote more time to each pupil and could lead to an improvement in discipline – two factors that also reinforce one another. However, studies on the impact of class size in other countries have not been uniform in their conclusions. For example, Chetty et al. (2011) found that pupils who attended smaller kindergarten classes were more likely to go on to higher education, but that their incomes at age 27 were not significantly higher. A recent study conducted in Norway found no significant relationship between class size and the income of pupils throughout their careers (Falch, Sandsør and Strøm, forthcoming). By contrast, Angrist and Lavy (1999) used an instrumental variable for class size in Israel and found that smaller class sizes substantially improved fifth grade reading and math scores. Achievements improved more moderately in fourth grade, while no improvement was found in third grade. However, Angrist et al. (2017) found that the class size impact disappears in more recent data.

Several studies have looked at the impact of school quality on pupil achievements. In one such study, Ellison and Swanson (2016) found substantial differences in the achievements of pupils at different schools, even when controlling for school and pupil characteristics. Woessmann (2016) showed that differences in education systems across countries are responsible for differences in pupil achievement. In Israel, Gould, Lavy and Paserman (2004) examined Ethiopian immigrants who had been randomly assigned to primary schools. They found that pupils who had been sent to schools with higher math achievements reached higher levels themselves, had a lower likelihood of dropping out of school and a higher probability of passing the matriculation exams. Another study by Gould, Lavy and Paserman, (2009) found that Israeli-born pupils in primary school classes with high shares of new immigrants reached lower achievements on matriculation exams.
Shavit and Blank (2011) and Blank and Shavit (2013) examined the relationship between pupil achievements and class discipline levels, finding that as discipline improves, so do achievements. They also found that closing the discipline gap between Israel and a group of comparison countries would likely produce a substantial reduction in the achievement gap, though the disparity would not be eliminated entirely. Lavy and Schlosser (2011) showed that in classes with high percentages of girls, there were fewer disruptions, less violence, better teacher-pupil and pupil-pupil interactions, and less teacher burnout. All of these resulted in better scholastic performance. Lavy, Paserman and Schlosser (2011) found that a high percentage of low-ability pupils in a classroom has the opposite effect: poorer instructional quality, lower quality teacher-pupil and pupil-pupil interactions, more violence and class disruption – all of which led to lower scholastic achievements. Lavy and Sand (2012) found that the presence of friends in class has a positive effect on test scores in English, math, and Hebrew language instruction, on the time devoted to homework, and on overall pupil satisfaction with the school, and a negative effect on violent behavior.

Lavy (2016) assessed the impact of teaching methods in English, Hebrew language, math and science on the grades of fifth graders (in 2002) and eighth graders (in 2005). He found that traditional methods for instilling knowledge and comprehension are more effective in improving the scores of girls and pupils from socioeconomically disadvantaged backgrounds, while modern methods for endowing pupils with analytical and critical skills are similarly effective with all pupils. Interestingly, no relationship was found between pupil scores and other instructional characteristics such as the teaching of individual study skills and teacher-pupil relations.

A key conclusion from this literature is that instructional quality and other features of the education system can be major factors in determining pupils’ future achievements – which underscores the importance of having an effective educational policy. That said, policy cannot ignore pupil background factors. For example, Gould, Lavy and Paserman (2011) followed pupils whose parents had immigrated to Israel from Yemen in the early years of Israeli statehood. They found that children who grew up in better living conditions were more likely
to pursue higher education. Since education yields substantial social and economic benefits at the national level that compound the private benefits to individuals, the policy challenge is to move the education system in a direction that will minimize the impact of poor socioeconomic backgrounds on pupils’ achievements.

3. Education quantity and Israel’s labor market

On the face of it, Israel’s prime working age population is one of the most educated on the planet.\(^2\) With 13.4 years of schooling per person between the ages of 35 and 54, the country is ranked third, after only the United States and Switzerland, each with an average of 13.5 years of schooling per person (Figure 1). To the extent that 12 years of schooling reflect completion of high school (though not necessarily graduation or matriculation), the majority of OECD countries are above this bar. Ten of the OECD countries sport a 13+ average, with an additional ten countries averaging at least 12 years of schooling.

While gaps in average years of schooling among the majority of OECD countries are not particularly large, this is not the case when the focus turns to the share of the prime working age population with an academic degree. In six OECD countries, this share falls below 10% of the 35-54 year old population, with 11 additional countries averaging in the teens (Figure 2). In Israel, 31.6% of the prime working age population has an academic degree, placing it behind only three countries: the United States (32.6%), Ireland (33.9%), and South Korea (37.6%).

Israel’s shift in educational attainment over the years has been dramatic. Figure 3 displays the distribution of the country’s prime working age population by years of schooling. Haredim (ultra-Orthodox Jews) are listed separately in Figure 3 and are not divided by years

---

\(^2\) While prime working age is generally considered between the ages of 25 and 54, this range is a bit more complicated in Israel. Because of compulsory military service, many Israelis delay their entry into higher education, thus pushing back graduation and full entry into the labor market until much later than is common in other countries. Consequently, the prime working age population considered here will be the 35-54 year old group.
of schooling. In 1970, 60% of Israel’s prime working age non-Haredi population had no more than 8 years of schooling. This share fell precipitously, to under 10%, by 2015. The share of persons with 16+ years of schooling has risen steadily over the decades, from just over 5% in 1970 to its current level with more than 35%.

As Israel’s economy has grown, it has shifted away from productive sectors using hired labor with little to no education, such as agriculture and textiles, toward services and hi-tech sectors requiring higher levels of education and skills. The analogous shift in labor demand over the years is vividly displayed in Figure 4. Although the share of prime working age men with no more than four years of schooling fell from 25% to 2%, indicating a marked decline in their supply, demand for such men has almost evaporated. Their rates of employment have been in a near free-fall until recently.

While there was almost no difference in 1970’s employment rates between the various education groups, a substantial gap has developed between them over the decades. Although the share of men with 16+ years of schooling has risen sharply during this span, demand for them has risen as well, with employment rates in 2015 over 90%, roughly where they were in 1970. For all other education groups, the lower the level of education, the greater the fall in employment rates – a trend that can only be expected to continue, despite the aberration in recent years among the less educated and Haredim, evidently as a result of significant cuts in welfare benefits (Ben-David, 2016).

The importance of education for female employment is shown in Figure 5. The increase in the supply of more educated women, coupled with the increase in demand for educated workers, has led to higher employment rates. While a gap has always existed between employment rates of the various education groups, this gap has widened over the decades. As

---

3 Nearly all Haredi men do not study a core curriculum for more than 8 years – and even then, it is just a partial one that excludes science, English and other basic material. After that, they continue with Torah studies for many years, and sometimes decades. Consequently, they are listed in the data as having 16+ years of education, even though this clearly designates something else entirely than it does for the remainder of the population. Until 1978, it was not possible to identify Haredim in Labor Force Surveys, so in the early years they are included in the figure. This is the reason for the drop in the fraction of 16+ years of schooling in 1979.

4 This trend is due, among other things, to the expansion of academic opportunities through non-research colleges since 1990.
Kimhi (2012a) shows, the primary source of the vastly increased female employment rates at the national level is due to a rising number of women moving up the education ladder into successively higher education groups characterized by higher employment rates.

Education’s impact on employment crosses gender and religious lines, and this fact is very relevant for labor market policy. For example, the very low employment rates of Arab Israeli women is due primarily to the fact that a very large share of such women have low levels of education. As shown by Ben-David (2017), higher levels of education lead to substantially higher employment rates for all population groups.

Higher levels of education also lead to higher wages. The spectrum of hourly wages for full-time prime working age employees can be seen in Figure 6. Employees with no education, and those with a primary school education at most, receive 33 and 35 shekels per hour, respectively. As education levels rise, so do hourly wages, reaching 86 shekels per hour for employees with undergraduate degrees, 100 shekels per hour for those with Masters degrees, and 130 shekels per hour for employees with Ph.Ds. As shown by Ben-David (2017), the gap in hourly wages between full-time prime working age employees with 13 years of schooling and more and those with 12 years of schooling at most has increased over the years. From 1999 to 2007, the 13+ group earned approximately 60% more than the 0-12 group. Since then, this gap has risen substantially, reaching 95% by 2015.

To summarize, employment gaps and wage gaps in Israel are closely linked to gaps in educational attainment, and these gaps are widening over time. In this respect, a national education policy aimed at enhancing educational attainment of less educated and poorer population groups could yield some major socioeconomic improvements. However, as will be shown below, the quantity of education is not what matters most.

4. Education quality and its economic impact

Israel is uniquely placed among the family of nations to highlight why an emphasis on the quantity of education is insufficient. It ostensibly has one of the most educated societies in the OECD (as measured by the number of school years per person or the share of individuals
with academic degrees) while its labor productivity is not only below most OECD countries, it has been steadily falling further and further behind the average labor productivity of the G7 countries since the 1970s (Ben-David, 2010).

However, Hanushek and Woessmann (2015) show that while there is a slight positive relationship between the average number of school years in a country and average annual growth rates, there is a much stronger positive relationship between the quality of a country’s education (as measured by achievements in math, science and reading) and its economic rate of growth.

A year of schooling in one country is not necessarily equivalent to a year of schooling in another country, due to quality differentials. Gauging the quality of education in Israel is not as accurate as it could, or should, be. On the one hand, the country requires all students wishing to graduate from high school to pass a matriculation exam (bagrut, in Hebrew). These exams have been given for decades, but have never been calibrated over time, rendering useless all intertemporal comparisons. The final matriculation grades also include a local school component for which no attempt is made at calibration across schools. The result is a relatively expensive exam process that is of little use in providing comparable benchmarks that could have been utilized for measuring the quality of education provided in Israel.

International exams, such as PISA, TIMSS and others used by Hanushek and Woessmann (2015) in their study, provide another route for gauging educational quality. These exams are calibrated on a per exam basis to a mean of 500. This mean remains 500 regardless of the year or the number of countries participating in the exam. Hence, any improvements or declines in achievements are relative to the mean and do not denote actual progress or deterioration over time. Nonetheless, it is still possible to gauge Israel’s relative position vis-à-vis other countries and whether this position has improved or declined.

