

## Shores Research Paper

# An Overview of Israel's Education System and its Impact

Dan Ben-David and Ayal Kimhi \*

### Abstract

Israel is at a crossroads. It has one of the lowest productivity levels and 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 are converging with the top American universities. The knowledge needed to raise Israel to viable economic trajectories exists within its borders. But, an extremely inadequate education system is unable to channel this knowledge effectively to the primary and secondary schools, which in turn limits the 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.

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\* Prof. Dan Ben-David, President, Shores Institution for Socioeconomic Research; Department of Public Policy, Tel Aviv University. Prof. Ayal Kimhi, Vice President, Shores Institution for Socioeconomic Research, Department of Environmental Economics and Management, Hebrew University. The authors thank the Maurice Falk Institute for Economic Research in Israel for financial support, and Anbar Aizenman, David Caro, Moty Citrin and Michael Crystal for their research assistance.

# **An Overview of Israel's Education System and its Impact**

Dan Ben-David and Ayal Kimhi

## **1. Introduction**

Israel's education system is, in many respects, an enigma. It is at once the home of some of the world's best universities, while also home to one of the worst primary and secondary education systems in developed countries.

Anecdotal evidence suggests that Israel's education system – or at least, large swathes of it – were actually very good once. In lieu of actual data, this is not possible to confirm.<sup>1</sup>

On paper, Israel has one of the most educated populations in the world, both in terms of average years of schooling and in terms of the share having an academic education. On the other hand, its productivity is not only low, it has been falling farther and farther behind the developed countries for decades, with the share of its population falling below the poverty line the highest in the developed world (Ben-David, 2016).

Vast discrepancies in the educational level of parents across Israel's religious and ethnic divides are carried over into the next generation. As is the case in other countries, the level of pupil achievement is highly related to the education levels of the parents – and, in particular, the mother's education.

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<sup>1</sup> It is possible that the economic situation of the country during its early decades did not offer much in the way of opportunities for many of the educated immigrants that reached its shores, causing a large number to choose teaching as their way of making ends meet. The free lunch experienced by Israel also extended to academia, where many of its first top scholars – those who helped to set the subsequent high standards – were born and trained abroad, at no cost to Israel, but to the great benefit of its future.

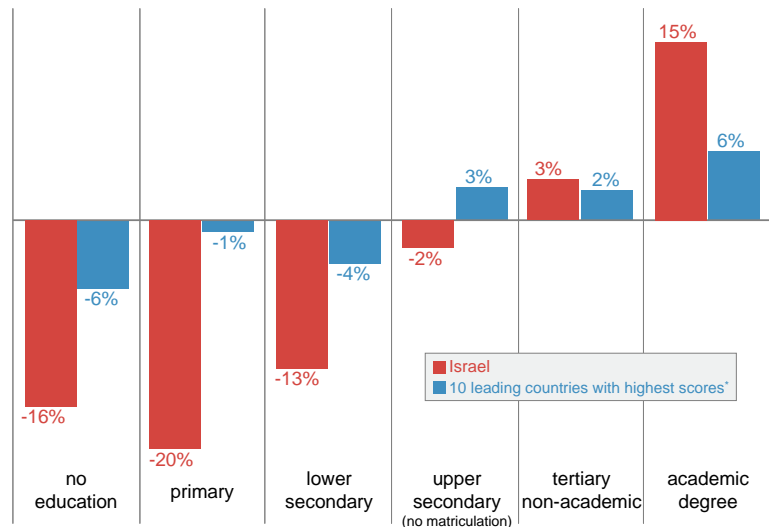
The failure of Israel's education system in reducing gaps – in comparison with other developed countries – is highlighted in Figure 1, which compares the PISA math achievements of pupils according to their mothers' education. All comparisons are made to the test scores of children whose mothers matriculated 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 study beyond primary school 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.

A country's education system is its primary mechanism for reducing 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

Figure 1  
GAPS IN GRADES RELATIVE TO PUPILS WHOSE  
MOTHER MATRICULATED FROM HIGH SCHOOL  
PERCENT GAPS, BY MATERNAL EDUCATION LEVEL



\* 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

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.

To get a better understanding of how such an ostensibly educated population has such low productivity and such high rates of poverty and inequality, this paper examines Israel's education system and its socioeconomic impact. Section Two provides some background and a review of previous studies that have examined the education system in Israel and elsewhere. The section analyzes quantitative measures of education and their impact on the labor market in section three. The fourth section turns to an examination of the quality of education in Israel and its economic impact. Section Five highlights the economic impact of improving math education at both the upper and lower ends of the achievement spectrum. Section Six illustrates basic facts and questions raised on the state of Israel's education. Section Seven examines the country's higher education system, while Section Eight concludes.

## **2. Background**

The theory of the firm holds that inputs are translated into output by means of a production function. Assessing the relationship between output and inputs over time requires an accurate measurement of inputs and output, 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 one rely solely on the size of the education budget to represent input? Given that the vast majority of the education budget goes toward teacher salaries, the question is: 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? Can one rely on the number of pupils per class (which is affected by both wage spending and physical infrastructure) to reflect the quality of teaching? And how can the education system's output be measured? Is it sufficient to rely

on quantitative indices, such as high school graduation rates, matriculation rates, and the percentage of persons with academic degrees, 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 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, starting with the early studies of Mincer (1958), Schultz (1961) and Becker (1962), who coined the term. 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 teaching skills.

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. They also found that academic schooling has a greater effect on output and productivity and recommended strengthening 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, Friedman, Hilger, Saez, Schanzenbach and Yagan, 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), subjects studied in high school (Altonji, 1995; Levine and Zimmerman, 1995; Rose and Betts, 2004; Morin, 2013; French et al., 2015), and preschool enrichment/early intervention programs (Crocker, Thomas, and Currie, 2002; Heckman, 2006) – were all found to have an 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 (2016) discovered that the choice of academic field of study explains one-fifth of 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 may increase future wages by about eight percent.

The importance of educational quality raises the question of how countries can upgrade this area. While some may believe that larger budgets improve pupil achievements in public education systems, 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. 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 despite 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 exams are below most of 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). Shavit and Feniger (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 budget increases led to an extended school week and more instructional time spent on the core subjects of mathematics, science, and the English and Hebrew languages. This teaching upgrade resulted in improved pupil achievements in the relevant subjects. It was 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. Angrist and Lavy (2002) found that introducing computers into primary and lower secondary classrooms during the 1990s 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. 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 reduced 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 pass 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. Studies on



the impact of class size in other countries have not been uniform in their conclusions. For example, Chetty, Friedman, Hilger, Saez, Schanzenbach and Yagan (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.

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 entirely eliminated. 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, increases in the time devoted to homework, overall pupil satisfaction with the school, and a reduction in 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 are more effective in improving the scores of girls and pupils from socioeconomically disadvantaged backgrounds, while modern methods 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 entirely 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 there are substantial social and economic benefits of education at the national level that compound the private benefits to individuals, the policy challenge is to take the educational 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.<sup>2</sup> 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 2). 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 3). 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%).

Figure 2  
AVERAGE YEARS OF SCHOOLING PER PERSON  
35-54 YEAR OLDS, 2010

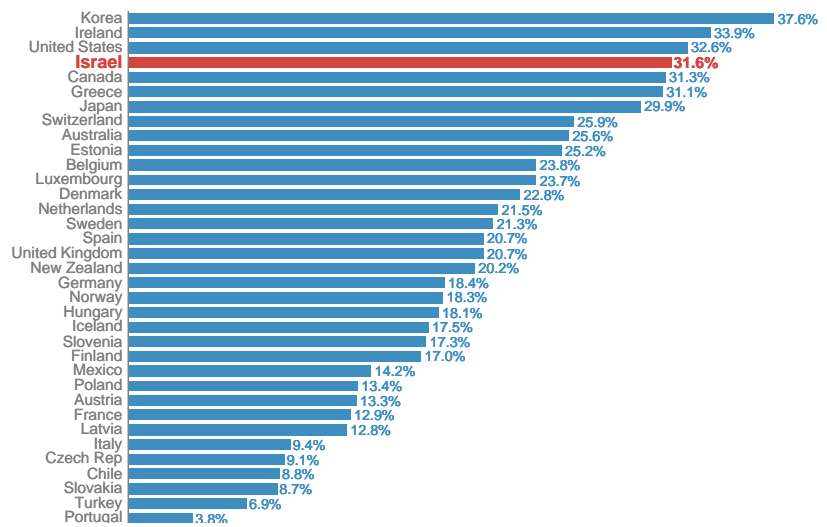


Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: Barro and Lee (2016)

<sup>2</sup> 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.

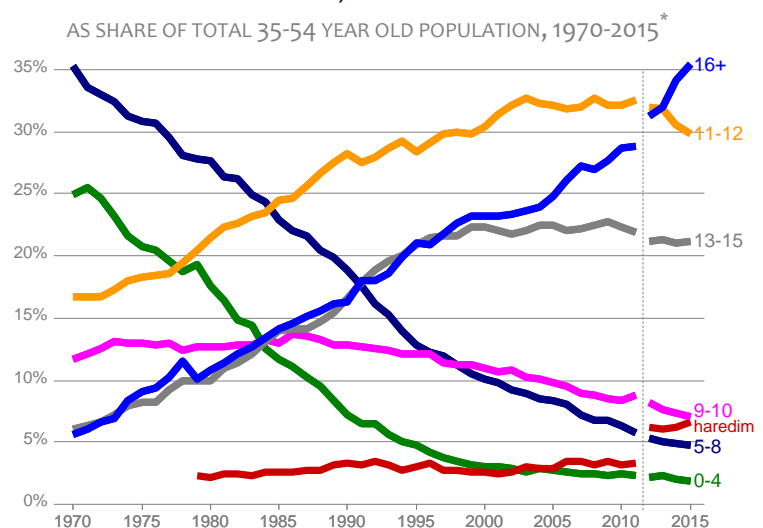
This shift in educational attainment over the years has been dramatic. Figure 4 displays the distribution of Israel's prime working age population – by years of schooling. Haredim (ultra-Orthodox Jews) are listed separately in Figure 4 and not divided by years of schooling because nearly all Haredi men 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 when this clearly designates something else entirely than for the remainder of the population. 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 having been the smallest in 1970 to its current position as the largest education group in Israel.

Figure 3  
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 4  
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. Since 2012, Haredim are self-identified in the data. Data by school years before 1979 includes Haredim.

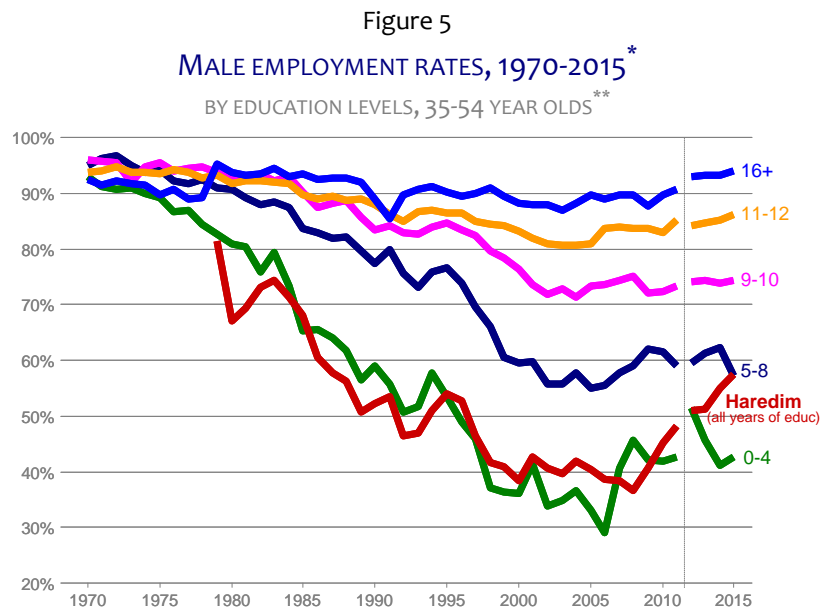
Source: Dan Ben-David and Oren Tirosh, Shoresh Institution  
Data: Israel's Central Bureau of Statistics

As Israel's economy has grown, it has shifted away from productive sectors necessitating 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 5. 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 as a result of significant cuts in welfare benefits.

While the share of non-Haredi men with very low levels of education has declined over the years, the share of Haredi men – most of whom have no more than 8 years of formal education including a core curriculum – has been rising. Two factors have contributed to the declining Haredi employment rates: (a) changing demand that has shifted away from the less skilled and poorly educated, and (b) greater welfare benefits that reduced supply.



\* 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

Though there is no reason to assume that Haredi education has become worse over the years, the fact that Israel's economy has evolved in a direction requiring better education and greater skills has translated into a declining employment share among Haredi men who are increasingly being left behind. Over 80% of them were employed in 1979. By the last decade, this share fell to less than 40%. While Haredim account for about 7% of the prime working age population, they account for 19% of all first-graders, indicating just how rapidly this group is growing and how quickly this issue may escalate into unmanageable proportions, if not addressed.

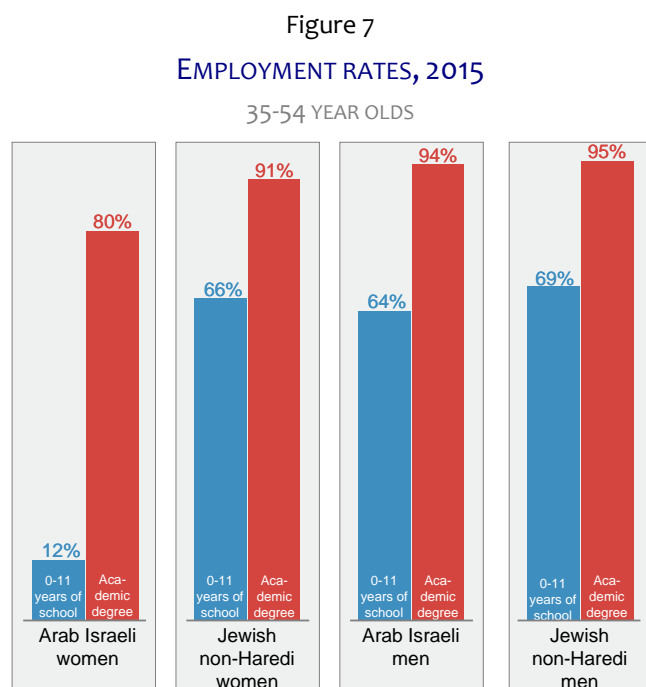
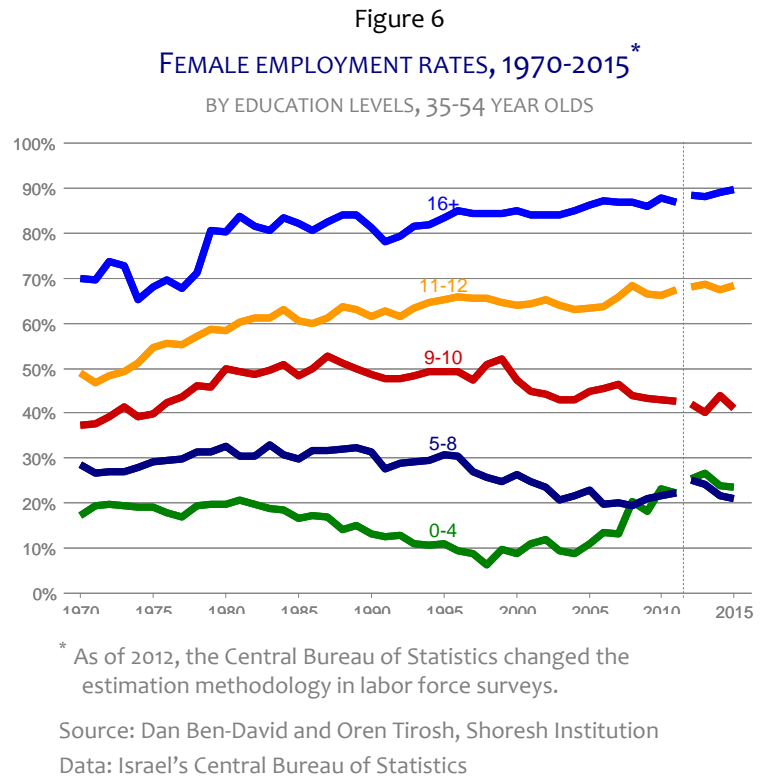
The decline in Haredi employment was enhanced by their rising political power, which translated into substantial increases in welfare and other assistance that could enable so many men to choose life-styles of non-work. For example, average income supplements per recipient and average child benefits per recipient grew by 57% each in real terms between 1983 and 2001.