As can be seen in Figure 7, despite the steady improvements – relative to the means – in the achievements of Israeli pupils over the last decade, their mean scores have been mostly
below the OECD average of 500. In particular, the average achievements in math, science and reading in the most recent PISA exam (administered in 2015) place Israeli children below the children of nearly all of the 25 relevant developed countries, with only Slovakian children attaining a lower score (Figure 8). Moreover, Israel’s Arabic speaking children obtained an average score below many developing countries. In fact, their average score was below the average score in most of the predominantly Muslim countries.

Not only are Israel’s average achievement levels below nearly all developed countries, education gaps between its children are by far the highest (Figure 9), and have been the highest in the developed world for many years. These gaps would have probably been even higher had all of the Haredi children taken the exam. With such a high level of disparity in what constitutes the jumping board into the labor market, it should come as no surprise that subsequent income gaps are high as well (Ben-David, 2015).

The failure of Israel’s education system in reducing gaps – in comparison with other developed countries – is highlighted in Figure 10, which compares the PISA math achievements of pupils according to their mothers’ education. All comparisons are made to the scores of children whose mothers matriculated from high school. In the ten countries with the highest PISA scores in 2015, children whose mothers did not have any formal education scored 6% below those whose mothers’ matriculated from high school. At the other end of the education spectrum, children whose mothers had an academic degree attained scores that were 6% above those of children with mothers who matriculated from high school.

The impact of maternal education on the scores of Israeli pupils was considerably greater than the maternal impact in the ten leading countries. Pupils with mothers who did not

---

5 Israel’s scores on the TIMSS exams have been consistently higher than in the PISA exams. This may be due to the fact that the share of developed countries participating in the TIMSS exams is much smaller than in the PISA exams, improving Israel’s position relative to such a mean.

6 In general, the international exams stipulate that a country may exclude up to 5% of its pupils from the sample. This is usually intended to account for special needs pupils, or those living in distant rural areas. Nearly all countries participating in the most recent TIMSS exam, administered in 2015, abided by these rules. A select few excluded slightly more than the acceptable exclusion rate. In Israel, Haredi boys do not study the material covered in these exams and do not participate in the exams. Consequently, Israel excluded a full 23% of its pupils from the exam. Thus, in all of the international comparisons, it can be assumed that the Israeli results reflect better outcomes than would have actually existed had all of the country’s pupils participated in the exams.
study beyond primary schools received math grades that were 20% below the grades of pupils whose mothers’ matriculated from high school. When mothers completed no more than lower secondary school, the gap among their children fell to 13%. Pupils with academically educated mothers attained scores that were 15% higher than those with mothers who only matriculated.

While the international exams provide a relative measuring stick for comparing Israel to other countries, they do not yield any information on the absolute level of knowledge that Israeli children possess in core subjects, or whether this level has risen or fallen over time. The only exam administered in Israel providing such an indication is the Meitsav exam – and only since 2008 for 8th grade pupils (these exams are also given to 5th graders). The average score of 500 in 2008 serves as the base score for all other years. Since then, scores have improved in each exam (Figure 11), though in English, this improvement stalled relatively quickly and average scores have been relatively stagnant for much of the past decade.

While the Meitsav exams are calibrated over time, the scores shown in Figure 11 are index numbers that provide no information as to how much of the material pupils actually know. Figure 12 provides a glimpse of the percentage of correct responses in the various exams administered in 2016. Both the fifth and eighth grade pupils answered correctly on only two-thirds of the questions in the English exam. The percent correct in math was even lower (61%) in fifth grade and in eighth grade (56%). Even lower is the average score of 50% in science and technology, an exam that is no longer given to fifth graders, as it had been in the past.

Returning to the international exams, a comparison of the weakest pupils in each developed country – that is, a comparison of the bottom five percentiles – indicates that Israel’s weakest pupils are the weakest of the weakest in the developed world (Ben-David, 2017). These children are the most likely candidates for a life of poverty since the sub-par skills that they are being provided reduce their chances of overcoming such a negative head start in the future. Israeli pupils in the top five percentiles are ranked below the top pupils in 18 of these 25 countries, an omen reflecting the country’s future ability to retain its qualitative edge in fields that keep its economy in the developed world.
The OECD defines 6 levels of achievement in math, science and reading. Pupils with a score in level 1 or below are considered inadequately prepared for future labor markets. 30% of Israel’s pupils are at or below level 1 on average in the three exams, tying Israel with the Slovak Republic for the greatest share of unprepared children in the developed world. Had all of the Haredi children participated in the exam, Israel would probably own last place all by itself. The OECD also measures the problem solving skills of children. Children scoring in Level 1 are considered unable to plan ahead or set subgoals. 39% of Israeli children are at or below level 1. This is double the German and American shares, and over five times the Japanese share (Figure 13).

The PIAAC survey of adult skills, conducted in Israel in 2016, provides an opportunity to examine skills of the existing labor force. Adult skills in Israel are not better, from an international perspective, than those of Israeli pupils in the international exams. Israeli workers were ranked last in OECD in reading skills and second to last in quantitative and problem-solving skills. The skill inequality in Israel is ranked second from top (Bank of Israel, 2016). The examination of worker skills by industry indicates that low-skilled workers tend to concentrate in low-productivity industries.

The quality of education in primary schools greatly influences the quality of secondary school education that a pupil can attain – which in turn affects subsequent academic choices. Many Israelis have the misconception that where a person studies is not important. In their minds, the only thing that matters is the attainment of an academic degree, regardless of the institution – a perception that is heightened by the plethora of misleading commercials advertising the various academic centers of study.

Evidence of the large discrepancies in quality among academic institutions can be found in the high-tech fields. Many high-tech firms claim that they are having an extremely difficult time finding sufficiently qualified job candidates. For example, the Ministry of Economy (Tzuk, 2016) reports that for every three positions in computing, there is only one candidate. However, findings by Bental and Peled (2016) indicated no such shortage, at least not on paper. Their study shows that the supply of academic graduates in high tech fields is roughly identical.
to the demand for such graduates. The difference reported by the Ministry of Economy is apparently due to the major qualitative differences between graduates of different academic institutions.

This gap between institutions is further highlighted in Figure 14, which shows just how much of an impact academic choices can have on wages – particularly in the high wage fields. In disciplines where graduates tend to enter the private business sector, as opposed to public sector positions, students who attended the research universities tended to earn considerably more than students graduating from the non-research colleges. Not only do employees with degrees in computer science earn considerably more than those with degrees in engineering, wage gaps are also affected by the quality of the higher education institution. Similarly, Achdut, Zusman and Mayan (2017) found a wage advantage of at least 10% for university graduates over college graduates, after controlling for field of study, psychometric score, math skills, and various socio-economic indicators.

Kril, Geva and Aloni (2017) found that graduates of computer sciences, engineering, physics and mathematics, accounting, economics and business administration have considerably higher wages as well. They differentiated between publicly funded colleges (where most college students are enrolled) and private colleges, finding that graduates of publicly funded colleges earned considerably less than university graduates. The average earnings of graduates of private colleges, on the other hand, were not very different from those of university graduates, in most fields of study. It should be noted that except for law, business administration, psychology and other social sciences, the number of graduates of private colleges is very small.

Thus, what a person studies, the level, and where, make a great difference with regard to wages. Figure 15, focusing on full time prime working age employees, illustrates just how big the wage gaps are. Non-academic Arab Israelis have particularly low hourly wages. This is partially due to the fact that 33% of all non-academic Arab Israeli females and 46% of all non-academic Arab Israeli males have no more than a primary school education. This compares with single digits for both groups of non-academic Jewish Israelis in Figure 15.
Over 80% of academically educated Arab and Haredi woman have no more than a BA degree, with most of these degrees coming from teaching colleges with extremely low entrance requirements. This compares to 54% of non-Haredi women with academic degrees who stop studying after attaining a BA. These outcomes are reflected in relatively similar wages for Arab Israeli and Haredi women with academic degrees (62 shekels per hour and 58 shekels per hour, respectively), as opposed to 81 shekels per hour for non-Haredi Jewish women with academic degrees.

To summarize, Israeli pupils do poorly in both local and international exams, and the achievement gaps among them are substantial. These gaps carry over into adult skills and into academic education, and are subsequently reflected in high wage inequality.

5. Educational inputs and pupil achievements in Israel

As shown above, quantitative measures suggest that Israel’s population is highly educated. But qualitatively, Israeli pupils and adults alike are at, or near, the bottom of the developed world. Is this problem due primarily to a lack of education system resources necessary for quality teaching, or are these resources used ineffectively?

Education expenditures

Israel’s overall budgetary picture has undergone some major changes in recent years. Figure 16 provides the long term perspective. National education expenditure, as a percent of GDP, rose throughout the 1970s, peaking at close to 9.5% of GDP towards the end of that decade. It then fell during the early 1980s, until stabilizing in the mid-eighties. During a brief period in the 1990s, education received a major injection of funds, though these were allowed to dissipate over the subsequent decade. In recent years, the national education expenditure received a renewed budgetary infusion.

A comparison of Israel with other OECD countries, in terms of both national and public expenditures as a share of GDP, would appear to paint Israel as a major spender (Figure 17). Israel’s national education expenditure, as a share of GDP, is second only to that of Iceland’s.
Its public education expenditure places the country in fourth place. While such comparisons are accurate and common, they can also be misleading – particularly in a country with a relatively young population such as Israel. The share of primary and secondary school pupils in Israel is 19.9% of the entire population (Ben-David, 2017), higher than in most OECD countries. Thus, the relevant measure for examining Israel’s education expenditures over time and in comparison to other countries is expenditure per pupil.

Figure 18 shows the evolution of real national expenditure per pupil in all three levels of education: secondary, primary and pre-primary education. These expenditures tend to rise with the level of education. National expenditure per pupil in secondary education fell during the 1980s, before climbing back and eventually eclipsing its 1979 level by 10% in 2009. Primary school expenditures per pupil rose by 47% from 1979 to 2009. Then came two major comprehensive wage agreements – one with the primary school teachers and one with the secondary school teachers. These led to significant spikes in national education expenditures, rising by 57% in just four years in the primary schools and by 62% in the secondary schools. Pre-primary school expenditure per pupil actually declined by 9% between 1998 and 2012. The catalyst for the 69% increase in 2013 were the massive social protests in the summer of 2011 on the high price of living in Israel, and the need for better and affordable day care.

For international comparisons of education expenditures, simple comparisons of expenditure per pupil are insufficient and can be misleading. Salaries comprise the vast majority of all education expenditures, and salaries are highly correlated with living standards. Thus, education expenditures per pupil in Israel that are higher than in a developing country do not mean that Israel is spending extravagantly – just as lower expenditures in Israel as opposed to the United States do not imply a need to increase Israeli expenditures. To make education expenditures per pupil comparable across countries, there is a need to normalize them by GDP per capita. This kind of discounting is also identical, mathematically, to the need to normalize the share of education expenditures out of GDP by the share of pupils in the population.

Panels A and B of Figure 19 provide a comparison of public education expenditures per pupil normalized by GDP per capita. Israel is situated close to the center of the OECD
rankings in primary school expenditures (Panel A), with 21.6% of GDP per capita going toward education expenditures per pupil. With regard to public spending in secondary schools (Panel B), Israel is situated third from the bottom, with a public expenditure per pupil, as a share of GDP per capita, that is 15.3%.

A closer look at the public spending on secondary education provides an interesting contrast with regard to how Israel divides its public education expenditures between public and private schools. Panel A of Figure 20 focuses on public education expenditures per pupil in public secondary schools as a share of GDP per capita. In this figure, Israel falls to last place in the OECD, with an expenditure per pupil that is 10.9% of GDP per capita. The picture flips completely when it comes to public spending per pupil on private secondary schools (Panel B). Israel’s public expenditure per pupil on its private schools is nearly four times the public expenditure per pupil on its public schools, and is the highest in the OECD.

The bottom line is that in international comparisons, educational funding per pupil in Israel, at least in primary schools, seems to be sufficient, so lack of funding cannot be the main reason for the low achievements of Israeli pupils. This conclusion is subject to two qualifications. First, private school pupils receive larger public funding per pupil than public school pupils, and many of these pupils, namely those in Haredi schools, do not even study core curriculum. Second, the increase in school funding over the past few years was mostly to raise teacher salaries. While raising teacher salaries may in the long run attract better teachers and lead to higher pupil achievements, it has yet to be effective in the short run. This raises the question of whether teachers are paid according to what is expected from them, and whether teacher wages are sufficient to attract competent teachers.

**Teachers’ salaries and qualifications**

On the face of it, teachers’ monthly salaries in Israel range from 14% below the OECD average in lower secondary schools to 16% less in primary schools to 28% less in upper

---

7 Private schools here refer to schools that obtain more than 50% of their funding from private sources.
8 When public funding accounts for under 50% of a school’s income, that institution is considered a private school. Haredi (ultra-Orthodox) schools, which are dependent primarily on donations, account for a large part of the private schools.
secondary schools (Figure 21). However, Israeli teachers work substantially fewer hours than in other developed countries. A comparison of total statutory working hours by primary school teachers indicates that Israelis work 23% less hours than the average for their counterparts in the OECD. In lower secondary schools, they work 30% less, while in upper secondary schools, Israeli teachers work just over half the average number of hours registered by teachers in the OECD. As a result, teachers’ hourly wages in Israel are higher than the OECD average (Figure 21). Israeli primary school teachers earn 9% more per hour while teachers in lower secondary schools make almost a quarter more per hour. In upper secondary schools, the gap rises to over a third more per hour for Israeli teachers.

These differences do not take into account the fact that Israeli incomes, in general, are lower than OECD incomes. When the salaries per hour are discounted by GDP per hour of work to control for differences in living standards, the gaps between what Israeli teachers earn per hour and the OECD average rises to 44% in primary schools and to 62% in lower secondary schools while Israeli high school teachers make 76% more per hour than their average OECD counterparts (Figure 21).

A sense of mission leads some gifted and talented persons, with a large range of professional options, to choose the teaching profession. But they are not the majority. One might expect that, even in lieu of such a sense of mission, the relatively high hourly wages of teachers in Israel should attract such talented and qualified individuals into the teaching profession. However, this does not seem to be the case for the majority of teachers in Israel – possibly because the standard monthly teaching schedule is so light (compared to other countries) that it yields relatively low monthly salaries that act as a negative counterbalance.

Over three-quarters of Israel’s first-year education students study in teaching colleges (Figure 22) with average psychometric scores (serving a similar purpose as American SATs) of 494 that are below 61% of all persons taking the exam. Another 15% of the first year education students are taught in general non-research colleges and their average psychometric (439) is below that of three-quarters of all test-takers. Just 6 percent of all first year education students study in research universities, and even their average psychometric score of 603 is
below the 617 average for all university students.\(^9\) When a vast majority of a country’s teachers do not have the personal qualifications to get accepted into a research university, how can it be expected that they will have the ability to enable their pupils to reach those levels?\(^{10}\)

**Instruction hours**

An often-cited reason for low pupil achievements is an insufficient amount of time devoted to the study of basic material. However, this does not appear to be the case in Israel. The average number of school days per year in Israel is in a league of its own when compared to the other OECD countries – nearly 220 days a year, compared to just over 200 days for the number two country, Japan (Ben-David, 2017).

A comparison of all OECD countries with data on the number of instruction hours per year in core subjects and data on achievements in the recent PISA 2015 exam provides a vivid indication that the number of instruction hours do not explain Israel’s low achievements (Figure 23). In all but one of the 20 OECD countries that provide fewer instruction hours than Israel, the pupils achieved higher scores. In general, OECD countries provide 21\% less hours than Israel in reading, writing and literature while attaining 3\% higher reading scores. They provide 28\% fewer math instruction hours while achieving grades that are 4\% higher than Israel’s. In the natural sciences, the average number of instruction hours in the OECD is 29\% lower than in Israel, while scores are 6\% higher.

In summation, Israeli pupils receive more instruction time, yet attain lower achievements than pupils in nearly all of the OECD countries. This raises the question about what occurs within the classroom during those instruction hours.

**Class size and discipline**

\(^9\) Blass (2016) has shown that while the average psychometric scores of first-year education students in research universities have improved over the last decade, those of students in other institutions did not change.

\(^{10}\) Not all first-year education students end up working as teachers, though it is not clear whether those who do not join the teaching profession are from the upper part or from the lower part of the quality distribution. In addition, the ICBS (2017) has shown that the fraction of teachers who join the profession after completing their academic education has risen between 2008 and 2014. Also, Ritov and Kril (2017) show that the psychometric ranking of new teachers has been on the rise between 2007 and 2016.
While empirical evidence may be inconclusive with regard to the impact of class size on education outcomes, there is no doubt that Israel’s classrooms are – on average – very congested. The 40 children per class maximum is not a rarity in the country. There are 26.7 pupils in an average Israeli primary school class, compared to just 20.9 pupils in an average OECD classroom (Figure 24). The numbers are even higher in lower secondary schools, with 28.1 pupils per class in Israel versus 22.9 in the OECD. However, the number of pupils per full-time equivalent teacher in Israeli primary schools is nearly identical to the OECD average. In secondary schools, the number of pupils per teacher in Israel (11.2) is actually lower than the OECD average (13.4). In other words, there is no lack of teachers in Israel, and hence, this is not the reason for the large classes.

There is a question about what is transpiring within the Israeli classroom during these teaching hours. This may be affected by another factor that may be related to class size, though not necessarily so: class discipline. Gruber (2017) focused on discipline in the classroom from both a subjective perspective (how pupils view themselves) and an objective perspective (using quantifiable measures to proxy for discipline) and examined its impact on PISA grades. One of the first things that he found is a sizeable gap between how Israeli pupils perceive themselves and how they actually behave. A higher share of Israeli pupils disagreed with the subjective statement, “Pupils don’t listen to what the teacher says,” than was the case in the ten countries with the highest PISA math scores. For a more objective instrument for discipline, Gruber (2017) used absences and unapproved tardy class attendance. The share of Israeli pupils arriving late (without permission) to class was nearly double the OECD rate. Almost three-quarters of the pupils in the top ten countries were never tardy at all in the two weeks prior to the exam, compared to less than half of the pupils in Israel.

Using the objective discipline index in factor analysis, Gruber (2017) found that discipline has a major impact on scores. After controlling for a number of other determinants such as parental education, instruction hours, class size, country and so on, Gruber estimated the addition to PISA scores as a result of increasing the class objective discipline index by one unit (Figure 25). These increments range from 9 to 15 additional points in classes with no more
than 30 pupils. However, in classes with 31 to 35 pupils, a one unit improvement in the objective discipline index was found to improve PISA math scores by 25 points. When there are 36-40 pupils per class, the improvement in achievements equals 42 points. In the largest classes, with 41 to 50 pupils, scores rise by 53 points for each increase of one unit in the objective discipline index.

The interaction between class size and discipline provides additional insight to Israel’s low achievements when compared to other developed countries. The country’s classes tend to be more congested while its children – despite their somewhat delusional self-perception of discipline – are among the least disciplined in the developed world. This rather combustible combination yields a less than conducive learning environment. It is an issue that is exacerbated when taking into account the general quality of Israel’s teachers.

**Educational "streams"**

The meager achievements of the Arabic-speaking students in the international exams, and the large correlation between mother's education and child achievements, highlight the failure of the Israeli education system to provide equal opportunities to pupils. Israel’s education system is divided into four separate “streams”: secular Jewish, religious Jewish ultra-Orthodox Jewish, and Arab. These "streams" differ not only in curriculum but also in funding. It is a structure that can provides a relatively convenient avenue for providing extra funding to weak socioeconomic population groups, though the system has not taken full advantage of this opportunity. On one hand, as described above, the State generously funds private schools, including the ultra-Orthodox schools, with little influence over their curriculum. On the other hand, Arab schools do not receive sufficient funding to substantially narrow the achievement gap between them and the Jewish schools.

Klinov (2010) examined the resources allocated to primary and lower secondary schools in Israel between 2003 and 2008, and reported that the allocation of resources within the non-Haredi Jewish sector was quite progressive, while preferential funding for Arab and Haredi schools was insufficient. Blass (2015) described the changes in the preferential funding
provided to weak schools over the years and showed that they were biased towards sectors with political power rather than to sectors with the most urgent needs. He also found that the amounts allocated to preferential funding were too small to have significant impact. Moreover, Blass, Tsur and Zusman (2010) showed that at least part of the gap-reducing effect of the preferential funding to Arab schools is neutralized by extra school funding provided by economically strong Jewish municipalities.