Israel's major recession in the early 2000s led to extensive budget cuts, including many welfare benefits. By 2005, average income supplements per recipient had fallen by 26% while average child benefits per recipient fell by 46% (Ben-David, 2016). Over the next decade, average income supplements per recipient recovered a bit, rising by 6% through 2015, while average child benefits per recipient fell a further 13%. As Ben-David shows, these large reductions in benefits were accompanied by substantial changes in the labor market – particularly among the less educated. Among the prime working age population with 16 or more years of education, each addition of 100 persons to this population was accompanied by an increase of 95 additional employed persons from 2002 to 2015. By contrast, in the prime working age population with less years of schooling, each increase of 100 persons in the population was accompanied by an increase of 270 employed persons. In other words, many less educated persons who had not worked before began to enter the labor market, including many Haredim, since the early 2000s.

The importance of education for female employment is shown in Figure 6. Despite the increase in supply of more educated women, corresponding increases in demand have led

to higher employment rates. There has always been a gap between employment rates of the various education groups, though this gap has widened over the decades. As Kimhi (2012) shows, the primary source of the vastly increased female employment rates at the national level is due to more and more women moving up the education ladder into successively higher education groups that are characterized by higher employment rates.

Education's impact on employment crosses gender and religious lines. Figure 7 compares employment rates among poorly educated and highly educated prime working age Jewish (non-Haredi) and Arab Israelis, men and women. Only 12% of Arab Israeli women who did not complete high school and have no more than 11 years of schooling were employed in 2015. About two-thirds of similarly educated Jewish women and men of both religions are employed. At the other end of the education spectrum, nearly all Jewish (95%) and Arab Israeli (94%) prime working age men with academic degrees are employed, alongside 91% of similarly educated Jewish women. Employment rates among Arab Israeli



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



women are lower (80%), but are, nonetheless, in a different league from what is transpiring among the less educated Arab Israeli women.

The conventional wisdom in Israel, that Arab Israeli women do not work, is based primarily on the fact that a very large share of such women have low levels of education. Higher levels of education lead to substantially higher employment rates for all population groups.

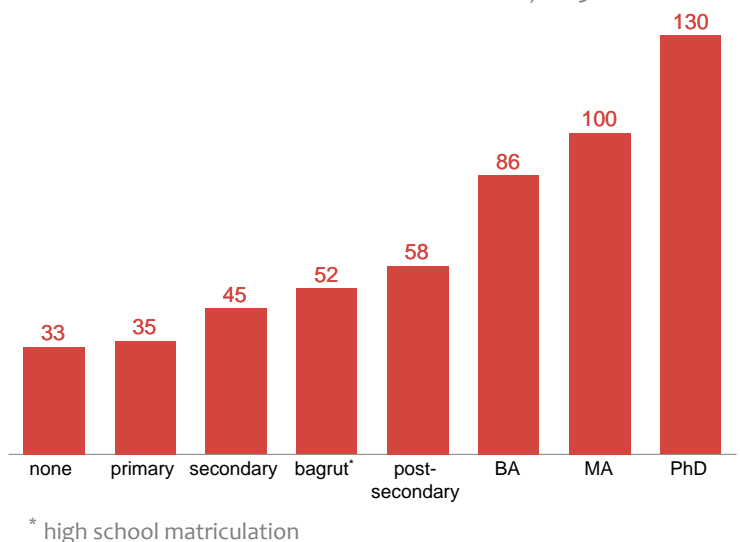
Higher levels of education also lead to higher wages. Figure 8 displays the gap in hourly wages between full-time prime working age employees with 12 years of schooling at most and those with 13 or more years of schooling. From 1999 to 2007, the 13+ group earned approximately 60% more than the 0-12 group. Since then, this gap has risen substantially, reaching 95% by 2015.

The spectrum of hourly wages for full-time, prime working age employees can be seen in Figure 9. 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 BAs, 100 shekels per hour for those with MAs, and 130 shekels per hour for employees with PhDs.

Figure 8  
GAP IN HOURLY WAGES BETWEEN EMPLOYEES WITH  
13+ AND 0-12 YEARS OF SCHOOLING, 1999-2015



Figure 9  
HOURLY WAGES BY EDUCATION LEVEL  
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



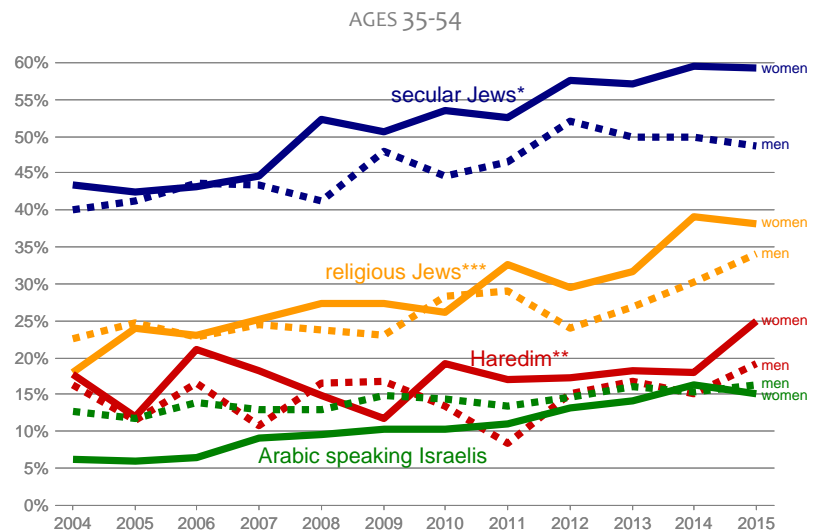
An examination of academic degree attainment rates and their changes over time (Figure 10) provides a glimpse of the high degree of disparity between key population groups in Israel. Secular (non-religious) Jews comprise the most highly educated group in the country. Not only is the this group's share of individuals with academic degrees substantially higher than in all of the other groups, it has also been rising over the past decade for the women, and

during most of the past decade – with some stagnation in recent years – for the men. Half of prime working age secular Jewish men in Israel have academic degrees, while nearly 60% of the secular Jewish women have attained one, as well.

Religious Jews – those spanning the spectrum between secular and Haredi Jews – had considerably lower rates of academic attainment than secular Jews in the mid-2000s. Since then, the share of prime working age religious men and women has climbed steadily, by almost a half (from 23% to 34%) for the men and over two-fold (from 18% to 38%) for the women. As in the case of secular Jews, and as is prevalent in much of the developed world, the share of religious women with academic degrees is greater than the men's share.

The prevailing wisdom in Israel with regard to Haredim is that the country has begun to turn the corner on their academic education, with a plethora of new higher education possibilities opening up to Haredim and substantial increases in their registration to these institutions. A more precise examination of the evidence suggests that this is no more than a misconception.

Figure 10  
SHARE OF ISRAELIS WITH ACADEMIC DEGREES, 2004-2015



\* Non-religious Jews

\*\* ultra-Orthodox Jews

\*\*\* Jews ranging from traditional through Orthodox

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

Data: Israel's Central Bureau of Statistics

While the sample is small, leading to high annual variability, the share of prime working age Haredim with an academic degree is both very low and has also been relatively constant over the past decade. There was an increase in 2015 that may, or may not, signal a change in trend for the future. Two commonly overlooked factors underlie the perception of a major improvement that is not borne out by the data. The first is that the Haredi population is growing very quickly, so there are many more Haredim in general, and not just those trying their luck in academia. This is why the figure focuses on population shares rather than on absolute numbers. Second, simply starting down the academic road does not imply successful completion of the entire route and the eventual attainment of an academic degree. The very poor primary and secondary school education that Haredim receive (men, in particular) acts a major stumbling block when they become adults and contributes to more Haredim dropping out than those completing an academic degree.

The fact that Haredim in other countries are not allowed to deprive their children of a complete core curriculum as mandated by law in all of the developed world – except in Israel – provides Haredim in those countries with better prospects of successfully completing academic degrees. For example, 25% of American Haredim above the age of 20 have an academic degree (PEW, 2015), which is low compared to other population groups in the United States, but just over double the 12% rate for Israeli Haredim (Ben-David, 2015).

The population group with the lowest rates of academic attainment are Arabic speaking Israelis, though their rates of academic degree attainment have been steadily climbing since the mid-2000s. This is especially true for the women, rising from 6% in 2004 to 15% in 2015 (from 13% to 16% for the men).

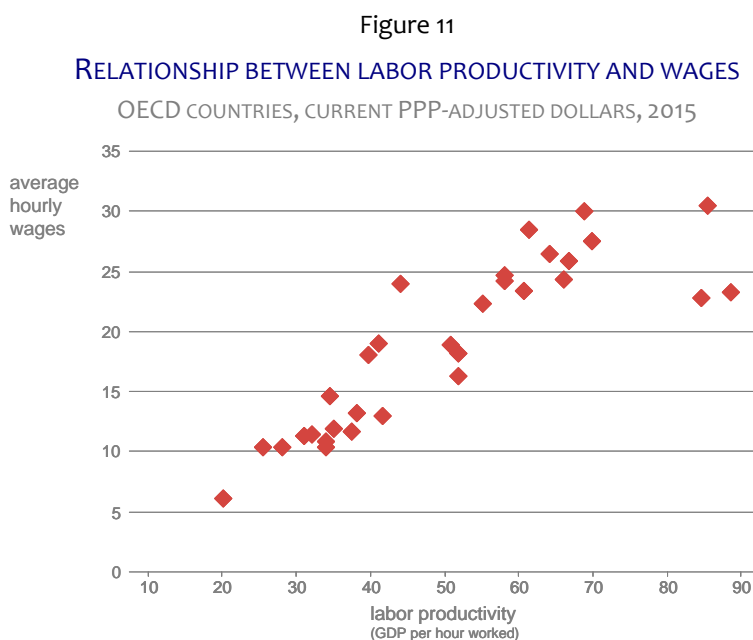
There are vast differences within the Arabic speaking group. In 2004, 10% of prime working age Muslim men attained an academic degree, compared to 15% of the Druze men. Christian Arab Israelis, whose primary and secondary education system is considerably better than that of the Muslims and Druze, also have much higher academic completion rates, with 23% of these men receiving degrees in 2004. In all of these groups, the increases in

academic degrees per capita were substantial: rising to 14% for Muslim men, 22% for Druze men, and 31% for Christian Arab men.

The increases for women in two of the three Arab speaking groups was even greater than the increases exhibited by the men. Muslim women saw an almost three-fold increase within just over a decade in the share with academic degrees, from the extremely low 4.6% in 2004 to the still low – but considerably higher – 13.5% in 2015. The share of prime working age Druze women with academic degrees rose from 6.7% to 10.8% during the same time span. Christian Arab woman exhibited a doubling in their rates of academic attainment, from 16.4% in 2004 to 22.1% in 2015, becoming the only Arabic speaking community in Israel in which there is a greater share of women than men with academic degrees.

Human capital plays a major role in determining the amount produced per hour of work, or labor productivity. In the final analysis, labor productivity determines how high hourly wages can rise. This positive link between hourly wages and hourly production across OECD countries (Figure 11) is visually apparent, despite the relative outliers (Luxembourg and Ireland). Clearly, other factors may play a role in loosening this relationship, but it does appear to hold in general.

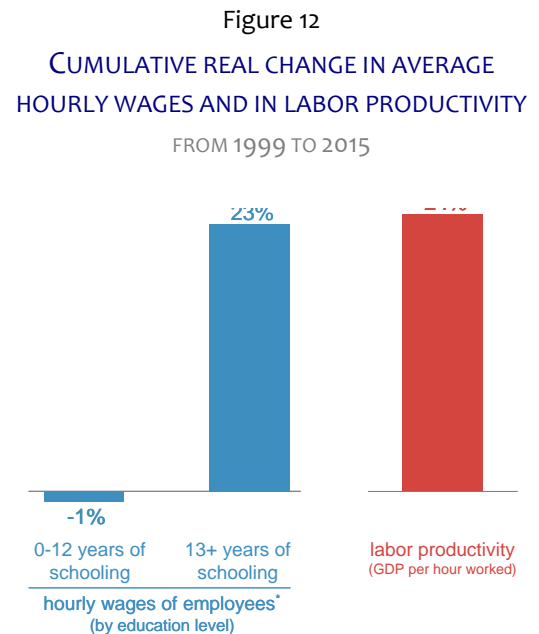
What transpired within Israel since 1999 is a case in point. The major recession that the country underwent in the early 2000s led to wage reductions in both the 0-12 and 13+ education groups. The wage paths of the two groups diverged in the recession's aftermath. While structural changes inherent in the growth process reduced demand for the less skilled and poorly educated, the major cuts in welfare benefits



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

discussed above led many of the less educated to enter the labor market for the first time – thus driving up the supply of the less educated, further dampening their wages. Between 2006 and 2011, this process resulted in a drop of over 10% in the wages of employees with 0-12 years of schooling. In the years since 2011, wages of this education group recovered, returning to a level just 1% below the 1999 levels.

This outcome contrasts sharply with what has taken place among employees with 13+ years of schooling. The growth process led to increases in demand for this group after Israel emerged from its recession, resulting in substantial real wage increases. Overall, wages of employees with 13+ years of schooling rose by 23% from 1999 through 2015, almost identical to the 24% increase in labor productivity during this period (Figure 12).



\* Full-time employees, ages 35-54

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

## 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 (as measured by the number of school years per person or the share of individuals with academic degrees) is insufficient. It has one of the most educated societies in the OECD – when measured by education quantity, as opposed to quality – alongside labor productivity that is below most OECD countries (Figure 13). Not only is its labor productivity relatively low, it has been steadily falling further and further behind the average labor productivity of the G7 countries since the 1970s (Figure 14) – an outcome that is diametrically opposed to what one might expect in a country that caught up with, and even surpassed, nearly all of the developed world in terms of the quantitative education measures.

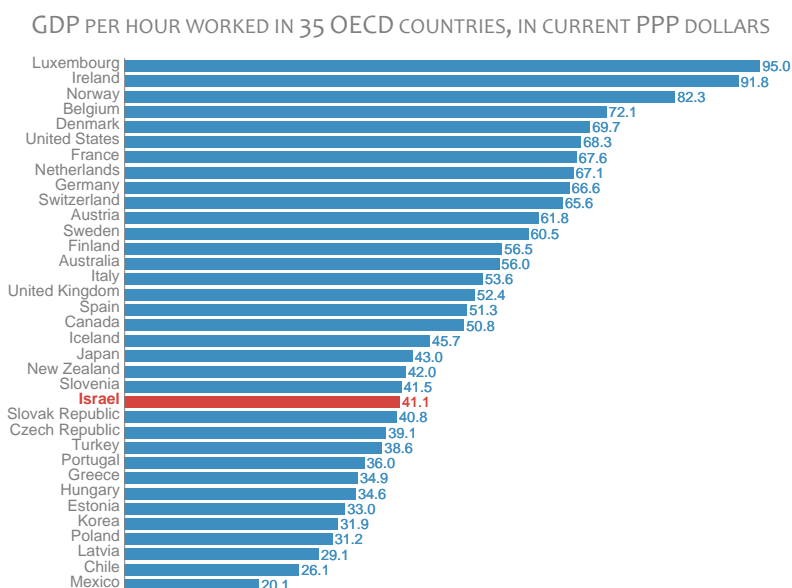
Low physical capital investments also played a key role in dampening Israeli productivity (Ben-David 2017). Similarly, insufficient transportation infrastructure investments, causing extraordinarily heavy traffic congestion, further depressed productivity. For example, Israel has over three times the number of vehicles per kilometer road than the OECD average, though it has 38% fewer vehicles per capita (Ben-David 2015).

And yet, even within the education realm, an important ingredient is missing from the analysis thus far: education quality. 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 (Figure 15), 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 (Figure 16).

A year of schooling in Japan or Canada, for example, is not equivalent to a year of education in Thailand or India – or to a year of schooling in Israel. 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

Figure 13

### LABOR PRODUCTIVITY IN 2015

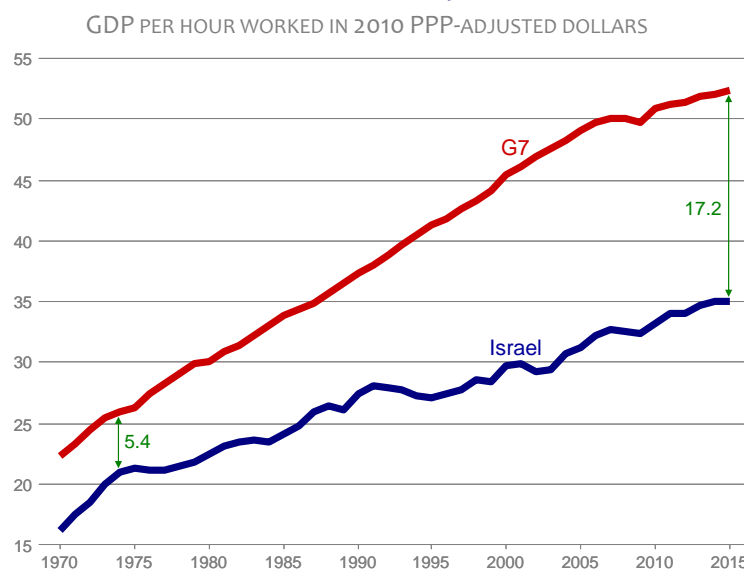


Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: OECD

Figure 14

### LABOR PRODUCTIVITY, 1970-2015

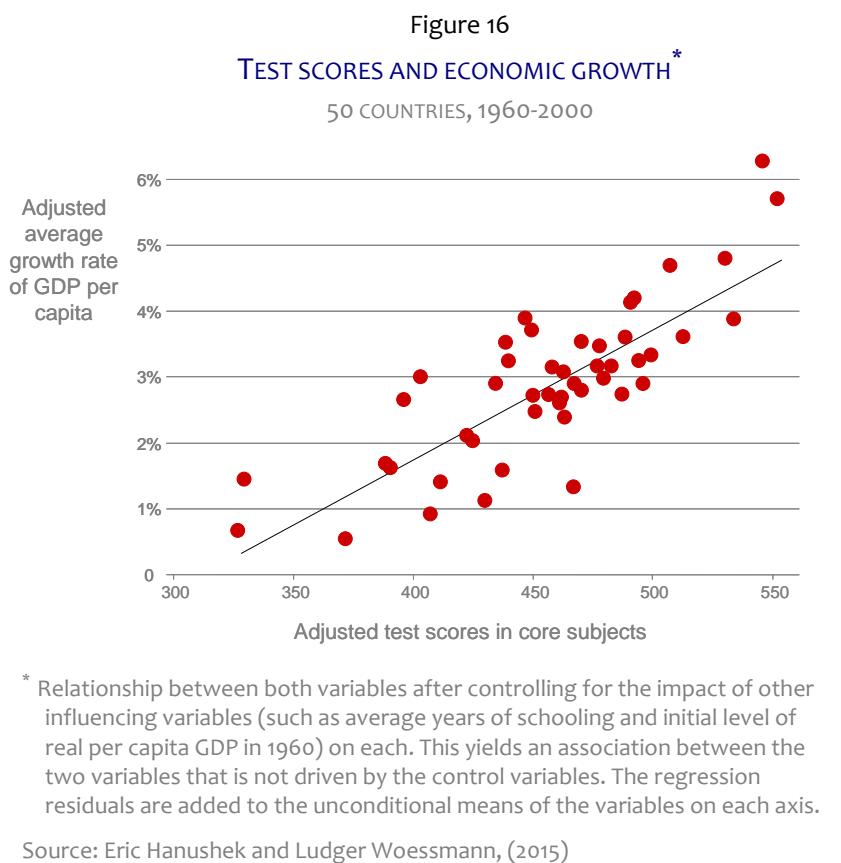
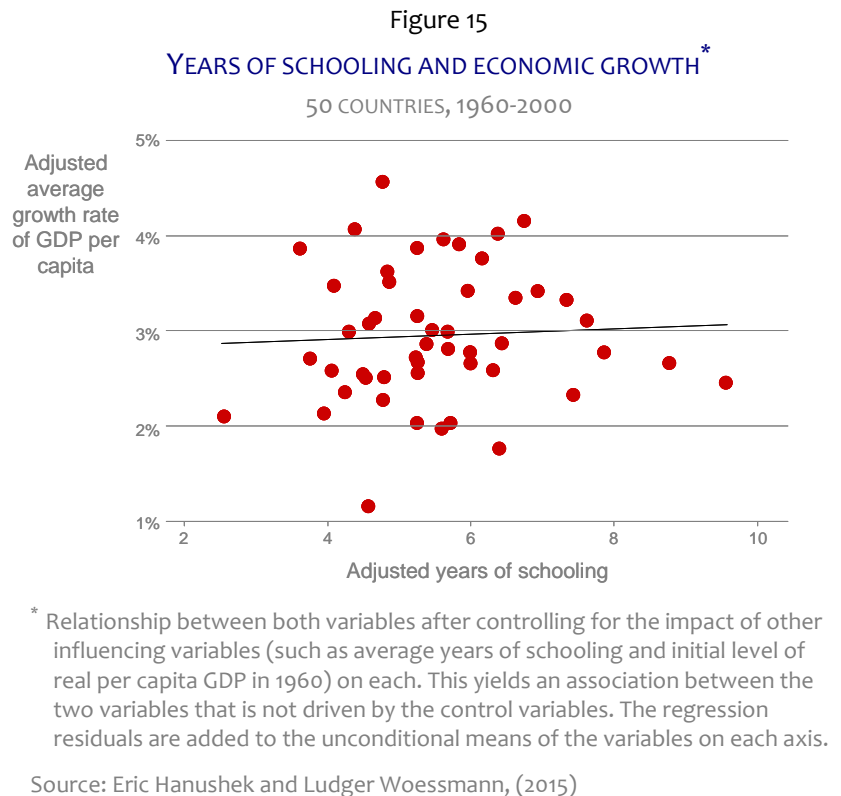


Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: OECD, Israel's Central Bureau of Statistics, Bank of Israel

school to pass a matriculation exam (*bagrut*, in Hebrew). These exams have been given for decades and could have been a very useful tool for determining whether education levels have improved or declined over the years. But the national exams have never been calibrated over time, rendering useless all intertemporal comparisons. To reduce the validity of these exams even further, final matriculation grades include a local school component for which no attempt is made at calibration across schools. The result is a relatively expensive exam process that yields little to no usefulness in providing comparable benchmarks 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. But these

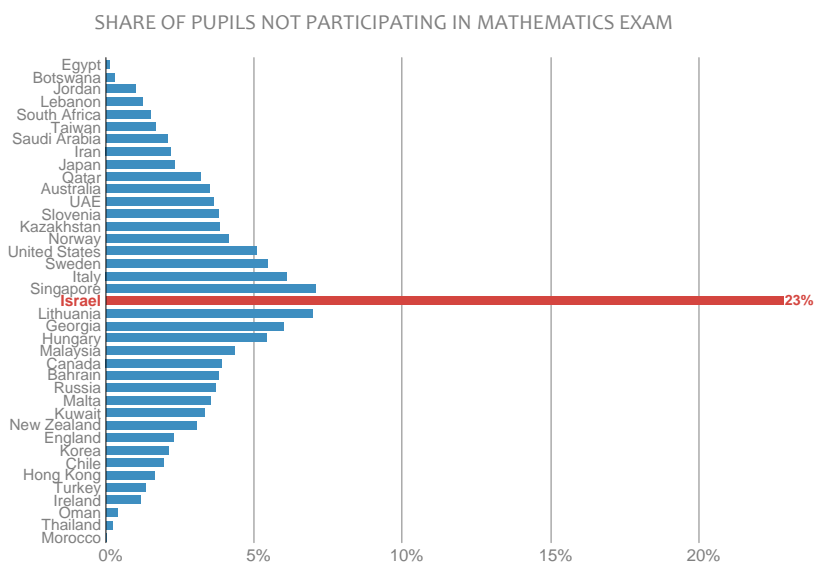


exams are not without their own problems – especially when it comes to comparisons of Israel to other countries. Haredi boys, for example, do not study the material covered in these exams and do not participate in the exams. In general, the international exams stipulate that a country may exclude up to 5% of its pupils from the sample. This is usually intended for special needs pupils, or those living in distant rural areas. As shown in Figure 17, 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. And then there is Israel, which excluded a full 23% of its pupils from the sample. Thus, in all of the international comparisons that follow, 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.

The international 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.

Figure 17

### OVERALL EXCLUSION RATES IN TIMSS 2015



Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: TIMSS 2015

Figure 18 provides composite achievements in the three main areas tested, math science, and reading, over the past several decades for 13 to 15-year olds on all international exams that Israel has participated in since 1963. On the face of it, Israel – ranked number 1



in math in 1963 – experienced a major decline in achievements ever since. However, it turns out that the country excluded so many pupils and schools in 1963, that the results for that year are apparently without much basis in terms of reflecting the actual math level that existed in Israel then.

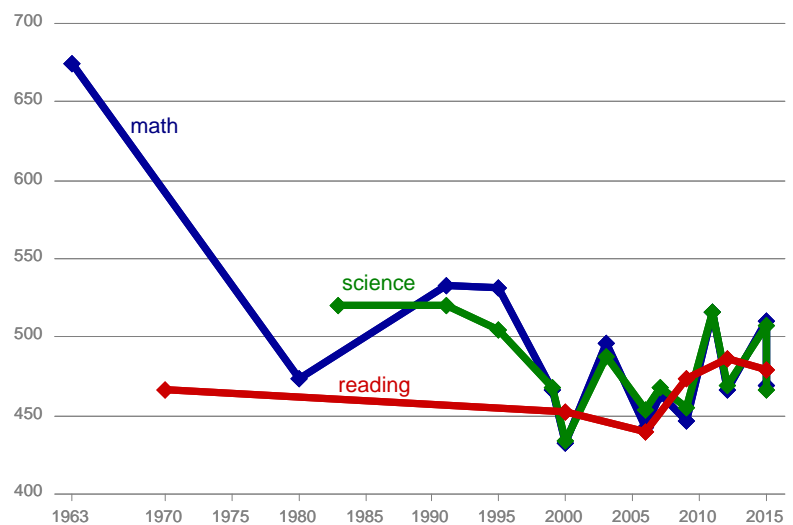
Only since 1999 have Arab Israeli children been included in the international exams on a regular basis. Israel's scores on the TIMSS

exams have been consistently higher than in the PISA exams (Figure 19). 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. Regardless of the exam however, there have been steady improvements – relative to the means – in the achievements of Israeli pupils whether in math, science or reading.

Despite these improvements, 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 20). One can

Figure 18

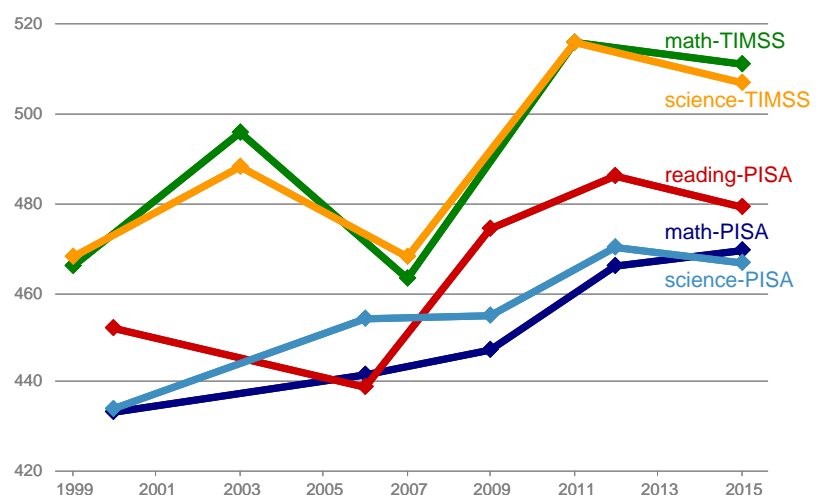
### ISRAELI SCORES ON INTERNATIONAL EXAMS SECONDARY SCHOOLS (13-15 YEAR OLDS), 1963-2015



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

Figure 19

### 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



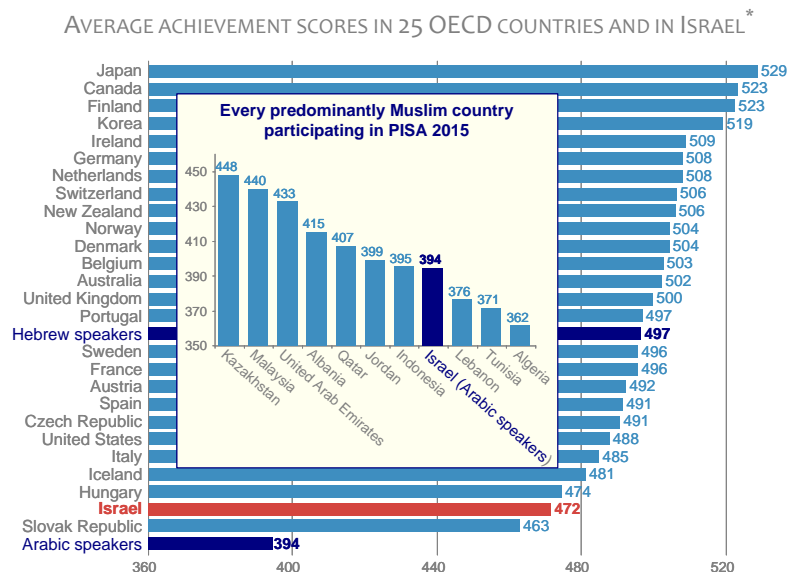
only guess how much lower Israel's score would have fallen had the country included all of the Haredi children who do not even study the material.

Non-Haredi Jewish children attained a score placing them below most of the developed countries. Israel's Arabic speaking children receive an average score below many developing countries. In fact, their average score was below the average score in most predominantly Muslim countries (Figure 20 insert).

Unless something is done to immediately improve the quality of education that Israel's children receive, the outcome depicted in Figure 20 portends some harsh realities for the country's future. Like other small countries, Israel cannot produce all of its domestic needs, nor does it possess domestic economies of scale that can make much local production profitable. Consequently, it needs to trade extensively with other countries – most of whom are shown (in Figure 20) to be preparing their children better for a future in an increasingly integrated and competitive global economy.

Not only are Israel's average achievement levels below nearly all developed countries, education gaps between its children (as measured by standard deviations within countries) are by far the highest (Figure 21), and have been the highest in the developed world for many years. These gaps would likely be 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.

Figure 20  
AVERAGE LEVEL OF EDUCATION IN DEVELOPED WORLD, PISA 2015



\* 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

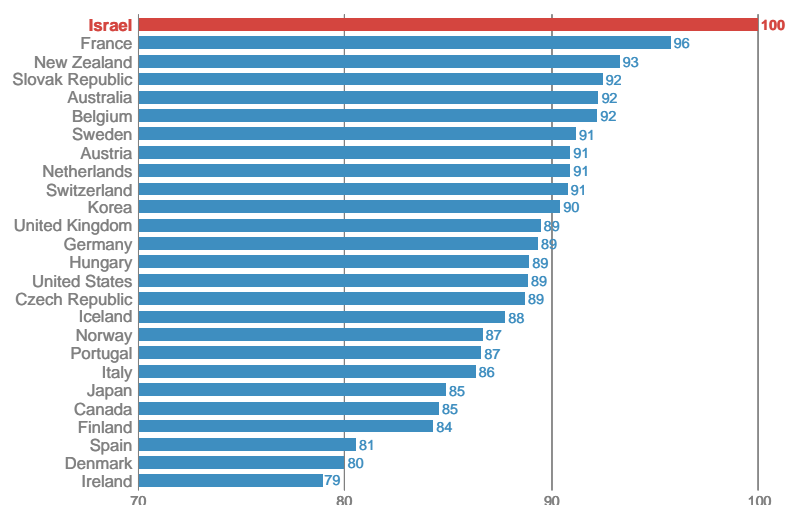
While the international exams provide a relative measuring stick for comparing Israel to other countries, they do not yield any information on the absolute level of knowledge that Israeli children possess in core subjects, or whether this level has risen or fallen over time. The only exam administered in Israel providing such an indication is the Meitsav exam – and only since 2008 for 8<sup>th</sup> grade pupils (these exams are also given to 5<sup>th</sup> graders). The base year average score in each exam is 500 in 2008. Since then, scores have improved in each exam (Figure 22), though in English, this improvement stalled relatively quickly, with average scores remaining relatively stagnant for much of the past decade.