While the division of the education system into “streams” may have had more advantages than disadvantages decades ago, when the vast majority of pupils studied in Jewish state schools (Blass and Shavit, 2016b), it is more problematic these days, when barely more than 50% of the pupils are in Jewish state schools (Ben-David, 2017). One outcome of the autonomy given to the separate “streams” is the ultra-Orthodox decision to deprive their school children of core fields of study, which becomes a huge obstacle if and when they subsequently decide to join the labor market.

**Early childhood education**

The importance of early childhood education to individual adult outcomes and the economy as a whole has been highlighted by Heckman (2006), among many others. While kindergarten education has been part of the free universal schooling provided by the Israeli authorities for many years, compulsory education for children in the 3-4 year-old age group was only legislated in 1984 and has begun to be implemented on a selective basis only in 1999, with priority given to municipalities with relatively low socioeconomic rankings (Kimhi, 2012b). Public preschools are jointly administered by the Ministry of Education and the municipal authorities, but the Ministry alone is responsible for preparing the curriculum and supervising the preschools. While there are numerous private pre-schools that must be licensed by the Ministry of Education, some operated by NGOs, in practice there is little control of their quality.

Preschool enrollment has been lower in Arab municipalities than in Jewish municipalities, but the enrollment gap has narrowed during 2000-2010 (Kimhi, 2012b). The
Trajtenberg Commission, appointed by the government after the social protests of 2011 in order to suggest changes in socioeconomic policy, recommended (among other things) the implementation of a Compulsory Education Law for children 3-years and older throughout the country, moving gradually to a longer school day in preschools, passing legislation for universal supervision of preschools, and moving the responsibility for the daycare system for 0-3-year-olds from the Ministry of the Economy to the Ministry of Education. The government adopted the commission’s recommendation for universal free public preschool for all in 2012, and began implementing it in 2013. Blass (2015) shows that this policy was regressive, with its funding of 2 billion NIS benefitting primarily those living in municipalities with high socioeconomic rankings who moved their preschool children from private to public institutions. Moreover, while enrollment rates of 3-4 year-old children in public institutions increased in both the Jewish and the Arab sectors, Israel's national expenditures per preschool pupil as a fraction of GDP per-capita is still very low compared to the OECD average (Shraberman and Blass, 2016).

6. The importance of high-school curriculum and academic fields of study

The sharp decline in the number of high-school students taking the math matriculation exam at the highest level (five units) in the years leading up to 2012 (Figure 26) motivated a Kimhi and Horovitz (2015) study on the impact of high-school math levels on future hourly wages at the age of 29. They found that those who took the math matriculation exam at the lowest level, three units, attained subsequent wages that were 19% higher than those who did not take the math matriculation exam. Those who took the exam at the intermediate level, four units, had 36% higher wages, while those who took the exam at the highest level, five units, had 60% higher wages (Figure 27).

11 Their data included some 14,000 people born in 1979, took the matriculation exams in 1997, and reported their labor market situation in the 2008 census of population.
The study of mathematics in high school has both direct and indirect effects on wages as adults. While simply knowing math at higher levels acts as a gateway to further knowledge accumulation in other fields dependent on math, the study of high-school math at higher levels is also a signal and a necessary condition for acceptance to top academic departments in the country’s best research universities. This, in turn, helps university graduates find jobs in high-paying occupations such as engineering and computer programming. To account for the direct and indirect effects of math level of study on future wages, Kimhi and Horovitz (2015) estimated a wage equation controlling for such factors as high school math grades, the existence of an academic degree and academic area of study (where relevant), economic branch and occupation, grades in other high school subjects and also socioeconomic background. The results, displayed in Figure 27, show that after all the other contributory factors were accounted for, math study at five units was found to have contributed to a statistically significant 7% increase in hourly wages compared to the case of not matriculating in math.

Kimhi and Horovitz (2015) simulated a number of scenarios showing how a shift from four units of math to five units would increase subsequent hourly wages (Figure 28). These wage increases were divided into their direct and indirect (via field of academic studies) impact. A key finding from this simulation is that the wage increase is substantially higher for women than for men in each of the various scenarios. This is mostly due to the indirect effect. In other words, a higher level of math matriculation is more important as a key to subsequent high-level academic studies for women than for men.

Of course, math is not the only matriculation field that is important for labor market outcomes. In Israel, a declining trend of studying STEM courses at the highest levels in high school has been documented since the mid-1990s (Figure 29). This highlights the need to broaden the scope of the analysis of Kimhi and Horovitz (2015) to additional fields of study. Using the same data, the log-wage equation was estimated as a function of the level of study in each and every matriculation field (with the number of units ranging from 0 to 5), as well as the matriculation grade in each of the fields, academic field of study differentiated into colleges and universities, occupation, industry, and socio-economic background. The equation was
corrected for selectivity into wage employment, using marital status, number of children, home ownership and number of rooms as identifying variables.

Selected regression coefficients are presented in tables 1-3. In all but a few instances, raising the level of study in a given high school field does not have a statistically significant effect on subsequent wages. Raising the level of math matriculation by one unit has a statistically significant direct hourly wage effect of almost 7% for females and almost 9% for males (Table 1). No other matriculation field has a statistically significant effect for both males and females. For males, raising the level of biology has a direct effect of 8%, while raising the level of Hebrew has a direct effect of under 6%. The level of physics has a surprisingly negative wage effect, but this can be explained by the structural multicollinearity between the level of study and the matriculation grade (which has a statistically significant positive coefficient), and by the fact that the number of high-school students taking the physics matriculation exam is rather small. For females, raising the level of biblical studies actually lowers subsequent hourly wages, and the same is true for the matriculation grade in that field. This probably indicates that females who study in religious schools (who are probably the majority of those taking the matriculation exam in bible at higher levels) do poorly in the labor market for reasons other than the level of biblical studies. Altogether, the decision of Kimhi and Horovitz (2015) to focus on the level of math matriculation is borne out by these results. The level of math is still the leading and most consistent determinant of future wages among all matriculation fields.

As shown earlier, in Figure 14, wage gaps among people who studied different academic disciplines can be quite high. This relationship is highlighted more explicitly in Table 2. Regardless of the field, all academic areas of study in research universities and all but two areas of study (life sciences and law) yield significantly higher wages than for women without an academic education. The higher education impact is considerably less widespread for men.

Computer science and exact sciences are the two leading fields for both males and females. After controlling for other covariates (see Table 2 for details), males who studied computer science in a research university earned 63% more per hour of work than those with
no higher education, while those who studied computer science in a college earned 52% more. Males with a degree in exact sciences from a research university earned 32% more, while those who studied in college did not enjoy a statistically significant wage premium. In the case of females, the leading field is also computer science with a 68% hourly wage premium for graduates from research universities and 60% for college graduates, over those with no higher education. This is followed by exact sciences with wage premiums of 54% (university) and 28% (college) and economics/business with wage premiums of 47% (university) and 29% (college).

It turns out that academic field of study seems to be more important for future wages than levels of matriculation exams. But this may be misleading, because studying the leading academic fields in research universities is limited to candidates who took the relevant matriculation exams at the highest levels. Therefore, the overall importance of the level of math matriculation is above and beyond its direct effect on wages as expressed by the regression coefficients. In turn, the field of academic studies contributes to future wages indirectly by channeling the graduates into more remunerative occupations such as managerial, academic and technical positions. As shown in Table 3, compared to unskilled workers, managerial occupations yield a wage premium of 30% and 33% for females and males, respectively. Academic occupations yield a wage premium of 22% and 26% for females and males, respectively, while technical occupations yield a wage premium of 20% and 18% for females and males, respectively. And this can again be tracked back to levels of matriculation fields.

The fact that so few pupils choose to take STEM matriculation exams at the higher levels is due, at least in part, to inadequate preparation that these pupils received at lower levels of the education systems, as reflected in the low achievements of the Israeli pupils in the international exams (Figure 8). In this respect, the aggressive promotion of studying math at the highest level by the Ministry of Education in the last two years perhaps had impressive immediate results as reflected by the sharp increase in the number of pupils taking math at the highest level (Figure 26), but did not take address the root causes of the problem.
7. Higher education

In the 1990s, Israel began filling in the gap between high school and top-tier research universities by establishing non-research colleges. These were initially intended to focus just on the provision of undergraduate degrees, though many have since begun to offer graduate degrees as well.

The colleges enabled the number of students per capita in Israel to take off. Initially, colleges acted as a complement to the universities, with enrollment in the universities (as a share of Israeli population) rising by 23% between 1990 and 2000 while the overall number of students in academia rose by 68% (Figure 30). The share of students per capita in the research universities then plateaued through the mid-2000s while the overall number of students per capita continues its steep climb. From this point, the colleges began to capture all of the incremental part of the population choosing to attain a higher education.

Between 2004 and 2012, the number of students per capita choosing to study in the research universities fell by 13% while the overall number attending institutions of higher education continued to rise. Since 2012, the share of students in Israel’s population has begun to fall. In light of the fact that the share of prime working age adults with an academic degree in the country is the fourth highest in the world (Figure 2), it is possible that Israel may have reached a saturation point in terms of the quantity of academic education demanded.

The de-emphasis of qualitative academic institutions in the nation’s budgetary priorities began far before the founding of non-research colleges in the 1990s. The starkness of this shift in national priorities can be seen in Figure 31, showing the share of senior faculty positions at the universities as a share of the population. In the 25 years that elapsed after 1948, the year that Israel attained its independence, the country’s population grew at a phenomenal 297%, while the number of senior faculty positions jumped by 3619%. Faced with tremendous economic hardships as it gathered in waves of new immigrants with little more than the clothes on their backs, the country also found the wherewithal to build research universities. By 1973,
there were seven such universities in Israel and the share of senior faculty positions per capita had risen over nine-fold.

Then came the Yom Kippur War and a subsequent turnaround in national priorities. Though the country’s population has risen by an additional 161% since then, and though Israel is much wealthier today – with a GDP per capita 107% greater in 2016 than it was in 1973 – the number of university senior faculty per capita has fallen to just 40% of what it was in 1973. Even when the public non-research colleges are included, the share of total senior faculty in Israel’s population is considerably below the 1973 heights, and it is declining.

A reflection of the shift in priorities is evident in the national higher education expenditures per student depicted in Figure 32. These expenditures fell steadily for decades, dropping by 60% from 1979 through 2009. Part of this reduction was certainly warranted by the large growth in undergraduate students attending the colleges. The cost of providing education to such students in these institutions is considerably less than the cost of educating students – particularly, graduate students – in full-fledged research universities. However, as noted above, this decline also reflects a national pivot away from the state-of-the-art institutions. There has been a small change in direction since 2010, resulting from a greater recognition of what has transpired in Israel since the 1970s and its socioeconomic implications on the future of the country. Whether this change will persist remains to be seen.