While the Meitsav exams are calibrated over time, the scores shown in Figure 22 are index numbers with 2008 as their base. These index numbers provide no information as to how much of the material pupils actually know. Figure 23 provides a glimpse of the percentage of correct responses in the various exams administered in 2016. Both the fifth

Figure 21

### EDUCATIONAL INEQUALITY IN DEVELOPED WORLD, PISA 2015

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



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

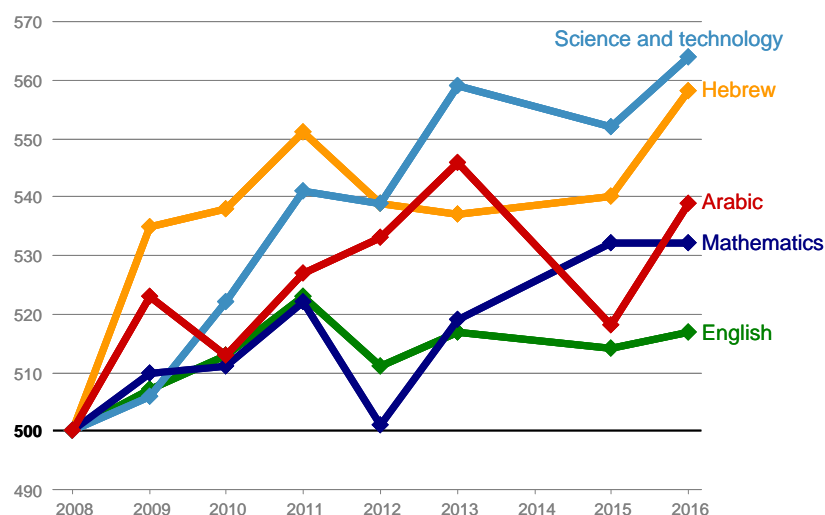
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: PISA

Figure 22

### SCORES ON MEITSAV EXAMS\*, 8<sup>TH</sup> GRADE

MEAN IN 2008 = 500 (BASE)



\* Not including Haredi boys.

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

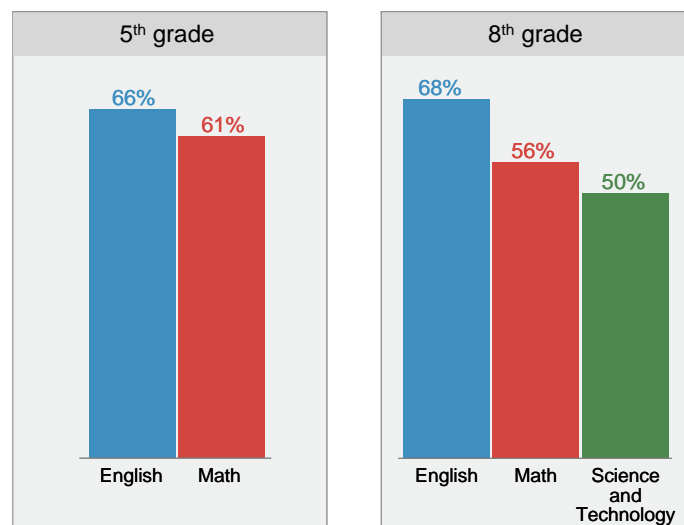
Data: National Authority for Educational Measurement and Evaluation (RAMA)

and eighth grade pupils answered correctly on only two-thirds of the questions in the English exam. The percent correct in math fell to 61% in fifth grade – barely a passing score – and to 56% in eighth grade, which would be a failing mark were it a course grade. Even lower is the average score of 50% in technology, an exam that is no longer even given to fifth graders, as it had been in the past.

Compounding this problem is the fact that Israel has never really determined a core curriculum for each grade level that specifically defines what pupils need to know to pass on to the next grade level. As a result, it appears that these Meitsav exams are testing some unclear ad hoc levels that were never formally set by the Education Ministry.

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 (Figure 24). These children are the most likely candidates for a life of poverty since the skills they are provided are so sub-par

Figure 23  
PERCENT CORRECT RESPONSES IN MEITSAV EXAMS, 2016\*

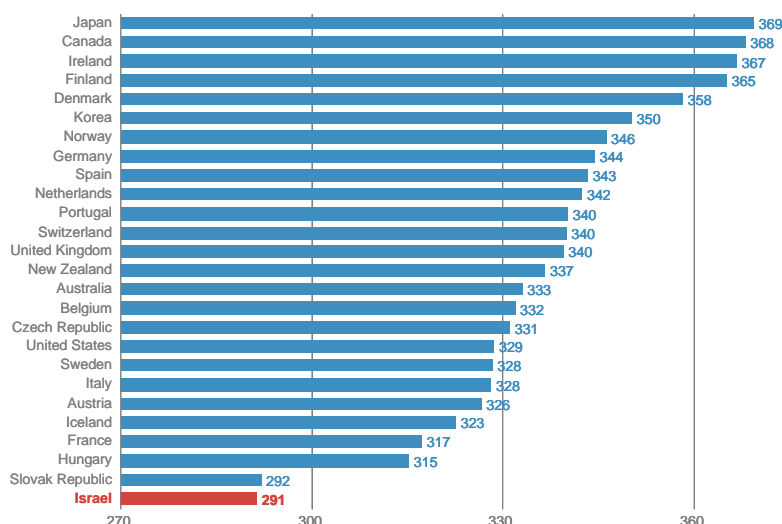


\* Not including Haredi boys.

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

Figure 24  
COMPARISON OF WEAKEST PUPILS IN DEVELOPED WORLD, PISA 2015

AVERAGE ACHIEVEMENT SCORES IN BOTTOM (5<sup>TH</sup>) PERCENTILE  
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

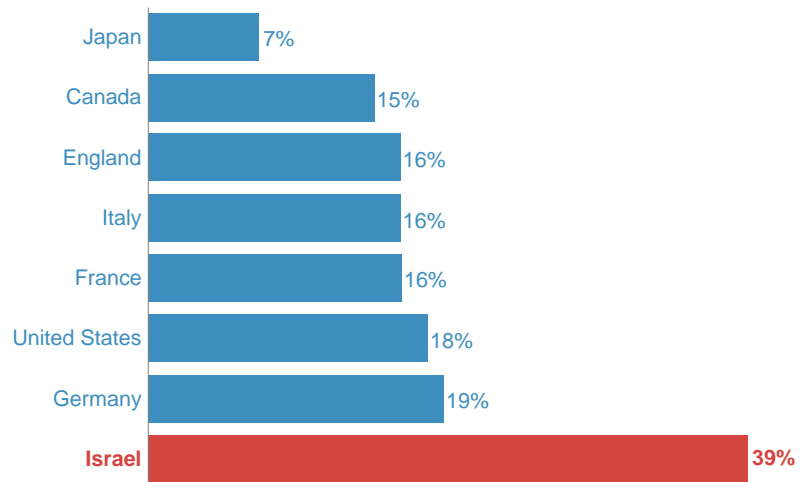
that their chance to overcome such a negative head start are slim to none.

A view from 30,000 feet provides a broader perspective that is even more problematic. The OECD define 6 levels of achievement in math, science and reading. Pupils that score within 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. Were the Haredi children to participate in the exam, Israel would likely 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 25). As shown in Figure 26, there exists a very strong relationship between the share of

Figure 25  
SHARE OF PUPILS WITH POOR PROBLEM SOLVING SKILLS IN G7 AND ISRAEL

PERCENT AT OR BENEATH LOWEST LEVEL\* IN PISA 2012

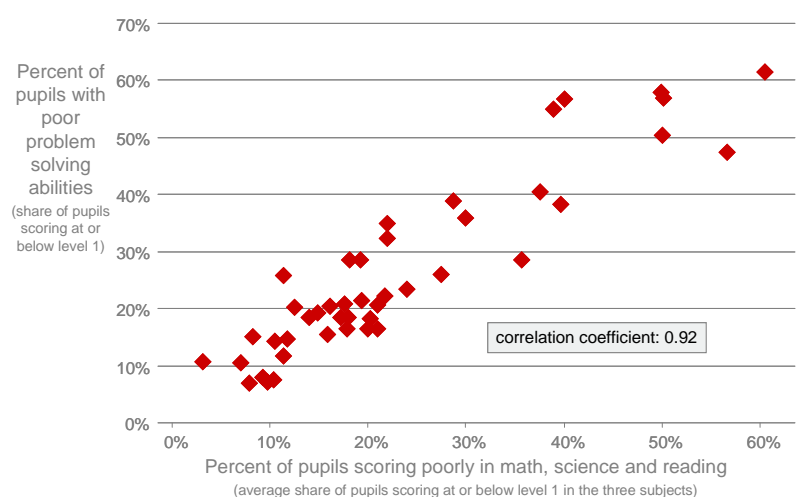


\* The lowest problem solving level measured by the OECD is level 1, which defined as follows: "Level 1 students tend not to be able to plan ahead or set subgoals."

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

Figure 26  
RELATIONSHIP BETWEEN CREATIVE PROBLEM SOLVING SKILLS AND ACHIEVEMENTS IN MATH, SCIENCE AND READING

COMPARISON OF PUPILS IN 44 COUNTRIES WHO ARE AT OR BENEATH LEVEL ONE\*, PISA 2012



\* 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

pupils who score very poorly in math, science and reading, and the share of pupils with very low problem solving abilities.

Put differently, consider adults who are unprepared to work in a modern labor market because of inadequate math, science and reading skills. They will probably have an exceedingly difficult time finding a job – and keeping it – in a competitive and global economy. Such individuals will be extremely unhappy about their circumstances and will search for salvation anywhere they can find it. In democracies, such people can vote. The high correlation between not having the basic skills to work in a modern economy and not being able to plan ahead, or set subgoals, provides an open invitation for demagogic charlatans to make promises for unattainable outcomes that draw such voters who do not understand the true source of their predicament, nor the root treatment that can improve the situation.

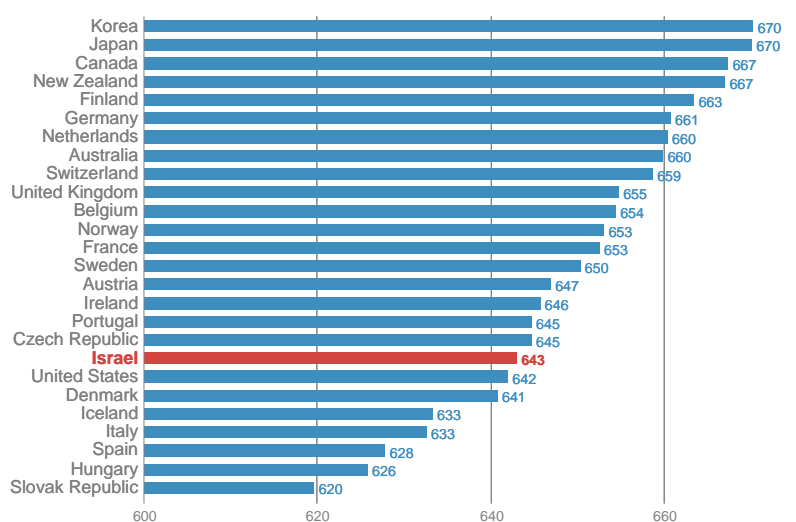
To round out the picture from the international exams, Figure 27 provides a comparison of the top pupils – those in the top five percentiles – in each of the 25 developed countries. Israel's top pupils ranked below the top pupils in 18 of these countries, an omen reflecting the country's future ability to retain its qualitative edge in fields that keep its economy in the developed world.

The 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. There is a misconception among many Israelis, heavily promoted by advertisements of many lower level

Figure 27

**COMPARISON OF TOP PUPILS IN DEVELOPED WORLD**

AVERAGE ACHIEVEMENT SCORES IN TOP 5 PERCENTILES IN  
25 OECD COUNTRIES AND IN ISRAEL\*, PISA 2015



\* National average in math, science and reading exams. Israeli examinees did not include Haredi boys.

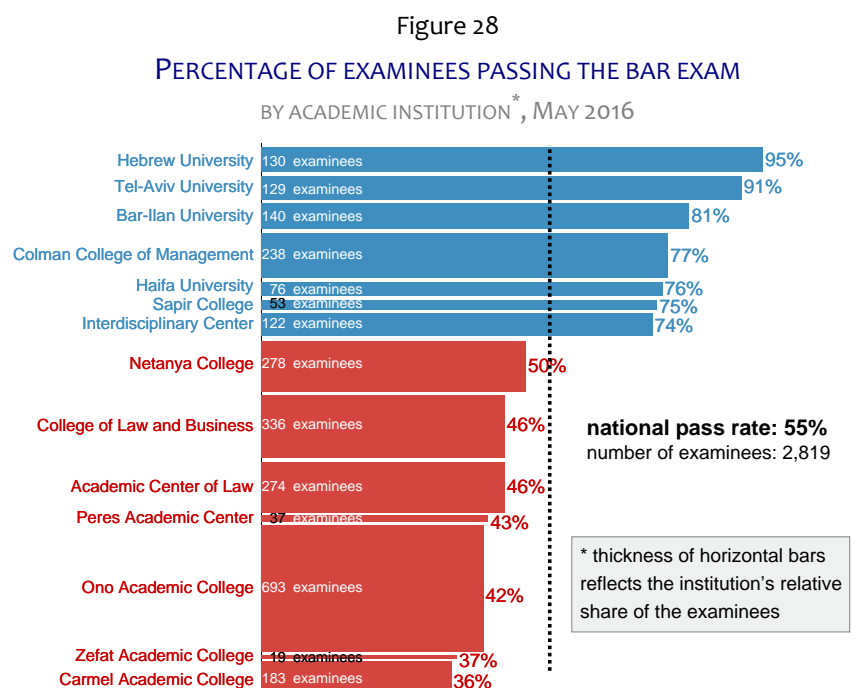
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: PISA and Israel's National Authority for Educational Measurement and Evaluation

academic institutions, that where a person studies is not important. The only thing that matters, according to the advertisements that influence the uninformed and gullible, is the attainment of an academic degree, regardless of where it comes from.

While the actual level of knowledge attained by college graduates within the various disciplines across academic institutions is not always known, there are a few fields in which graduates must take a uniform exam to be able to practice in the profession. One such field, that is taught in a large number of institutions, is law. The periodic Bar exams provide insight as to the qualitative disparity among graduates. In the May 2016 exam, only 55% of the examinees passed, leading to another of the periodic outcries that the exam was unfair. A more detailed look at the outcomes, provided in Figure 28, suggests that the problem was not with the exam, but with expectations about what an academic degree is supposed to confer.

The thickness of the horizontal columns in Figure 28 reflects the share of total examinees coming from a particular institution. While the Hebrew University and Tel-Aviv University accounted for just a small proportion of the examinees, nearly all of their graduates passed the exam. On the other hand, non-research colleges with the largest shares of law students had very high failure rates. This is due to their having accepted students at very low incoming levels, and subsequently teaching them at accordingly low levels.