Consequently, Israel’s public expenditure per student in tertiary education is one of the lowest in the OECD (Ben-David, 2017). In and of itself, this does not imply a lower quality higher education system, as evidenced by some of the other countries ranked close to, or below, Israel. However, a low public expenditure per student implies that a greater share of the cost of an academic education needs to be borne by the students themselves. In fact, the share of household expenditures out of total tertiary expenditures in Israel places the country in the top third of the OECD.

Since students personally benefit financially from attaining an academic education, a good case can and should be made for why they should bear a large part of the cost. The fact that there is a major societal benefit from having a greater share of the population increase their
knowledge base means that society must also bear a part of the cost. After all, a worker who may not have a college education can personally benefit from the success of a firm with educated managers who navigate it well in competitive markets. Where to draw the line between the private and public contributions to a person’s academic education are determined on the basis of a host of idiosyncratic national characteristics and preferences.

The higher education expansion since the early 1990s was expected to shift the focus of the universities toward a greater emphasis on graduate study. As Israel has grown and the demand for workers with greater skills and higher education has risen, this change has indeed occurred. While the number of academic degrees awarded by Israel’s research universities rose by 31% between 1999 and 2014, the number of graduate degrees has increased by 85%. Accordingly, the share of graduate degrees out of the total number of degrees conferred by the universities has risen by 41%.

Today’s graduate students form the primary pool of the country’s future sources of research and innovation – which are the keys to economic growth. The higher the degree, the more personal the guidance needed from senior academic faculty members. Though this surge in the share of graduate students at the universities has transpired, there was no comparable increase in the number of senior faculty to teach and train the next generation. In fact, the opposite has occurred. In 1999, there was one senior faculty member for every 7.2 graduate students. By 2014, this changed to one senior faculty member per 10.6 graduate students in the research universities, a fall of 32% in the ratio of senior faculty members to graduate students.

The resultant impact of these changes does not bode well for the quality of graduate research. While many graduate students do not opt for research tracks, there has been a major increase in those who do. There are less mentors to provide the necessary personal guidance so important for students at these levels. Consequently, either the amount of time devoted to advising each student has fallen, or there has been a decline in the time spent by Israel’s leading researchers on their own research – or a combination of both outcomes.
The primary role of academia, other than educating students, is pushing the research envelope forward. Just how good are Israel’s academic institutions in this regard? The total number of publications, even if discounted by country size, are mere indicators of quantity. What actually counts is quality. One measure of quality could be the number of papers, or pages, published in top journals. While this can be considered an important measure at or near the time of publication – and top tier journals can certainly increase awareness for a paper, signaling its potential gravity to others within academia – the ultimate determinant of a paper’s research impact is the number of times that subsequent studies cite it as a stepping stone for their findings.

Using Web of Science data on citations and publications since 1975, it is possible to gauge the quality of Israel’s academic research in relation to other countries. In light of the massive labor intensity that such data collection requires, this study limited its focus to all countries currently members of the OECD and to five year intervals since 1975. Since the number of researchers and papers has increased considerably over time, there is little intrinsic value to be gained from examining how the average number of citations per article has changed over time. Hence, the analysis that follows focuses on a cross-country comparative analysis rather than on the examination of absolute changes over time.

Citation customs vary from discipline to discipline, as does the average number of articles published during a career and the average number of coauthors. Making a relatively strong – and potentially inaccurate – assumption that the law of large numbers guarantees that the distribution of disciplines is relatively similar across countries and over time, Figure 33 compares Israel to the OECD average as well as to the average for the G7 countries. In light of the fact that the world’s top universities tend to be located in the United States, a direct comparison between Israel and the U.S. is included as well.

The gaps between Israel and the other countries were quite large in 1975. Academic papers from Israeli universities were cited almost a third more than the OECD average and 16% more than the G7 average. On the other hand, they were cited 28% fewer times than papers originating in the United States. One of the interesting outcomes depicted in the figure...
is the steady convergence process that has taken place between Israel and each of the three groups – and between each of the groups with each other. By 2015, all of the gaps had nearly disappeared entirely.

In an effort to pare down the noise in the above comparison, the focus now turns to an examination of three specific disciplines: engineering, physics and computer science. Since the idea is to gain some insight with regard to the relative quality of each country’s cutting edge research, the noise at the national level is further reduced by concentrating only on the top five institutions in each of these fields in each country.

The Leiden Ranking, based exclusively on bibliographic data from the Web of Science database, was used to determine the top universities in each field and country. A university’s number of publications refers to articles published by its faculty members.12 Since the goal is to determine a country’s most important academic institutions in the chosen fields, the size of an institution also matters.

Some universities in a few of the countries attained high rankings on the basis of just a few publications. Hence, the median number of publications was used to reduce the presence of the small outlier institutions. Any university ranked among the top five that did not produce at least the median number of publications was removed and the next university in the ranking was included instead. In cases with multiple universities at the same ranking, the university with the highest number of publications was chosen.

The three panels of Figure 34 display the findings. In computer science, the top five Israeli universities had considerably fewer citations per article in 1975 than the average of the top five universities in the OECD countries, the average of the top five universities in the G7 countries, and the average for the top five American universities. This changed over the next decade and a half as the leading Israeli universities pulled ahead of the OECD and G7 averages, and substantially narrowed the gap with the top American universities. Over the subsequent quarter century, the Israeli lead over the OECD and G7 dissipated and eventually turned into a

---

12 Fractional counting was used to designate the share of a university’s authors out of a paper’s total. For instance, if publication’s authors include five individuals, with two of these come from the same university, that university will receive two-fifths of the credit for the article.
lag while the lag vis-à-vis the United States in 2015 was roughly half what it was in the late 1980s.

Through the 1970s and 1980s, Israel’s leading engineering departments closed the gap with the OECD leaders, eventually reaching and maintaining equality for the next three decades. It took 30 years to close the gap with the average of the five leading engineering departments in the G7 countries. The initial gap between America’s top five departments and Israel’s was the largest in 1975, with Israel’s leading engineering departments receiving almost 90% fewer citations per article. This gap declined steadily over the next three and a half decades, to just under 30% fewer citations per article.

In 1975, Israel’s top physics departments received more citations per article than the average for the top physics departments in the OECD, a bit fewer than the G7 average, and considerably fewer than the top US physics departments. By 2015, Israel, the OECD and the G7 averages converged and the gaps almost entirely eliminated. This occurred alongside a narrowing of the gap with the top American departments, a convergence that abated between the 1980s and the 2000s, and picked up again in recent years.

In general, it is possible to conclude that there has been a substantial convergence in top tier academic research across the developed world in general, and between Israel and the other countries in particular. There still remains a gap between the top American universities – which reflect the top of the top – and the leading Israeli universities. But the fact that this gap has substantially declined over the years is a good indication of the direction that academic research in Israel is headed.

The ability of Israel’s universities to remain centers of excellence depends on their ability to attract and retain the top researchers. It also depends on their ability to train future generations of students at the highest levels. In the final analysis, all of the above depends on the quality of the primary and secondary education funnel into higher education.

8. Conclusion
A superficial examination of Israel’s society would appear to indicate that the country has one of the most educated populations in the world – at least in terms of average number of schooling years per person and the number of academics per capita. The economic data provides a major warning light that something may be amiss in such a simplistic assessment. The country’s productivity levels are below those of most developed countries and have been falling further and further behind (in relative terms) the G7 countries for decades (Ben-David, 2015). In addition, Israel’s income inequality and poverty rates are among the highest in the developed world.

The amalgamation of low productivity levels and high poverty rates suggests that Israel provides a textbook case highlighting the importance of education quality, as opposed to education quantity. Despite some improvements in the quality of primary and secondary education, Israel’s pupils receive a failing grade in some core subjects and barely attain above a 60% correct response rate in other subjects. In international exams, Israel consistently scores below almost all developed countries. Haredi boys, who do not even study the material, do not participate in either the domestic or the international exams. Had this group – which is not only large, it is by far the fastest growing in Israel – participated in the exams, the national results would have been even lower.

Hanushek and Woessmann (2015) provide a glimpse of the potential economic impact resulting from an improvement in the quality of math education at the lower end of the spectrum. Their study posits the what-if question: by how much would a country’s GDP rise if it instituted education reform targeted only at raising the scores of pupils below level 2 in the PISA 2012 exam. Their simulation assumes that it takes 15 years to complete the education reform, and that it would take four decades until the only workers remaining are those who studied in the reformed system, and they calculate the present value of the increment to GDP over an 80 year life expectancy span of a person born in 2015.

To the extent that all countries raise the math achievements of their lowest achievers to at least the acceptable minimum score, then the main beneficiaries will be countries whom today have the highest share of children with low scores – chief among them is Israel. Thus,
while the leading countries can expect a present value of an increment amounting to “just” half as much more to a doubling of GDP, the authors calculate that the addition to Israel’s GDP will be three times its current GDP, or 3,462 billion shekels in 2015 terms. The 2015 Education Ministry budget of 51 billion shekels provides a bit of perspective as to the enormity of the economic transformation that Israel will undergo.

Such an education reform would reverse the multi-decade growth in the labor productivity gap between the G7 countries and Israel, shown by Ben-David (2015). Comparing the increment to annual growth rates of GDP per capita in G7 countries and in Israel shows just how sharp this turnaround would be. While economic growth in Japan would rise by 0.10% annually, the increase would be roughly a quarter of one percent in the U.S., Italy and France. Israel’s growth rates would rise by three-quarters more than in these three countries.

Even if the Hanushek-Woessmann projections are considerably off-mark and the benefits that accrue will be only half the estimated amounts, this would still be an outcome that would entirely change Israel’s standard of living and its rate of growth. One should bear in mind that a reform that can raise the score of the lowest achievers should do wonders for all the rest of the pupils not even included in the Hanushek-Woessmann simulations.

The common thread tying together all of the above is that the necessary resources appear to be available for providing a good primary and secondary education in Israel, whether in terms instruction hours, teacher availability and – at least in the case of primary schools – the overall education budget. The key issue is not a lack of resources but a major inefficiency in nearly all aspects of education provision (see also Klinov, 2010). Throwing money and instruction hours at the problem is not a cure. Only a serious, comprehensive, education reform can overcome some of the underlying inequalities that pupils bring with them to class.