Another example of the large discrepancies in quality can be found in the high tech fields. Firms in these areas claim that they are having an extremely difficult time finding sufficiently qualified job candidates. For example, the Economy Ministry (Tzuk, 2016) reports that for every three

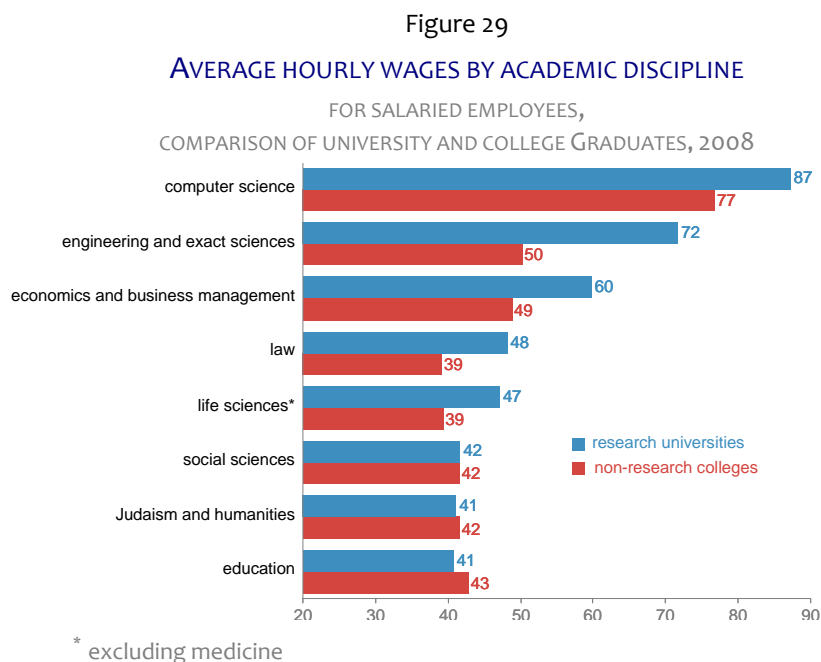


Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: Israel Bar Association

positions in computing, there is only one candidate. Findings by Bental and Peled (2016) indicated no such shortage of potential workers for such a position, 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 Economy Ministry is apparently due to the major qualitative differences between academic institutions.

This gap between institutions is further illustrated in Figure 29, which highlights the impact academic choices can have on wages. Employees with degrees in computer science earn considerably more than those with degrees in engineering, and so on. As noted above, wage outcomes are not only affected by discipline of study, they are also affected by the quality of the higher education institution – 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 country's leading institutions – the research universities – tended to earn considerably more than students graduating from the non-research colleges. Similarly, Achdut, Zusman and Mayan (2017) found a 10% wage advantage for university graduates over college graduates.

Occupational choice also plays a major role in determining wages, as Figure 30 attests. At the top end of the hourly wage spectrum for full-time, prime working age employees are managers (averaging wages of 102 shekels per hour) and assorted academic professionals (earning 95 shekels an hour, on average). At the other end of the spectrum are



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

Data: Israel's Central Bureau of Statistics



unskilled workers, making 30 shekels an hour and less skilled workers in varying professions earning roughly 40 shekels an hour.

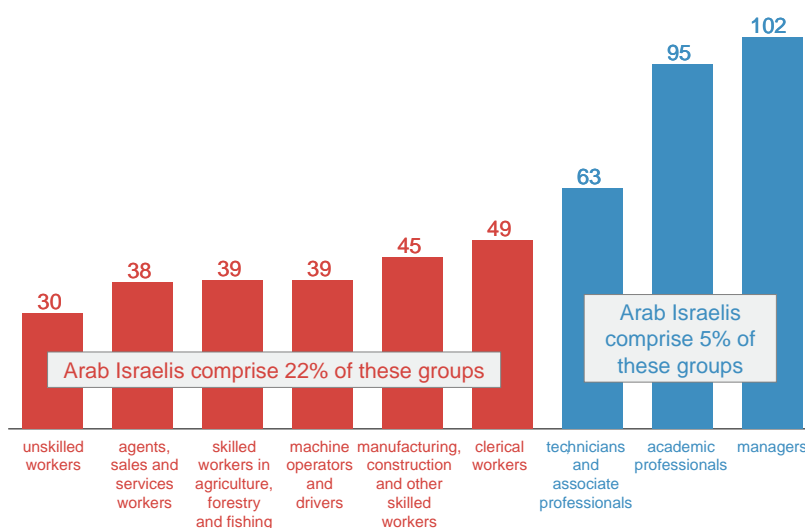
Thus, while Figure 7 showed that almost all Jewish men and Arab men with academic degrees are employed – as are 90% of Jewish women and 80% of Arab women with academic degrees – what a person studied, at what level, and where, make a great difference with regard to wages, as does

occupational choice (which is often determined by the academic decisions). Figure 31, focusing on full-time, prime working age employees, illustrates just how big these 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 31.

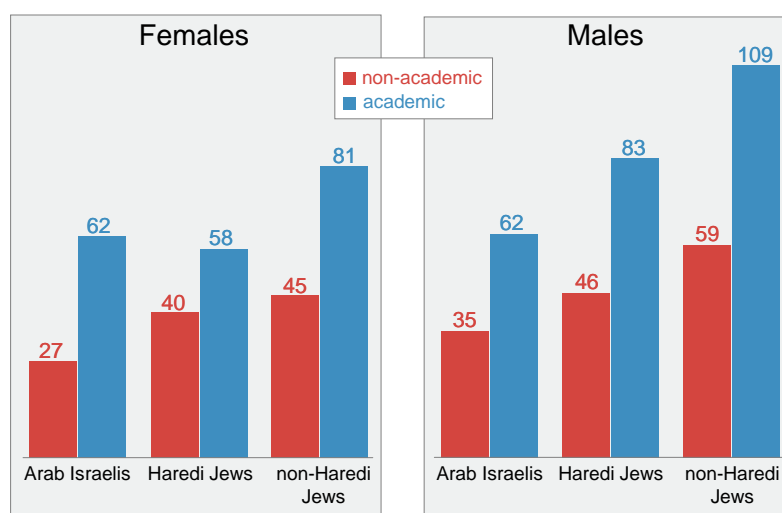
Over 80% of academically educated Arab and Haredi woman

Figure 30  
**AVERAGE HOURLY WAGES BY OCCUPATION, 2015**  
FULL-TIME EMPLOYEES, AGES 35-54



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

Figure 31  
**HOURLY WAGES BY EDUCATION, GENDER AND SECTOR**  
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

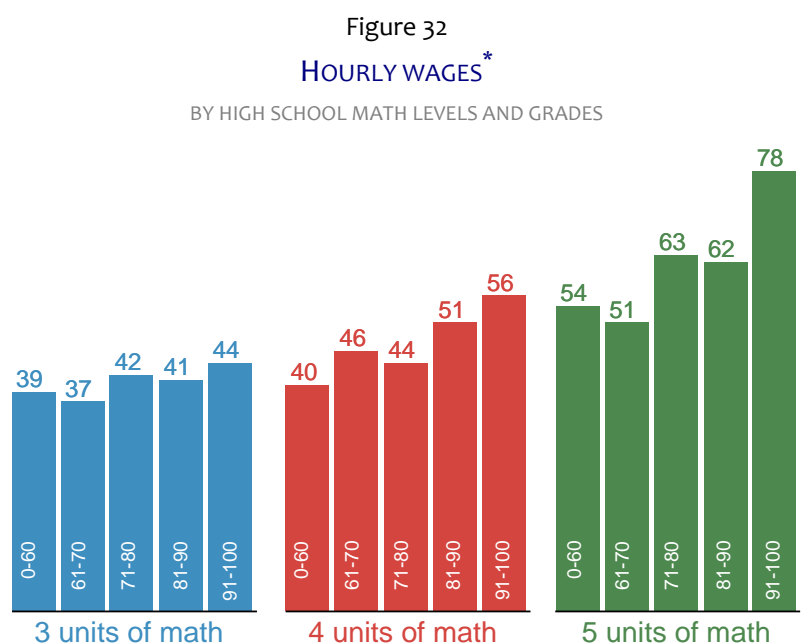


have no more than a BA degree, with most of these degrees coming from teaching colleges with extremely low entrance requirements. This compares to 54% of non-Haredi women with academic degrees who stop studying after attaining a BA. These outcomes are reflected in relatively similar wages for Arab Israeli 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.

Also contributing to the wage gaps between Arabs and Jews are the occupational choices, as shown in Figure 30 – which are determined, in no small part, by prior education. Arab Israelis account for 22% of the full-time, prime working age employees in the lower paying occupations marked in red. This contrasts sharply with their 5% share of the employees in the higher paying occupations.

## 5. The economic impact of improving math education

Kimhi and Horovitz (2015) highlight the impact of raising the quality of math education at the upper end of the spectrum. Their pilot study focused on the contribution of high school math at various levels to hourly wages in the job market a dozen years later. Kimhi and Horovitz found that 12<sup>th</sup> graders with low grades at the highest math level, five units, attained subsequent wages roughly comparable to pupils who excelled at the next level down, four units. Similarly, pupils who did poorly at four units of math attained wages similar to those who did very well at three units of math (Figure 32).

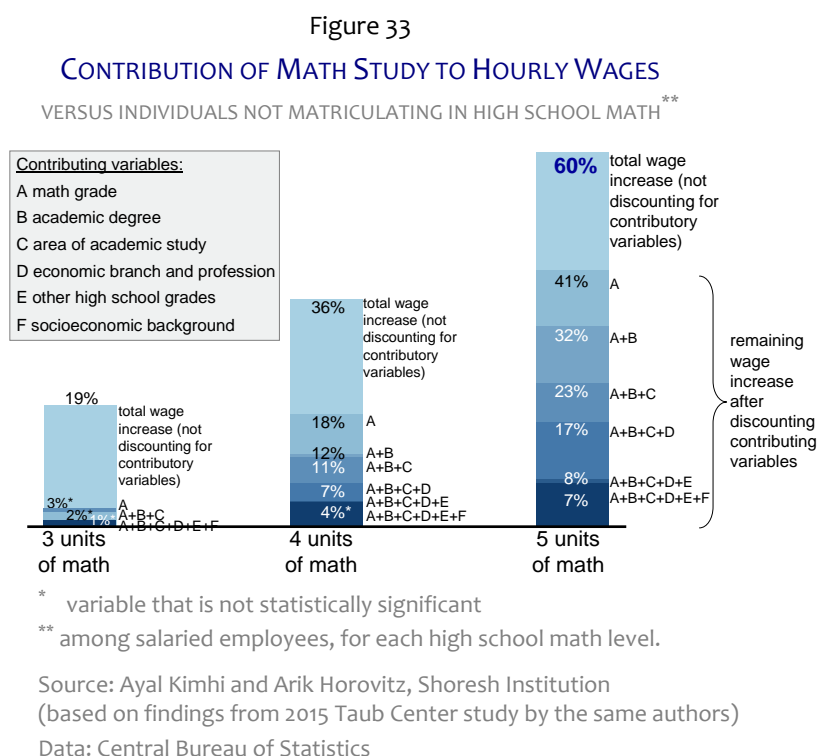


\* among salaried employees born in 1979 who were 29 years old in 2008

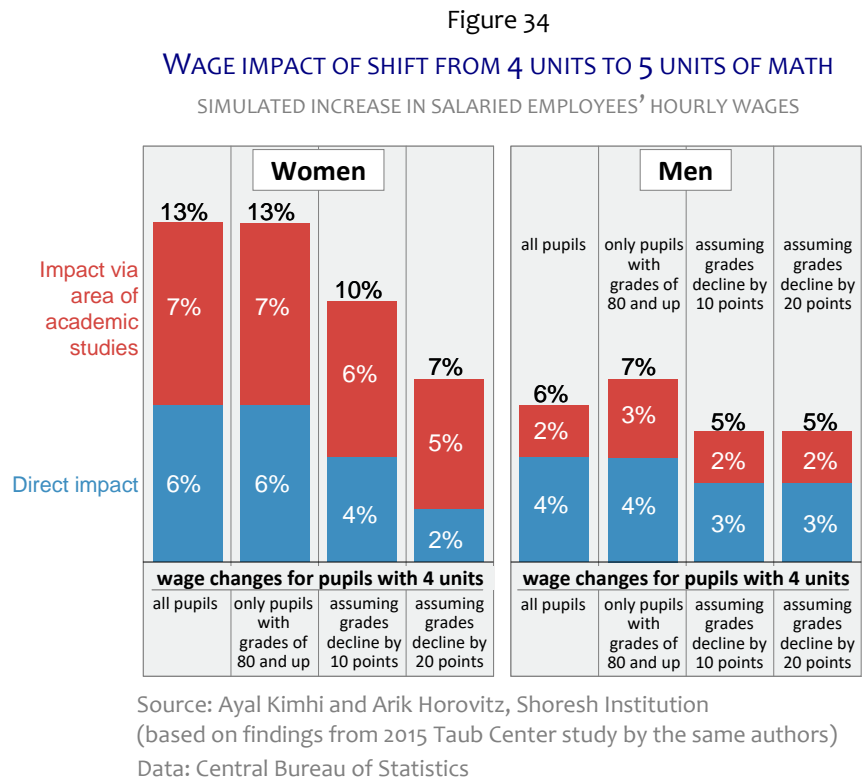
Source: Ayal Kimhi and Arik Horovitz, Shoresh Institution  
(based on findings from 2015 Taub Center study by the same authors)  
Data: Central Bureau of Statistics

The study of mathematics has both a direct and an indirect effect on subsequent wages. While simply knowing math at higher levels acts as a gateway to further knowledge accumulation in other fields dependent on math, the study of 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. To isolate the effect of math level of study on future wages, Kimhi and Horovitz estimated an equation controlling for such factors as math grades in high school, existence of an academic degree and academic area of study (where relevant), economic branch and occupation, other high school grades and socioeconomic background. The results are visually displayed in Figure 33 (estimation results are available in Kimhi and Horovitz, 2015).

Hourly wages of those who studied three units of math ended up 19% higher a dozen years after graduation than the hourly wages of those who did not matriculate in high school math. Pupils who studied four units received 36% more and the wages of pupils studying five units were 60% higher. In the case of those who studied five units, 19 percentage points out of the 60% gap could be explained by the math grades. An additional 9 percentage points were explained by the existence of an academic degree, and so on. After all of 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.

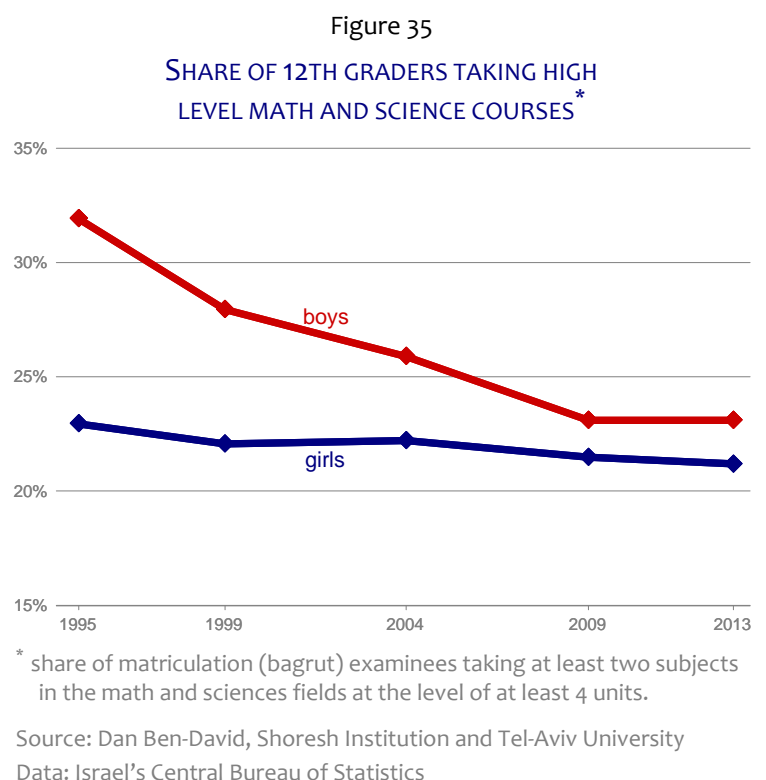


Kimhi and Horovitz also provided a simulation with a number of scenarios showing how a shift from four units of math to five units would increase subsequent hourly wages (Figure 34). These wage increases were divided into their direct and indirect impact. A key finding from this simulation is that the wage increase is substantially higher for women than for men in each of the various scenarios.



Despite the subsequent economic benefits of studying STEM courses at the highest levels in high school, the overall trend has been negative since the mid-1990s (Figure 35). The slight decline in girls studying at the highest levels has been accompanied by a much sharper decline among the boys. On the one hand, such a convergence could eventually result in a reduction of gender wage gaps. However, this outcome has negative implications with regard to the nation's future ability to stay at the international technological cutting edge.

Hanushek and Woessmann (2015) provide a glimpse of the economic impact resulting from an improvement in the quality of math education at the lower end of the spectrum. Figure 36 displays



the shares of pupils in each developed country that scored below Level 2 in the PISA 2012 math exam, which the OECD considers the minimum acceptable level of math knowledge. In the leading countries, roughly one-tenth to one-eighth of the pupils were below Level 2. In Israel, a full third of the pupils – by far the highest share in the developed world – scored below the minimum acceptable level. Again, this did not include Haredim who did not study the material and did not participate in the exam.