It should be noted that what have been referred to as educational reforms in recent years did not do much more than major hikes in teachers’ wages. While raising teachers’ wages is an important step in and of itself for drawing better teachers into the system, that does not constitute a structural reform. First, the wage agreements were heavily biased towards experienced teachers, providing little incentive for young people with attractive alternatives to
join the profession.\textsuperscript{13} Second, the extra hours mandated by the new wage agreements stipulating that teachers have to stay in school to complete their off-class duties simply replaced the time that they devoted to these duties – perhaps more efficiently – at home. Finally, actual structural reform needs to include many additional changes needed for raising the quality of education in Israeli schools. Some of the other changes in the education system introduced over the past decade and a half – extending and improving the measurement of pupil achievements and teacher effectiveness, establishing the Avney Rosha Institute for training school principals and supervisors, initiating an academization of teaching colleges, reducing class sizes, promoting the study of math and English at higher levels, and favoring schools in localities with low socioeconomic status – were introduced in an ad-hoc manner rather than as parts of a comprehensive long-term strategy.

In academic education, what students study – and where – has a major impact on their occupational choices and on their subsequent wages. Average hourly wages in some disciplines can be several dozen percentage points higher than in other disciplines, with considerable wage gaps within the higher paying disciplines on the basis of the academic institution where the degrees were attained. While Israel has opened up a large number of non-research colleges to fill in the gap between high school and its cutting edge research universities, it has not established a single research university since the 1970s, though its population and standards of living have more than doubled. The number of senior faculty in the research universities, as a share of the population, has fallen by more than half since the mid-1970s.

Qualitatively, Israel’s research universities are a part of a larger convergence trend within the developed world. The gap in the number of citations per academic article between Israel and the OECD average, as well as between Israel and the G7 average has been nearly eliminated over the past 4 decades. This is true also with regard to the gap between Israel and the United States. A comparison of Israel’s leading universities and America’s leaders in a

\textsuperscript{13} The recent wage agreement signed with secondary school teachers in December 2017 tried to correct this bias and reduce the salary gaps between experienced and beginning teachers.
number of designated disciplines also indicates a substantial reduction in the gap over the past several decades.

The situation described in this study does not appear to be sustainable over the long run. If the primary and secondary school feeders into Israel’s academic system continue to remain at, or near, the bottom of the developed world, it is hard to see how the country will be able to retain its top tier research universities. From a wider perspective, the socioeconomic cost of providing such a poor education weighs down productivity and constrains future growth while at the same time increasing future welfare needs to care for a large and potentially growing segment of society lacking the qualitative tools needed for contending in a modern competitive economy. What has always been a fairly extensive brain drain out of Israel may turn into a mass exodus if the country continues falling further and further behind while needing to amass greater and greater financial resources to cover the costs of those left behind.

With the economic burden increasingly falling on fewer and fewer shoulders in a country situated in the most dangerous region on the planet, the provision of a considerably better education to those less fortunate is not altruism. It is self-preservation.
References

**English**


IEA (International Association for the Evaluation of Educational Achievement), various exam results.


OECD, various statistics.


PISA (Program for International Student Assessment), various exam results.


Taub Center (2015), A Picture of the Nation: Israel’s Society and Economy in Figures.

TIMSS (Trends in Mathematics and Science Studies), various exam results.


Web of Science, various statistics on academic publications and citations.


World Bank, World Development Indicators, various statistics.

Hebrew


Bank of Israel. Statistical Appendices to various Annual Reports, various years.


Bental, Benjamin and Dan Peled (2016), Is there a Shortage of Academic Degree Holders in Science and Technology? Samuel Neaman Institute working paper.

Blass, Nahum, Shay Tzur and Noam Zussman (2010), The Allocation of Teachers’ Working Hours in Primary Education, 2001-09, Bank of Israel research paper 2010:18. #


Central Bureau of Statistics, Expenditure Survey, various years.


Central Bureau of Statistics, Social Survey, various years.


Bank of Israel. Statistical Appendices to various Annual Reports, various years.


Bental, Benjamin and Dan Peled (2016), Is there a Shortage of Academic Degree Holders in Science and Technology? Samuel Neaman Institute working paper.

Blass, Nahum, Shay Tzur and Noam Zussman (2010), The Allocation of Teachers’ Working Hours in Primary Education, 2001-09, Bank of Israel research paper 2010:18. #


Central Bureau of Statistics, Expenditure Survey, various years.


Central Bureau of Statistics, Social Survey, various years.


Flug, Karnit (2015), *Productivity in Israel: the key to increasing the standard of living: overview and a look ahead*, speech by the Governor of the Bank of Israel at the Israel Economic Association Annual Conference.


Israel Bar Association (2016), statistics on Bar examinees.


Ministry of Bar Association, National Authority for Measurement and Evaluation in Education (RAMA), various statistics.

Ministry of Finance (2016), *State Revenue Administration Report*.


Table 1. Wage equations for females and males by matriculation levels and grades+

<table>
<thead>
<tr>
<th></th>
<th>females</th>
<th></th>
<th></th>
<th>males</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff. t-stat Sig.</td>
<td>Coeff. t-stat Sig.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Level of study</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>-0.0206 -1.11 0.266</td>
<td>0.0129 0.47 0.641</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bible</td>
<td>-0.0295 -2.83 0.005**</td>
<td>0.0117 0.60 0.551</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature</td>
<td>0.0147 1.30 0.192</td>
<td>0.0355 1.27 0.205</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hebrew</td>
<td>-0.0289 -1.59 0.113</td>
<td>0.0563 2.49 0.013*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>-0.0058 -0.40 0.687</td>
<td>-0.0126 -0.72 0.474</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citizenship</td>
<td>-0.0458 -1.06 0.288</td>
<td>-0.0349 -0.52 0.601</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>-0.0360 -0.87 0.383</td>
<td>-0.0982 -3.43 0.001**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>-0.0324 -1.28 0.200</td>
<td>0.0012 0.03 0.972</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>0.0032 0.12 0.901</td>
<td>0.0816 2.56 0.010**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer science</td>
<td>0.0149 0.81 0.418</td>
<td>0.0101 0.44 0.658</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>0.0694 3.45 0.001**</td>
<td>0.0870 2.97 0.003**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Matriculation grades</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>-0.0005 -0.56 0.572</td>
<td>-0.0021 -1.64 0.100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bible</td>
<td>-0.0019 -2.20 0.028*</td>
<td>-0.0008 -0.62 0.532</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature</td>
<td>-0.0018 -2.96 0.003**</td>
<td>0.0010 0.92 0.358</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hebrew</td>
<td>0.0023 1.55 0.122</td>
<td>-0.0021 -0.99 0.323</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>-0.0003 -0.35 0.724</td>
<td>-0.0015 -1.33 0.183</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citizenship</td>
<td>0.0012 1.32 0.185</td>
<td>-0.0010 -0.72 0.474</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>0.0013 0.51 0.607</td>
<td>0.0060 3.59 0.000**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry</td>
<td>0.0017 1.14 0.256</td>
<td>0.0008 0.38 0.703</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>-0.0001 -0.07 0.944</td>
<td>-0.0042 -2.10 0.036*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer science</td>
<td>0.0000 -0.06 0.953</td>
<td>0.0010 0.94 0.345</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>0.0028 4.03 0.000**</td>
<td>0.0004 0.39 0.698</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ Level of study measured in number of units, ranging from 0 to 5. The regressions also controlled for academic field of study differentiated into colleges and universities, occupation, industry, and socio-economic background (district of residence, nationality, parents’ continent of birth and immigrant status (before 1989 and 1989 and later). They were corrected for selectivity into wage employment using marital status, number of children, home ownership and number of rooms as identifying variables.

* Coefficient significant at 5%.
** Coefficient significant at 1%. 
Table 2. Wage equations for females and males by academic institution and discipline

<table>
<thead>
<tr>
<th></th>
<th>females</th>
<th>males</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>t-stat</td>
</tr>
<tr>
<td>Research universities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humanities/Judaism</td>
<td>0.124</td>
<td>3.24</td>
</tr>
<tr>
<td>Education</td>
<td>0.116</td>
<td>2.11</td>
</tr>
<tr>
<td>Life sciences</td>
<td>0.234</td>
<td>5.08</td>
</tr>
<tr>
<td>Social sciences</td>
<td>0.215</td>
<td>6.64</td>
</tr>
<tr>
<td>Law</td>
<td>0.223</td>
<td>3.69</td>
</tr>
<tr>
<td>Economics/business</td>
<td>0.467</td>
<td>9.25</td>
</tr>
<tr>
<td>Computer science</td>
<td>0.684</td>
<td>8.67</td>
</tr>
<tr>
<td>Exact sciences</td>
<td>0.541</td>
<td>9.00</td>
</tr>
<tr>
<td>Non-research colleges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humanities/Judaism</td>
<td>0.129</td>
<td>2.30</td>
</tr>
<tr>
<td>Education</td>
<td>0.240</td>
<td>2.65</td>
</tr>
<tr>
<td>Life sciences</td>
<td>0.195</td>
<td>1.71</td>
</tr>
<tr>
<td>Social sciences</td>
<td>0.172</td>
<td>4.17</td>
</tr>
<tr>
<td>Law</td>
<td>0.022</td>
<td>0.29</td>
</tr>
<tr>
<td>Economics/business</td>
<td>0.285</td>
<td>6.59</td>
</tr>
<tr>
<td>Computer science</td>
<td>0.607</td>
<td>8.58</td>
</tr>
<tr>
<td>Exact sciences</td>
<td>0.277</td>
<td>5.00</td>
</tr>
<tr>
<td>Non-academic study</td>
<td>0.108</td>
<td>4.37</td>
</tr>
<tr>
<td>Number of cases</td>
<td>4262</td>
<td></td>
</tr>
</tbody>
</table>

+ The excluded category is no academic studies. The regressions also controlled for the level of matriculation studies by field, matriculation grades by field, occupation, industry, and socio-economic background (district of residence, nationality, parents’ continent of birth and immigrant status (before 1989 and 1989 and later). They were corrected for selectivity into wage employment using marital status, number of children, home ownership and number of rooms as identifying variables.

* Coefficient significant at 5%.

** Coefficient significant at 1%. 
Table 3. Wage equations for females and males by occupation and industry

<table>
<thead>
<tr>
<th></th>
<th>females</th>
<th></th>
<th></th>
<th>males</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>t-stat</td>
<td>Sig.</td>
<td>Coeff.</td>
<td>t-stat</td>
<td>Sig.</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>0.2154</td>
<td>5.41</td>
<td>0.000**</td>
<td>0.2577</td>
<td>6.16</td>
<td>0.000**</td>
</tr>
<tr>
<td>Technical</td>
<td>0.1972</td>
<td>5.15</td>
<td>0.000**</td>
<td>0.1803</td>
<td>4.75</td>
<td>0.000**</td>
</tr>
<tr>
<td>Managerial</td>
<td>0.3045</td>
<td>6.37</td>
<td>0.000**</td>
<td>0.3277</td>
<td>7.02</td>
<td>0.000**</td>
</tr>
<tr>
<td>Clerical</td>
<td>0.0017</td>
<td>0.05</td>
<td>0.962</td>
<td>0.0634</td>
<td>1.60</td>
<td>0.109</td>
</tr>
<tr>
<td>Agents and sales</td>
<td>-0.0557</td>
<td>-1.46</td>
<td>0.145</td>
<td>-0.0054</td>
<td>-0.16</td>
<td>0.872</td>
</tr>
<tr>
<td>Skilled</td>
<td>-0.0458</td>
<td>-0.86</td>
<td>0.392</td>
<td>0.0144</td>
<td>0.47</td>
<td>0.641</td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>-0.1373</td>
<td>-2.10</td>
<td>0.036*</td>
<td>-0.0366</td>
<td>-0.89</td>
<td>0.374</td>
</tr>
<tr>
<td>Trade</td>
<td>-0.0428</td>
<td>-1.18</td>
<td>0.239</td>
<td>0.0479</td>
<td>1.49</td>
<td>0.137</td>
</tr>
<tr>
<td>Transportation</td>
<td>0.0324</td>
<td>0.81</td>
<td>0.418</td>
<td>0.0848</td>
<td>2.25</td>
<td>0.024*</td>
</tr>
<tr>
<td>Finance</td>
<td>0.0666</td>
<td>1.73</td>
<td>0.083</td>
<td>0.1332</td>
<td>2.61</td>
<td>0.009**</td>
</tr>
<tr>
<td>Real estate</td>
<td>-0.0174</td>
<td>-0.49</td>
<td>0.622</td>
<td>0.0328</td>
<td>0.99</td>
<td>0.323</td>
</tr>
<tr>
<td>Public management</td>
<td>-0.0191</td>
<td>-0.36</td>
<td>0.716</td>
<td>0.0084</td>
<td>0.17</td>
<td>0.865</td>
</tr>
<tr>
<td>Education</td>
<td>-0.0739</td>
<td>-1.95</td>
<td>0.051</td>
<td>0.0400</td>
<td>0.77</td>
<td>0.442</td>
</tr>
<tr>
<td>Health</td>
<td>-0.1022</td>
<td>-2.60</td>
<td>0.009**</td>
<td>0.0319</td>
<td>0.45</td>
<td>0.654</td>
</tr>
<tr>
<td>Private services</td>
<td>-0.0980</td>
<td>-2.16</td>
<td>0.031*</td>
<td>0.0476</td>
<td>0.85</td>
<td>0.397</td>
</tr>
<tr>
<td>Agriculture/manufacturing</td>
<td>-0.0227</td>
<td>-0.57</td>
<td>0.570</td>
<td>0.0926</td>
<td>2.98</td>
<td>0.003**</td>
</tr>
<tr>
<td><strong>Number of cases</strong></td>
<td>4262</td>
<td></td>
<td></td>
<td>3800</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ The regressions also controlled for the level of matriculation studies by field, matriculation grades by field, academic field of study differentiated into universities and colleges, and socio-economic background (district of residence, nationality, parents’ continent of birth and immigrant status (before 1989 and 1989 and later). They were corrected for selectivity into wage employment using marital status, number of children, home ownership and number of rooms as identifying variables.
++ the excluded category is unskilled workers
+++ the excluded category is public services
* Coefficient significant at 5%.
** Coefficient significant at 1%.
Figure 1

**AVERAGE YEARS OF SCHOOLING PER PERSON**

35-54 YEAR OLDS, 2010

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: Barro and Lee (2016)

---

Figure 2

**SHARE OF PERSONS WITH A TERTIARY DEGREE**

35-54 YEAR OLDS, 2010

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: Barro and Lee (2016)
**Figure 3**

**Education Groups, by Years of Schooling**

As share of total 35-54 year old population, 1970-2015

* As of 2012, the Central Bureau of Statistics changed the estimation methodology in labor force surveys. Data by school years in 1970-1978 includes Haredim. Since 1979, it excludes Haredim.

Source: Dan Ben-David and Oren Tirosh, Shoresh Institution
Data: Israel’s Central Bureau of Statistics

---

**Figure 4**

**Male Employment Rates, 1970-2015**

By education levels, 35-54 year olds

* As of 2012, the Central Bureau of Statistics changed the estimation methodology in labor force surveys.

** Data by school years in 1970-1978 includes Haredim. Since 1979, it excludes Haredim.

Source: Dan Ben-David and Oren Tirosh, Shoresh Institution
Data: Israel’s Central Bureau of Statistics
Figure 5
FEMALE EMPLOYMENT RATES, 1970-2015
BY EDUCATION LEVELS, 35-54 YEAR OLDS

As of 2012, the Central Bureau of Statistics changed the estimation methodology in labor force surveys.

Source: Dan Ben-David and Oren Tirosh, Shoresh Institution
Data: Israel’s Central Bureau of Statistics

Figure 6
HOURLY WAGES BY EDUCATION LEVEL
NIS, FULL-TIME EMPLOYEES, AGES 35-54
BY HIGHEST ATTAINED LEVEL OF EDUCATION, 2015

* high school matriculation

Source: Ayal Kimhi, Shoresh Institution and Hebrew University
Data: Israel’s Central Bureau of Statistics
Figure 7

ISRAELI SCORES ON PISA AND TIMSS EXAMS*
1999-2015

* PISA (15 year olds) and TIMSS (8th grade).
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: PISA and TIMSS

Figure 8

AVERAGE LEVEL OF EDUCATION IN DEVELOPED WORLD, PISA 2015

AVERAGE ACHIEVEMENT SCORES IN 25 OECD COUNTRIES AND IN ISRAEL*

* National average in math, science and reading exams. Israeli examinees did not include Haredi boys.
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: PISA and Israel’s National Authority for Educational Measurement and Evaluation
Figure 9

**EDUCATIONAL INEQUALITY IN DEVELOPED WORLD, PISA 2015**

* AVERAGE GAPS IN ACHIEVEMENT LEVELS IN 25 OECD COUNTRIES AND IN ISRAEL*

<table>
<thead>
<tr>
<th>Country</th>
<th>Gap 70-90</th>
<th>Gap 90-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Israel</td>
<td>96</td>
<td>100</td>
</tr>
<tr>
<td>France</td>
<td>84</td>
<td>98</td>
</tr>
<tr>
<td>New Zealand</td>
<td>83</td>
<td>95</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>82</td>
<td>93</td>
</tr>
<tr>
<td>Australia</td>
<td>82</td>
<td>92</td>
</tr>
<tr>
<td>Belgium</td>
<td>81</td>
<td>91</td>
</tr>
<tr>
<td>Sweden</td>
<td>81</td>
<td>91</td>
</tr>
<tr>
<td>Austria</td>
<td>81</td>
<td>91</td>
</tr>
<tr>
<td>Netherlands</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Switzerland</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Korea</td>
<td>79</td>
<td>90</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>Germany</td>
<td>89</td>
<td>91</td>
</tr>
<tr>
<td>Hungary</td>
<td>89</td>
<td>91</td>
</tr>
<tr>
<td>United States</td>
<td>88</td>
<td>91</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>87</td>
<td>91</td>
</tr>
<tr>
<td>Iceland</td>
<td>86</td>
<td>91</td>
</tr>
<tr>
<td>Norway</td>
<td>86</td>
<td>91</td>
</tr>
<tr>
<td>Portugal</td>
<td>85</td>
<td>91</td>
</tr>
<tr>
<td>Italy</td>
<td>86</td>
<td>91</td>
</tr>
<tr>
<td>Japan</td>
<td>85</td>
<td>91</td>
</tr>
<tr>
<td>Canada</td>
<td>81</td>
<td>91</td>
</tr>
<tr>
<td>Finland</td>
<td>81</td>
<td>91</td>
</tr>
<tr>
<td>Spain</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Denmark</td>
<td>79</td>
<td>90</td>
</tr>
<tr>
<td>Ireland</td>
<td>77</td>
<td>89</td>
</tr>
</tbody>
</table>

* National average standard deviation in math, science and reading exams. Israel is the base (100). Israeli examinees did not include Haredi boys.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: PISA

Figure 10

**GAPS IN GRADES RELATIVE TO PUPILS WHOSE MOTHER MATRICULATED FROM HIGH SCHOOL**

PERCENT GAPS, BY MATERNAL EDUCATION LEVEL

- no education: -16%
- primary: -20%
- lower secondary: -13%
- upper secondary: -4%
- tertiary non-academic: 3%
- academic degree: 15%

* Ten leading countries: Canada, Estonia, Finland, Hong Kong, Japan, Korea, Netherlands, Singapore, Switzerland, Taiwan

Source: Noam Gruber (Shoresh Institution research paper, 2017)
Data: PISA 2012
Figure 11

Scores on Meitsav Exams*, 8th Grade
Mean in 2008 = 500 (base)

* Not including Haredi boys.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: National Authority for Educational Measurement and Evaluation (ARAMA)

Figure 12

Percent Correct Responses in Meitsav Exams, 2016*

* Not including Haredi boys.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: National Authority for Educational Measurement and Evaluation (ARAMA)
**Figure 13**

**SHARE OF PUPILS WITH POOR PROBLEM SOLVING SKILLS IN G7 AND ISRAEL**

Per cent at or beneath lowest level* in PISA 2012

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent at or beneath lowest level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>7%</td>
</tr>
<tr>
<td>Canada</td>
<td>15%</td>
</tr>
<tr>
<td>England</td>
<td>16%</td>
</tr>
<tr>
<td>Italy</td>
<td>16%</td>
</tr>
<tr>
<td>France</td>
<td>16%</td>
</tr>
<tr>
<td>United States</td>
<td>18%</td>
</tr>
<tr>
<td>Germany</td>
<td>19%</td>
</tr>
<tr>
<td>Israel</td>
<td>39%</td>
</tr>
</tbody>
</table>

* The lowest problem solving level measured by the OECD is level 1, which defined as follows: “Level 1 students tend not to be able to plan ahead or set subgoals.”