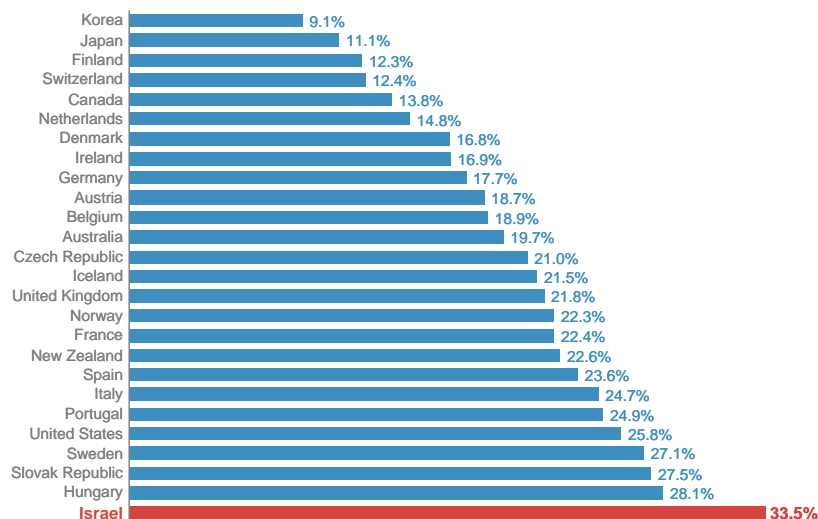
The Hanushek and Woessmann study posits the what-if question: By how much would a country's GDP rise if it instituted education reform targeted only at raising the scores of pupils below Level 2? Their simulation assumes that it takes 15 years to complete the education reform, and that it would take four decades until the only workers remaining are those who studied in the reformed system. Hanushek and Woessmann 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 ranging from “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 (Figure 37). 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.

Figure 36

**SHARE OF PUPILS AT THE LOWEST MATH LEVEL**

PERCENT OF PUPILS SCORING AT OR BELOW LEVEL 1  
(BELOW 420 POINTS) IN MATHEMATICS, PISA 2012



\* Israel examinees do not include Haredi boys.

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

Data: OECD

Such an education reform would reverse the multi-decade divergence in labor productivity shown in Figure 14. Comparing the increment to annual growth rates of GDP per capita in G7 countries shows just how sharp this turnaround would be (Figure 38). 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 of 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 could also do wonders for the rest of the pupils, even those not included in the Hanushek-Woessmann simulations.

Figure 37

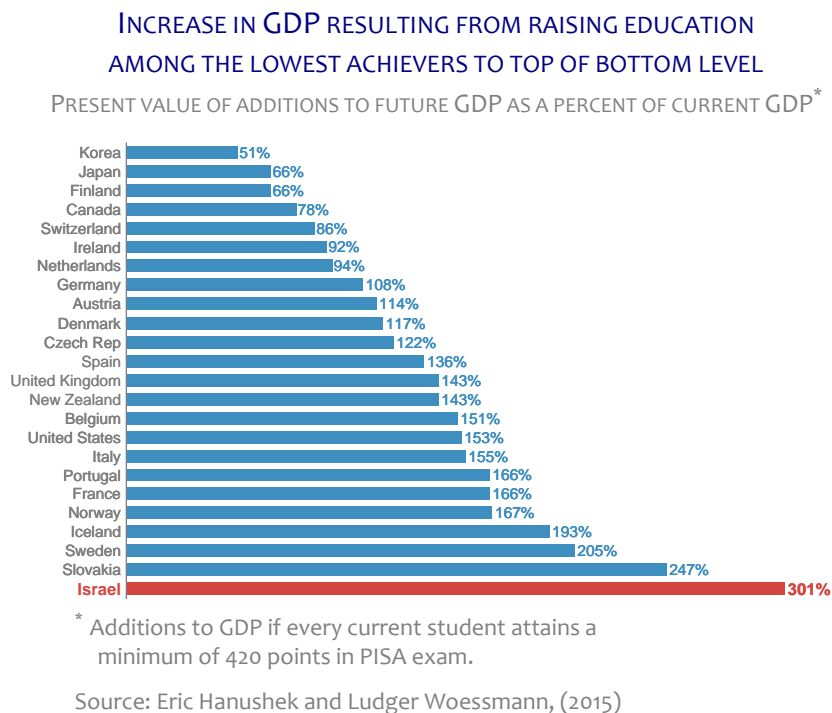
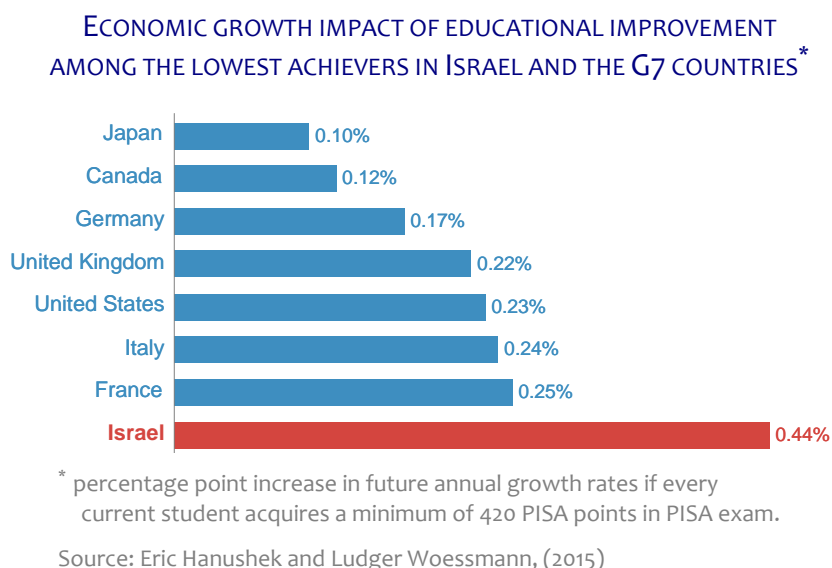


Figure 38



## 6. Some basic facts and questions on the state of education in Israel

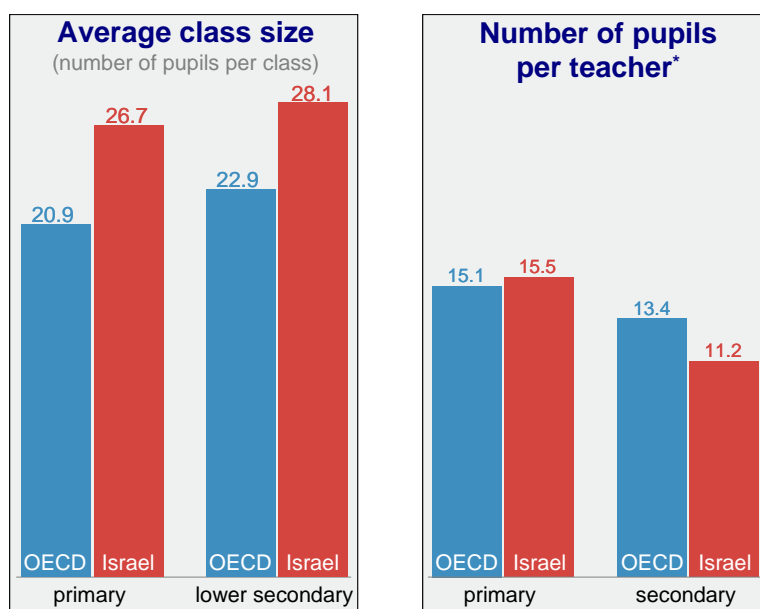
### Class size, instruction hours, teachers and discipline

While the jury may be out with regard to the impact of class size on education outcomes, there is no doubt that Israel's classrooms are – on average – overcrowded. 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 an average of just 20.9 pupils in an OECD classroom (Figure 39). The numbers are even higher in lower secondary schools, with 28.1 pupils per class in Israel versus 22.9 in the OECD.

However, it is not immediately obvious why Israeli classrooms are more crowded. 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. The only reason for the crowded classrooms is an organizational one. There are four main education streams in Israel –

Figure 39

NUMBER OF PUPILS PER CLASS AND PER TEACHER, 2014



\* According to full-time equivalents.

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

secular, religious Jewish, Haredi and Arabic language – with very little movement of teachers between them. There is also an issue of teacher work hours, which will be addressed below.

Another reason often cited for low 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 stands out when compared to the other

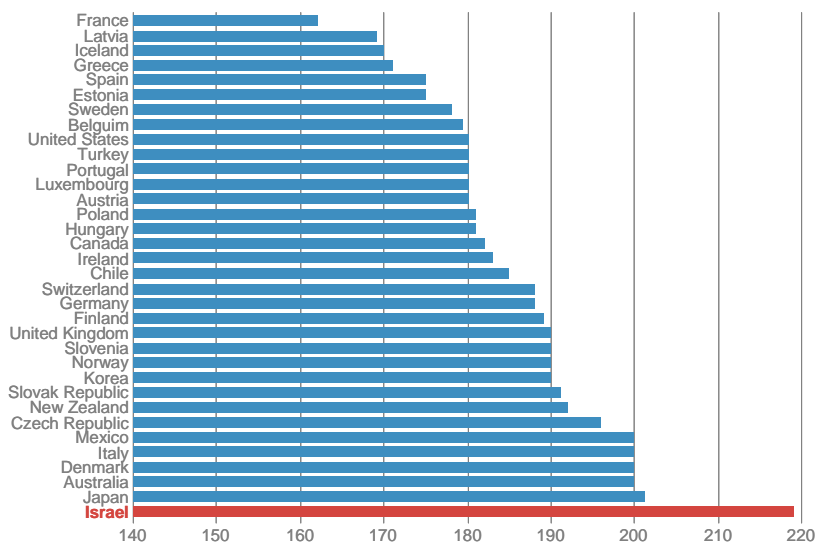
OECD countries – nearly 220 days a year, compared to just over 200 days for the number two country, Japan (Figure 40).

In fact, 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 shows that the number of instruction hours does not account for Israel's low achievements (Figure 41). Hungary,

for example, provides 38% less instruction time to its pupils, while they attain average PISA scores just above Israel's. Finland, Korea and Austria give their pupils 28-29% fewer instruction hours, yet produce 4-11% higher scores than Israel. In all but one of the 20 OECD countries that provide fewer instruction hours, the pupils achieved higher scores.

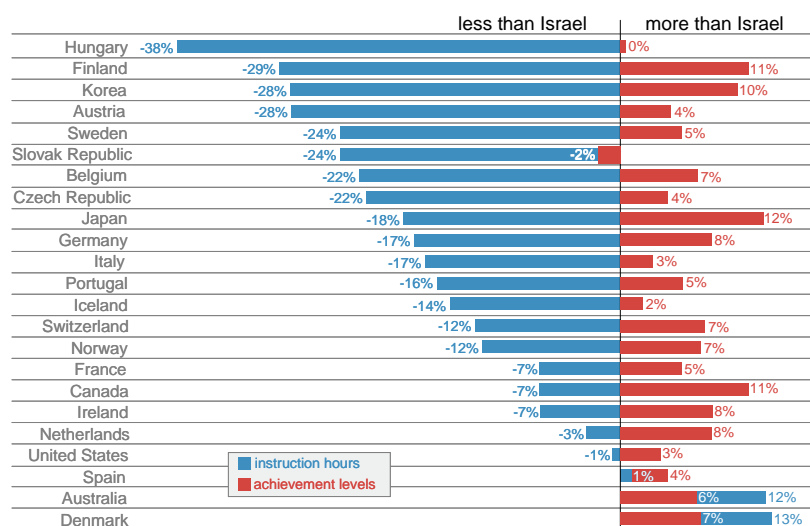
In general, OECD countries provide 21% less hours in reading, writing and literature, while attaining 3% higher reading scores. They provide 28% fewer math instruction hours, while achieving grades that are 4% higher. In the natural sciences, the average number of instruction hours in the OECD is 29% lower than in Israel, while scores are 6% higher.

Figure 40  
AVERAGE NUMBER OF SCHOOL DAYS IN YEAR  
PRIMARY SCHOOL, 34 OECD COUNTRIES, 2016



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

Figure 41  
INSTRUCTION HOURS AND ACHIEVEMENT, 2015\*  
23 OECD COUNTRIES RELATIVE TO ISRAEL



\* 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, Shoresh Institution and Tel-Aviv University  
Data: OECD



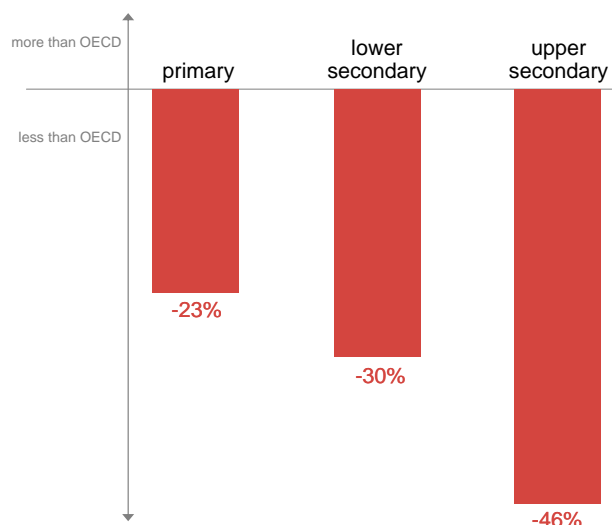
This raises the question of what is transpiring within the Israeli classroom during these teaching hours. There may also be a question of whether the numbers reported by Israel reflect actual teaching hours. In light of the fact that school budgets are determined in part by the number of teaching hours provided, it may be possible that the reported numbers are inflated for budgetary reasons, while the students may not actually receive that amount of instruction.

Returning to the relatively high number of pupils per class in Israel – compared to the OECD – and the identical, or even low, number of pupils per teacher, one possible explanation for this phenomenon may have to do with the number of hours that Israeli teachers work. Figure 42 provides a comparison of total statutory working hours by teachers, showing the difference between Israel and the OECD average. Primary school teachers in Israel work 23%

less hours than the OECD average. 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.

These working conditions have considerable ramifications on salaries. On the face of it, 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 secondary schools (Figure 43). However, hourly salaries in Israel are higher than in the OECD. Israeli primary school teachers make 9% more per hour, while teachers in lower secondary schools make almost a

Figure 42  
**TEACHERS' TOTAL STATUTORY WORKING TIME, IN HOURS**  
PERCENT DIFFERENCE BETWEEN ISRAEL AND OECD AVERAGE, 2014



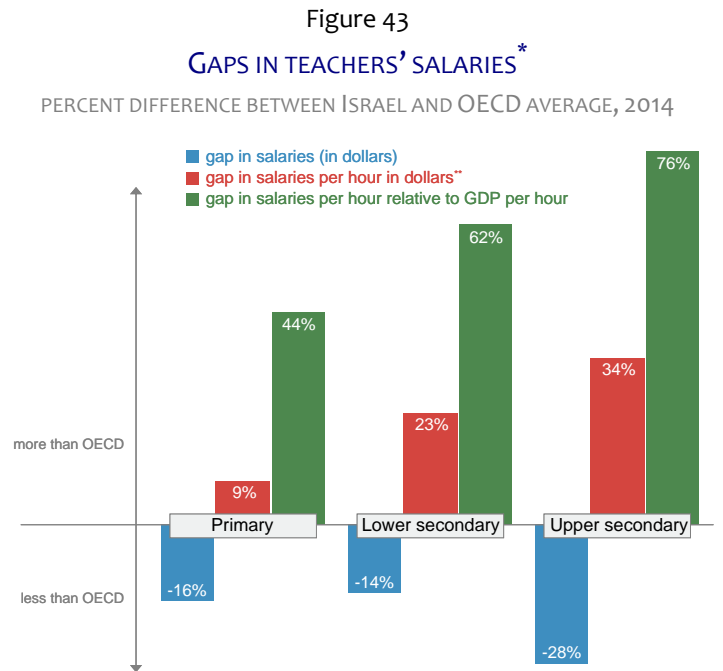
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: OECD



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 that Israeli incomes, in general, are lower than OECD incomes. When the salaries per hour are discounted by GDP per hour 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 62% in lower secondary schools while Israeli high school teachers make 76% more per hour than the OECD average.