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: PISA

---

**Figure 14**

**AVERAGE HOURLY WAGES BY ACADEMIC DISCIPLINE**

For salaried employees, comparison of university and college graduates, 2008

* excluding medicine

Source: Dan Ben-David, Ayal Kimhi and Moty Citrin, Shoresh Institution

Data: Israel’s Central Bureau of Statistics
Figure 15
HOURLY WAGES BY EDUCATION, GENDER AND SECTOR
NIS, FULL-TIME EMPLOYEES AGES 35-54,
BY HIGHEST ATTAINED LEVEL OF EDUCATION, 2015

Source: Ayal Kimhi, Shoresh Institution and Hebrew University
Data: Israel’s Central Bureau of Statistics

Figure 16
NATIONAL EDUCATION EXPENDITURE
AS SHARE OF GDP, 1970-2015

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Israel’s Central Bureau of Statistics
Figure 17

**EDUCATION EXPENDITURES**

**AS SHARE OF GDP, 2013**

* National expenditure in 2012.
** Public expenditure in 2012.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: OECD

Figure 18

**NATIONAL EDUCATION EXPENDITURES PER PUPIL**

**IN 2010 SHEKELS, 1979-2013**

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: Israel’s Central Bureau of Statistics
Figure 19
PUBLIC EXPENDITURE PER PUPIL
RELATIVE TO GDP PER CAPITA, 2013

Panel A
IN PRIMARY SCHOOLS

Panel B
IN SECONDARY SCHOOLS

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: OECD

Figure 20
PUBLIC EXPENDITURE PER PUPIL
RELATIVE TO GDP PER CAPITA, 2013

Panel A
IN PUBLIC SECONDARY SCHOOLS

Panel B
IN PRIVATE SECONDARY SCHOOLS

* when public funding accounts for under 50% of a school's income, that institution is considered a private school. Haredi (ultra-Orthodox) education, which is dependent primarily on donations, accounts for a large part of the private schools.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: OECD
### Figure 21

**Gaps in Teachers’ Salaries**

**Percent Difference Between Israel and OECD Average, 2014**

- Gap in salaries (in dollars) for Primary: 9%
- Gap in salaries per hour in dollars for Primary: 44%
- Gap in salaries per hour relative to GDP per hour for Primary: 62%
- Gap in salaries (in dollars) for Upper secondary: 34%
- Gap in salaries per hour in dollars for Upper secondary: 70%

* Annual average salaries (including bonuses and allowances) of 25-64 year old teachers in public institutions using purchasing power parities.
** Salaries per statutory hour worked.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: OECD

### Figure 22

**Education Students – Distribution and General Level**

**Distribution of Education Students**

- Distribution of education students by type of institution, first year undergraduate students, 2014-2015

- Teaching colleges: 79%
- Universities: 6%
- General colleges: 15%

**Average Psychometric Score**

- Average psychometric score by type of institution, all first year education students, 2014-2015

- Score above 74% of all examinees in Israel: 494
- Score above 69% of all examinees in Israel: 439
- Score above 62% of all examinees in Israel: 617
- Score above 55% of all examinees in Israel: 603

* The average psychometric score of all 1st year students in the general colleges was 529 (above 48% of all examinees in Israel).

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Israel’s Central Bureau of Statistics
**Figure 23**
**INSTRUCTION HOURS AND ACHIEVEMENT, 2015**

23 OECD COUNTRIES RELATIVE TO ISRAEL

<table>
<thead>
<tr>
<th>Country</th>
<th>Instruction Hours</th>
<th>Achievement Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hungary</td>
<td>-5%</td>
<td>-11%</td>
</tr>
<tr>
<td>Finland</td>
<td>-10%</td>
<td>4%</td>
</tr>
<tr>
<td>Korea</td>
<td>-10%</td>
<td>-10%</td>
</tr>
<tr>
<td>Austria</td>
<td>-10%</td>
<td>6%</td>
</tr>
<tr>
<td>Sweden</td>
<td>-11%</td>
<td>4%</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>-12%</td>
<td>3%</td>
</tr>
<tr>
<td>Belgium</td>
<td>-12%</td>
<td>7%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>-12%</td>
<td>3%</td>
</tr>
<tr>
<td>Japan</td>
<td>-13%</td>
<td>12%</td>
</tr>
<tr>
<td>Germany</td>
<td>-13%</td>
<td>8%</td>
</tr>
<tr>
<td>Italy</td>
<td>-13%</td>
<td>12%</td>
</tr>
<tr>
<td>Portugal</td>
<td>-15%</td>
<td>3%</td>
</tr>
<tr>
<td>Iceland</td>
<td>-15%</td>
<td>7%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>-15%</td>
<td>3%</td>
</tr>
<tr>
<td>Norway</td>
<td>-18%</td>
<td>3%</td>
</tr>
<tr>
<td>France</td>
<td>-18%</td>
<td>7%</td>
</tr>
<tr>
<td>Canada</td>
<td>-19%</td>
<td>11%</td>
</tr>
<tr>
<td>Ireland</td>
<td>-3%</td>
<td>13%</td>
</tr>
<tr>
<td>Netherlands</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Spain</td>
<td></td>
<td>7%</td>
</tr>
<tr>
<td>Australia</td>
<td></td>
<td>12%</td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td>13%</td>
</tr>
</tbody>
</table>

* Cumulative number of compulsory instruction hours in primary and lower secondary schools, and average achievement levels in math, science and reading in PISA 2015.

Source: Dan Ben-David, Shohresh Institution and Tel-Aviv University

Data: OECD

**Figure 24**
**NUMBER OF PUPILS PER CLASS AND PER TEACHER, 2014**

<table>
<thead>
<tr>
<th>Country</th>
<th>Average Class Size</th>
<th>Number of Pupils Per Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD</td>
<td>20.9</td>
<td>15.1</td>
</tr>
<tr>
<td>Israel</td>
<td>26.7</td>
<td>15.5</td>
</tr>
<tr>
<td>OECD</td>
<td>22.9</td>
<td>13.4</td>
</tr>
<tr>
<td>Israel</td>
<td>28.1</td>
<td>11.2</td>
</tr>
</tbody>
</table>

* According to full-time equivalents.

Source: Dan Ben-David, Shohresh Institution and Tel-Aviv University

Data: OECD
Figure 25

**IMPACT OF DISCIPLINE ON SCORE, BY CLASS SIZE**

Addition to score as a result of increasing the class objective discipline index by one unit.

* Addition to score after controlling for country, parental education (of the pupil and of the class average), hours of mathematics, private lessons, class size and individual discipline.

Source: Noam Gruber (Shoresh Institution research paper, 2017)
Data: PISA 2012

---

Figure 26

**SHARE OF TEST TAKERS IN 5 UNITS IN MATH**

Out of all 12th graders.

Source: Shoresh Institution for Socioeconomic Research
Data: Education Ministry
Figure 27
CONTRIBUTION OF MATH STUDY TO HOURLY WAGES
VERSUS INDIVIDUALS NOT MATRICULATING IN HIGH SCHOOL MATH**

Contributing variables:
A math grade
B academic degree
C area of academic study
D economic branch and profession
E other high school grades
F socioeconomic background

* variable that is not statistically significant
** among salaried employees, for each high school math level
*** gender, parents’ continent of birth, district of residence, religion, immigrant status, marital status, number of children, home ownership

Source: Ayal Kimhi and Arik Horovitz, Shoresh Institution
(based on findings from 2015 Taub Center study by the same authors)
Data: Central Bureau of Statistics

Figure 28
WAGE IMPACT OF SHIFT FROM 4 UNITS TO 5 UNITS OF MATH
SIMULATED INCREASE IN SALARIED EMPLOYEES’ HOURLY WAGES

Impact via area of academic studies
Direct impact

Women
Men

Source: Ayal Kimhi and Arik Horovitz, Shoresh Institution
(based on findings from 2015 Taub Center study by the same authors)
Data: Central Bureau of Statistics
Figure 29
SHARE OF 12TH GRADERS TAKING HIGH LEVEL MATH AND SCIENCE COURSES*

* share of matriculation (bagrut) examinees taking at least two subjects in the math and sciences fields at the level of at least 4 units.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Israel’s Central Bureau of Statistics

Figure 30
TOTAL NUMBER OF STUDENTS IN HIGHER EDUCATION
PER 100 THOUSAND POPULATION, 1990-2016

* Total number of students in research universities and non-research colleges.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Israel’s Central Bureau of Statistics and the Council for Higher Education
Figure 31
**SENIOR RESEARCH FACULTY IN UNIVERSITIES**
PER 100 THOUSAND POPULATION, 1948-2016

* Senior research faculty includes full professors, associate professors, senior lecturers and lecturers. Basis of data changed in 2011.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Israel’s Central Bureau of Statistics and the Council for Higher Education

![Graph showing senior research faculty in universities per 100 thousand population, 1948-2016.](image)

Figure 32
**NATIONAL HIGHER EDUCATION EXPENDITURES PER STUDENT**
IN 2010 SHEKELS, 1979-2013

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Israel’s Central Bureau of Statistics

![Graph showing national higher education expenditures per student in 2010 shekels, 1979-2013.](image)
Figure 33

AVERAGE CITATIONS* PER PUBLICATION

PERCENT DIFFERENCES BETWEEN ISRAEL AND OECD, G7 AND THE US

* Observations at five year intervals. Citations exclude self-citations.

Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Web of Science
Figure 34
CITATIONS PER PUBLICATION* IN EACH COUNTRY’S TOP 5 ACADEMIC INSTITUTIONS
PERCENT DIFFERENCES BETWEEN ISRAEL AND OTHERS IN SELECTED FIELDS, 1975-2015

**ECONOMICS OF EDUCATION IN ISRAEL**
Dan Ben-David and Ayal Kimhi

* Observations at five year intervals. Citations exclude self-citations.
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University
Data: Web of Science