Then there is the issue of teacher quality. Like in other countries, many gifted and talented persons with a range of options choose the teaching profession because of a sense of mission. However, these are not the majority of teachers in Israel. Over three-quarters of Israel's teachers come from teaching colleges (Figure 44). Their average psychometric score (serving a similar purpose as American SATs) of 494 is below 61% of all persons taking the exam. Another 15% of the teachers 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 the research universities, and even their average psychometric score of 603 is below the 617 average for all university students. 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?



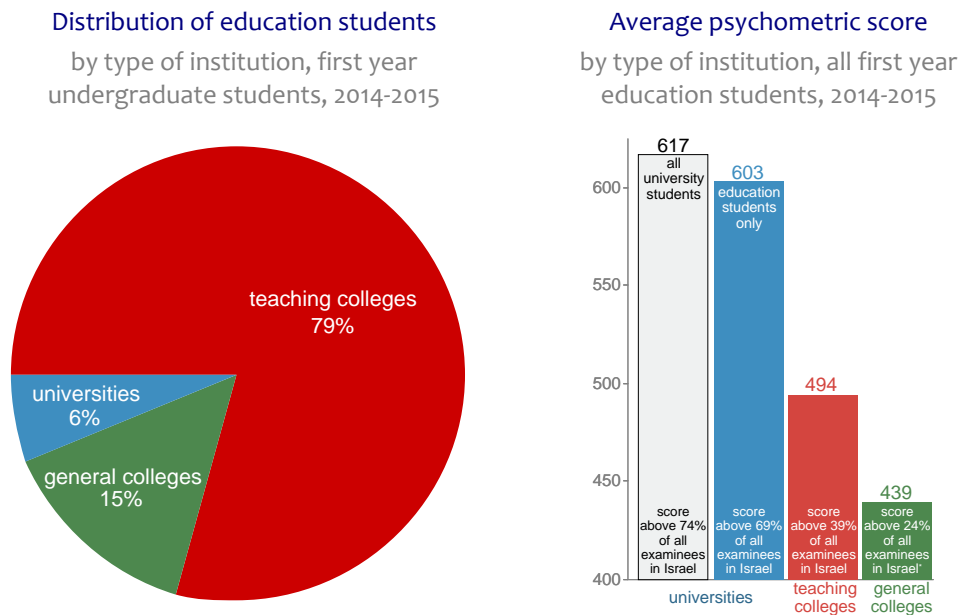
\* Annual average salaries (including bonuses and allowances) of 25-64 year old teachers in public institutions using purchasing power parities.

\*\* Salaries per statutory hour worked.

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

Figure 44

**EDUCATION STUDENTS – DISTRIBUTION AND GENERAL LEVEL**



\* The average psychometric score of all 1<sup>st</sup> 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

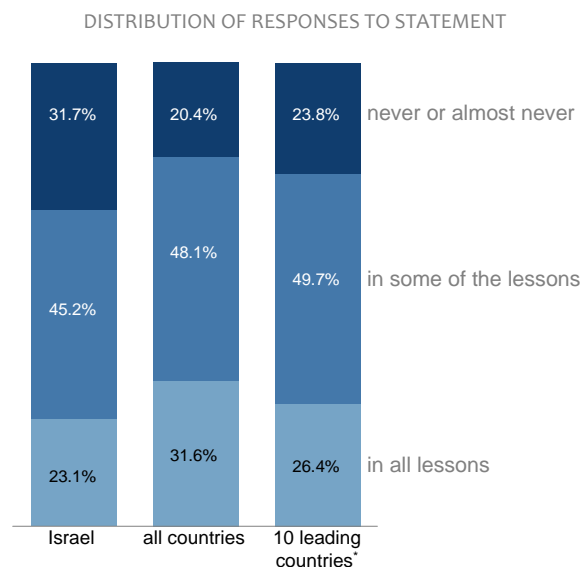
Another factor shown to affect scholastic achievements is class discipline. Gruber (2017) focused on discipline in the classroom from both a subjective perspective (how pupils view themselves) and an objective perspective (using quantifiable measures to proxy for discipline) and examined its impact on 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.

When posited the statement, “Pupils don’t listen to what the teachers says,” 24% of the pupils in the ten countries with the highest PISA math scores responded that this was “never, or almost never,” the case in their classrooms (Figure 45). An average of 20% of all pupils taking the exam felt that this did not describe their situation. In Israel, almost a third of the pupils believe that the statement “never, or almost never” applied. At the other end of the spectrum, 32% of all pupils taking the exam stated that this statement applied in all of their lessons, while just under a quarter of Israeli pupils felt this way.

Gruber used absences and unapproved tardies to provide a more objective instrument for discipline. In the ten countries with the highest PISA math scores, just 7.3% of the pupils arrived late to class at least three times without receiving approval in the two weeks preceding the exam (Figure 46). The overall PISA tardy rate was 9.7%, while the share in Israel arriving late (without permission) to class was 18.7% – nearly double the PISA 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) finds 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 estimates the addition to PISA scores as a result of increasing the class objective discipline index by one unit (Figure 47). These increments range from 9 to 15 additional points in classes with no more than 30 pupils. However, as class sizes rise to above 30 pupils, the impact of discipline increases considerably. In classes with 31 to

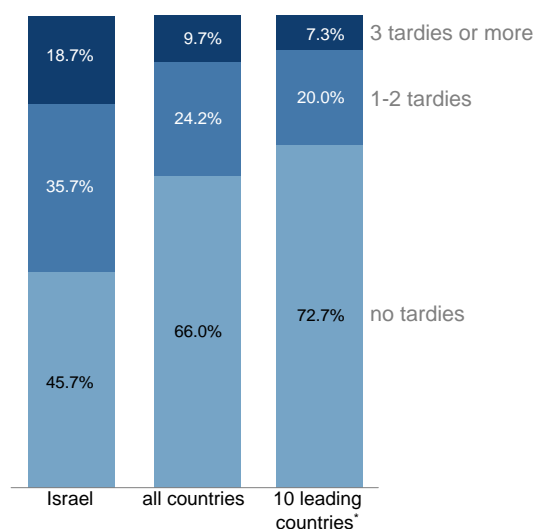
Figure 45  
“PUPILS DON’T LISTEN TO WHAT THE TEACHER SAYS”



\* 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 46  
DISTRIBUTION OF UNAPPROVED TARDY ARRIVALS  
TO CLASS IN TWO WEEKS PRIOR TO EXAM



\* 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

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. Its classes tend to be more crowded, while its children – despite their somewhat

delusional self-perception of discipline – are among the least disciplined in the developed world. This rather combustible combination produces a less than conducive learning environment. This issue is exacerbated when taking into account the general quality of teachers in Israel.

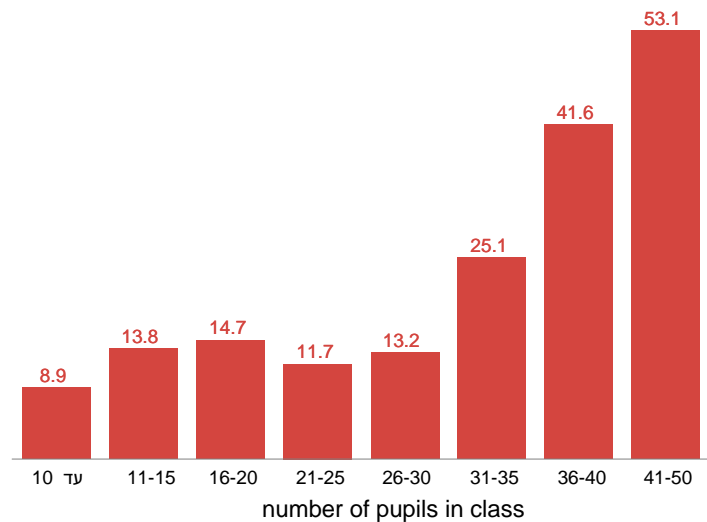
## Education expenditures

Israel's overall budgetary picture has undergone some major changes in recent years. Figure 48 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 decade's end. It then fell during the high inflation years, until stabilizing in the mid-eighties during implementation of the national stabilization plan (targeted at bringing down inflation to sustainable levels). During a brief period in the 1990s, education received a major injection

Figure 47

### 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

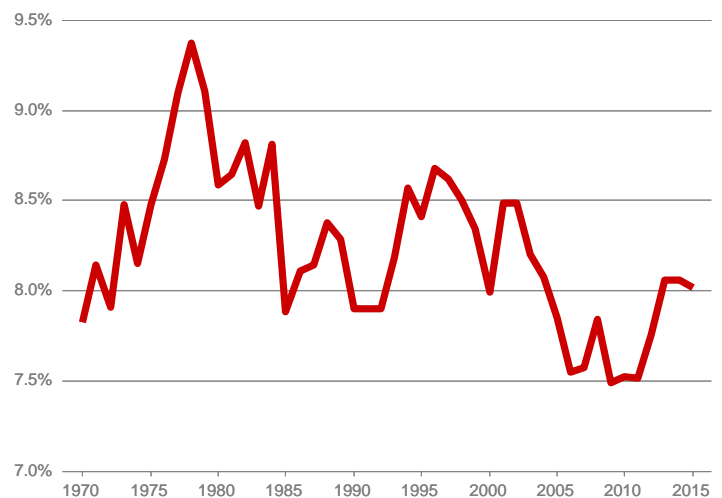
of funds, though these were allowed to dissipate over the subsequent decade. In recent years, the national education expenditure received a renewed budgetary infusion.

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 49). 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 the case of Israel.

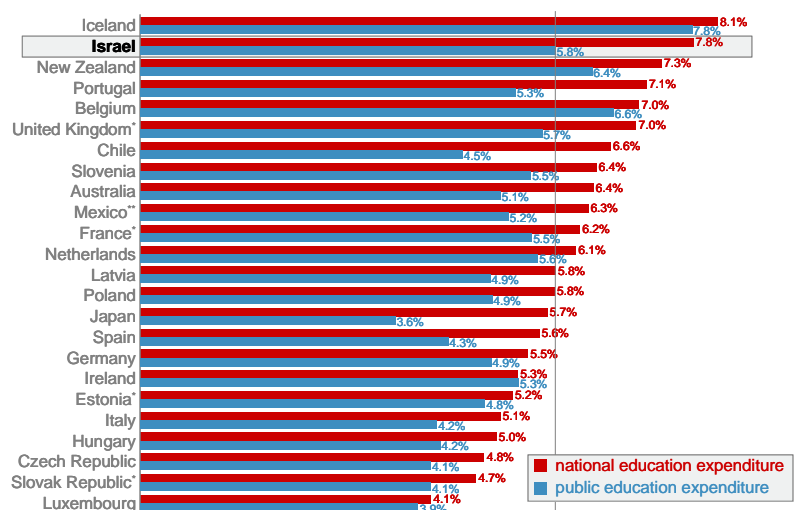
Israel's population is relatively young. The share of primary and secondary school pupils in the population is 19.9% of the entire population (Figure 50). This is higher than the 15.3% in the United States, or the 12.6% in Germany, and it is considerably higher than Japan's 11.1%. In fact, the share of pupils in Israel's population is lower than that of only Mexico, Turkey and Iceland. Thus, the relevant measure for examining Israel's education expenditures over time, and in

Figure 48  
**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 49  
**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

comparison, to other countries is the expenditure per pupil.

Figure 51 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

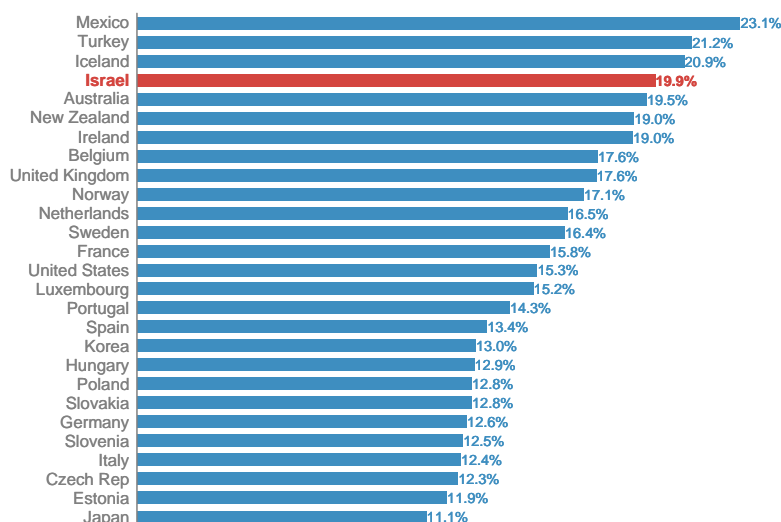
10% in 2009. Primary school expenditures per pupil rose by 47% during these three decades. Then came two major comprehensive wage bargaining agreements – one with the primary school teachers and one with the secondary school teachers. These led to significant spikes in national education expenditures, rising by 57% in just four years in the primary schools and by 62% in the secondary schools.

Pre-primary school expenditures 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 more affordable day care.

For international comparisons of education expenditures, simple comparisons of expenditure per pupil are

Figure 50

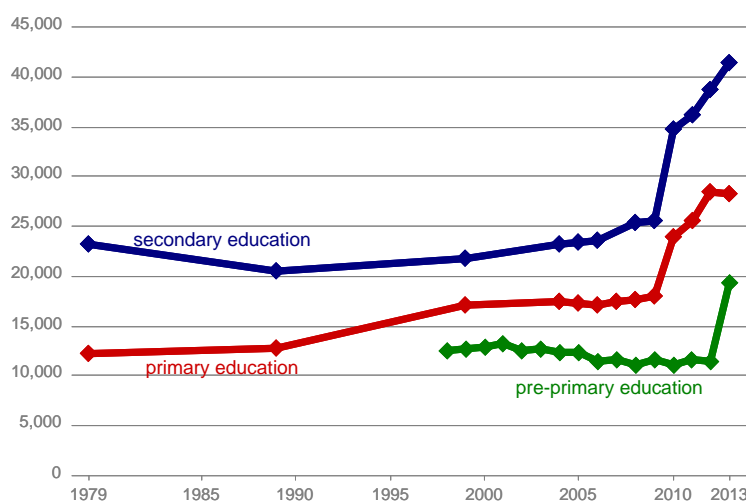
### SHARE OF PRIMARY AND SECONDARY SCHOOL PUPILS IN POPULATION, 2013



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

Figure 51

### 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

insufficient and can be misleading. Salaries comprise roughly 90% 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 52 provide a comparison of public education expenditures per pupil normalized by GDP per capita. Heading the OECD rankings in primary schools are Eastern European countries (Panel A). Slovenia leads the OECD with public education expenditures per pupil comprising 28.3% of its GDP per capita. Behind it are Latvia (25.9%), Estonia and Poland (at 25.8% each). Israel is situated close to the center of the OECD ranking, with 21.6% of GDP per capita going toward education expenditures per

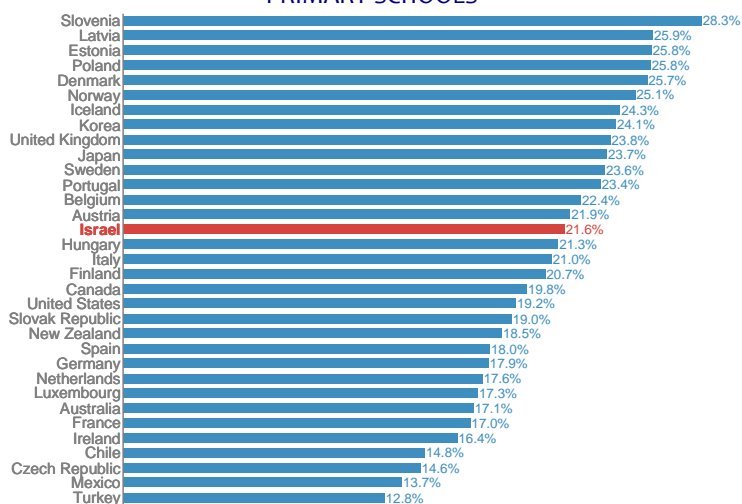
Figure 52

**PUBLIC EXPENDITURE PER PUPIL – IN PRIMARY AND SECONDARY SCHOOLS**

RELATIVE TO GDP PER CAPITA, 2013

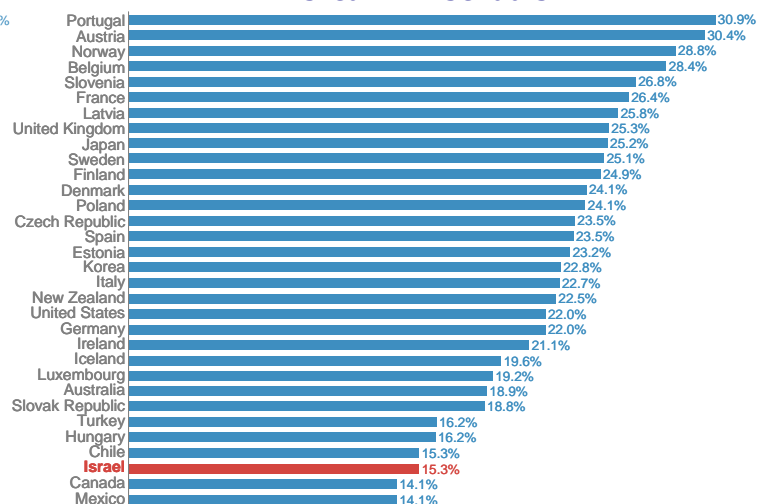
Panel A

**PRIMARY SCHOOLS**



Panel B

**SECONDARY SCHOOLS**



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

Data: OECD



pupil. At the bottom of the list are the two poorest OECD countries, Turkey and Mexico, spending 12.8% and 13.7% of GDP per capita, respectively. The third poorest OECD country, Chile, is situated fourth from the bottom, at 14.8%.

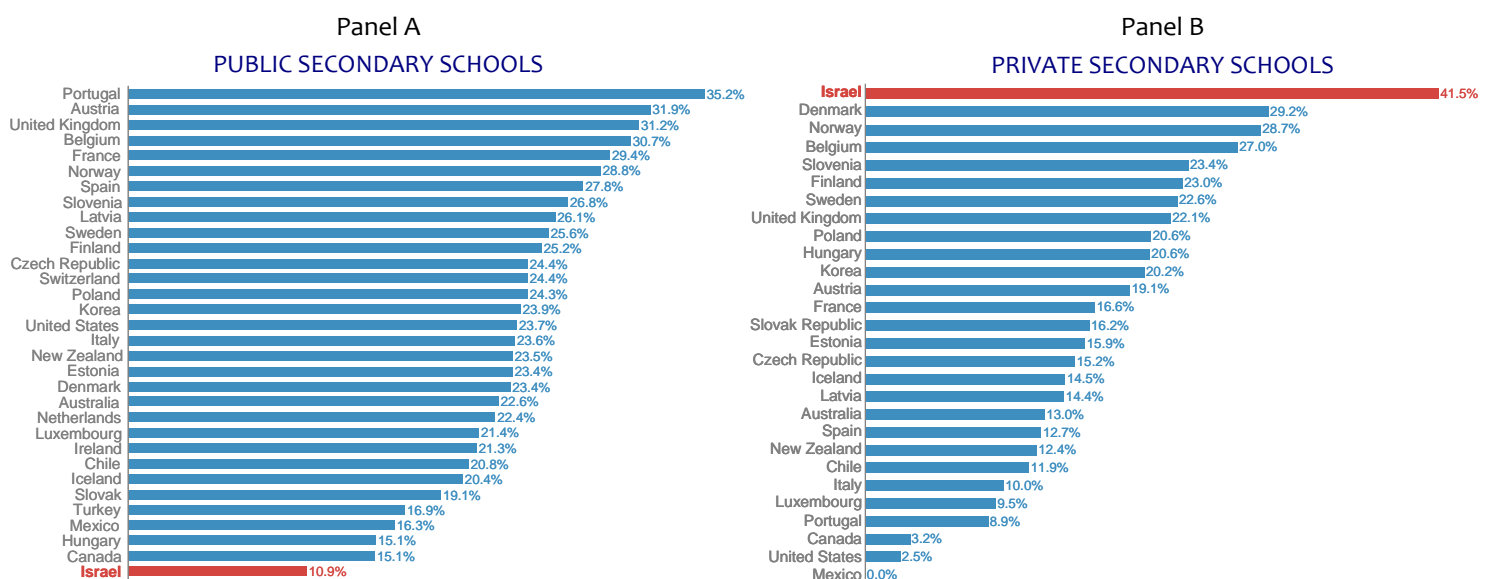
The picture changes with regard to public spending in secondary schools. Portugal heads the OECD with an education expenditure per pupil that is 30.9% of GDP per capita. Israel is situated third from the bottom, with a public expenditure per pupil, as a share of GDP per capita, that is 15.3%, or half of Portugal's expenditure. Below Israel are Canada and Mexico, at 14.1% apiece.

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 53 focuses on public education expenditures per pupil in public 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 two countries above it, Canada and Hungary, spend almost one half more, at 15.1% of GDP in each.

Figure 53

**PUBLIC EXPENDITURE PER PUPIL – IN PUBLIC AND PRIVATE SECONDARY SCHOOLS**

RELATIVE TO GDP PER CAPITA, 2013



\* 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

Portugal, who leads the list, spends almost three and a half times more than Israel on its public secondary schools.

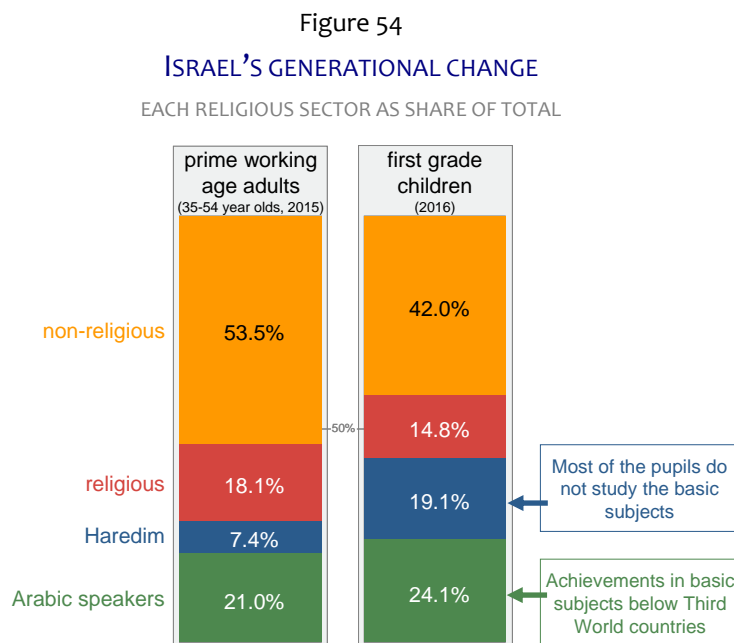
The picture flips completely when it comes to public spending per pupil on private secondary schools (Panel B of Figure 53). The Central Bureau of Statistics defines private schools as institutions receiving under 50% of their income from public funds. Haredi schools comprise a large share of such schools in Israel.

Israel's public expenditure per pupil on its private schools is nearly four times the public expenditure per pupil on its public schools. The expenditure share out of GDP per capita, 41.5%, is over a third higher than in the second place country, Denmark (29.2%). In the United States, with a vast array of private schools, public spending per private school pupil amounts to just 2.5% of GDP per capita.

## Demography and education

A comparison of the distribution among Israel's prime working age adults to the distribution of first grade enrollment in groupings consistent with the country's four main education streams provides a demographic perspective of the direction that Israel is headed. Arabic speaking adults comprise 21.0% of the prime working age population and 24.1% of the country's first graders (Figure 54). The share of non-religious Jews<sup>3</sup> among prime working age adults is 53.5% while their share of the first graders has fallen to 42%.

<sup>3</sup> All non-Arabs describing themselves as Christian, or without a religion, are included in the figure's non-religious category.



Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: Central Bureau of Statistics and Ministry of Education

Haredim are, by far, Israel's fastest growing population group. As a group, their boys also happen to be receiving the worst education in the developed world, with a nearly uniform banning of all core subject matter after eighth grade (and even what is studied until eighth grade is only partial). Only 7.4% of the working age population are Haredi adults while 19.1% of Israel's first graders are Haredi pupils. According to the Central Bureau of Statistics, this group, which comprised just 4 percent of the population in 1980, will comprise 32% of the Israeli population in 2065<sup>4</sup>.

Unless some major change occurs in the Haredi and Arabic speaking education streams, Israel is headed towards an unsustainable future that will more than likely occur far before the country reaches the year 2065. Projections by the Bank of Israel (Flug, 2015) and the Finance Ministry (Geva, 2015) show just how quickly the economic situation will deteriorate (severe drop in future employment alongside ballooning budget deficits and debt, with extremely low productivity growth) if Haredim and Arab Israelis are not quickly assimilated into the work force. These official studies focus on the more superficial issue of simply being employed, as opposed to the more basic concern revolving around levels of education and skills that will raise, rather than weigh down, national productivity and wages.

Demography is not just a result of birth and death rates. It also encapsulates emigration and immigration flows. To date, while many Israelis have left the country – one example is the disproportionate share of Israeli academics in the United States (Ben-David, 2008) – their numbers have been dwarfed by new immigrants. From Holocaust survivors and Jews fleeing Arab lands to Israel in its first years, through Jews fleeing Ethiopia and the former Soviet Union after the Iron Curtain came down in the 1990s, to the more recent wave of immigration from France spurred by anti-Semitic outbursts in the country, Israel has been a sanctuary for the Jewish people. To a large extent, this massive inward immigration of persons fleeing their home countries has exhausted itself. Aside from the large Jewish community in the United States, all other Jewish diaspora communities are fairly small. Even

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<sup>4</sup> This is the Central Bureau of Statistics' (2017) middle estimate.

if some calamity were to strike, their possible immigration to Israel would have little effect on the country's population.

On the other hand, a future emigration wave by highly skilled and educated Israelis with alternatives in the leading developed countries – persons that Israel is completely dependent on from an economic and defense standpoint, if it is to remain viable in the future – cannot be ruled out. Already today, Israel is more dependent on regressive indirect taxes than most OECD countries. If it will need to increase expenditures to care for a population increasingly unable to contend with a modern, competitive economy, its only recourse will be to move in the direction of direct taxes. However, even before the future unfolds, fifty percent of Israel's population do not currently reach the bottom rung of the income tax ladder and pay no income tax. In 2015, 90% of all income tax revenue in Israel came from the top two income deciles alone (Ministry of Finance, 2016). This twenty percent of the population contains most of Israel's most highly educated and skilled persons – the very ones that the country cannot afford to push away with increasingly higher tax burdens.

While government policies do not show any sign of a systemic education reform or enforcement of a uniform core curriculum for all of Israel's pupils, there are some indications of a change in the behavior of individuals that may signal the beginning of a pivot in the direction of a sustainable future. The major reductions in welfare benefits beginning in 2002 resulted not only in a major increase in employment among the less educated. They also led to a decline in child birth among the Bedouin in the Negev Desert and, to a certain extent, among the Haredim (Cohen, Dehejia and Romanov, 2007; Toledano, Frish, Zussman and Gottlieb, 2009). Between 2003 and 2008, the number of children per Haredi woman fell from 7.5 to 6.5, while the number of children per Muslim woman in fell from 4.4 to 3.6 (Hleihel, 2011). Religious and traditional Jewish woman averaged 2.8 children in 2008, while secular Jewish woman had an average of 2.1 children.

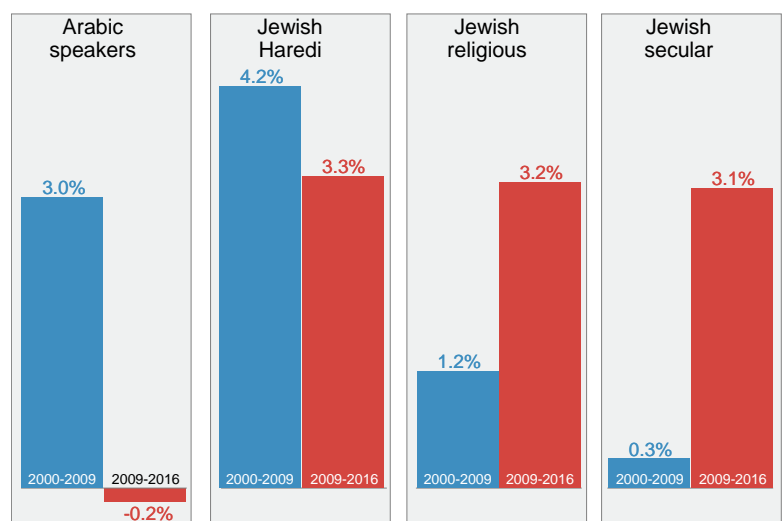
Annual changes in first grade enrollment between 2000 and 2009 tended to reflect the differing birthrates in the various population groups. Enrollment by Arabic speaking children rose by 3.0% a year during this period, while Haredi enrollment increased by 4.2% annually.

In the religious and secular schools, enrollment increased by 1.2% and 0.2% a year, respectively.

The turning point in first grade enrollment came in 2009. Children turning 6 then were born right after the significant reductions in welfare earlier in the decade. The large, and continuing, fall in birth-rates among Arabic speakers has led to relatively stable first grade enrollment in their schools since 2009 (Figure 55).

Among Hebrew speakers, Haredi birth rates continue to vastly exceed those of religious Jews, who have higher fertility rates than secular Jews. But the annual changes in first rate enrollment in each of the three Jewish groups have been nearly identical since 2009. This means that some Haredi parents must have begun enrolling their children in religious, non-Haredi, schools (and possibly, in secular schools, though this seems less likely). It is also possible that some

Figure 55  
**ANNUAL CHANGES IN FIRST GRADE ENROLMENT**  
BY SECTOR AND PERIOD, 2000-2016



Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: Israel's Ministry of Education

Haredi parents have stopped being Haredim. Since religious Jewish families have greater fertility rates than secular Jewish families, and since Haredi children now seem to also be enrolling in their schools, then it stands to reason that the annual increase in their enrollment rates should be greater than that of the secular Jewish schools. The fact that these are almost the same implies that more religious Jews have begun to register their children in secular schools. It is also possible that there has been an influx of Arabic speaking children into the secular Jewish schools, as well.

While there is no discernable qualitative difference between Jewish religious and secular schools, both of these tend to be considerably better than Haredi and Arab language

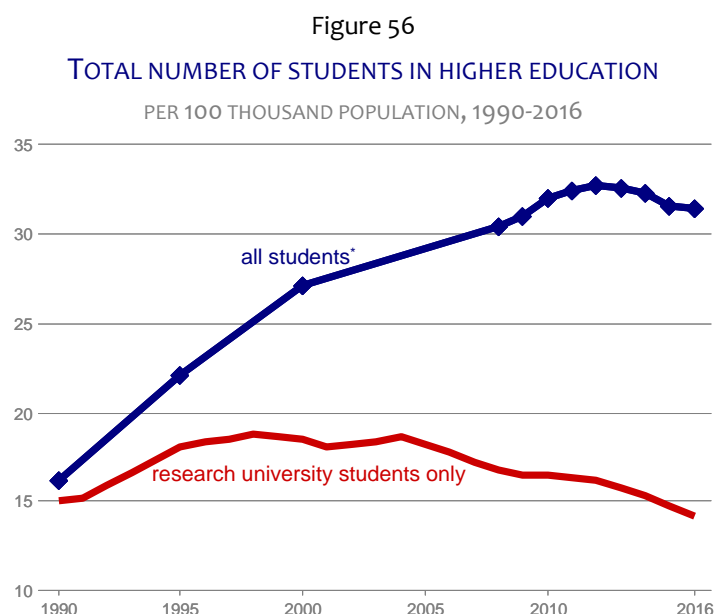
schools (with the possible exception of Christian Arab schools). In lieu of actual data, which is not available from the Education Ministry, the possible shifts in enrollment described above are no more than conjecture. But to the extent that an increasing number of Haredi and Arabic speaking parents are enrolling their children in the better Jewish schools, there is a chance that larger portions of these growing populations will be better prepared for a modern economy in the future.

## 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, the 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 56). The share of students per capita in the research universities then plateaued through the mid-2000s, while the overall number of students per capita continued its steep climb. At 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



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

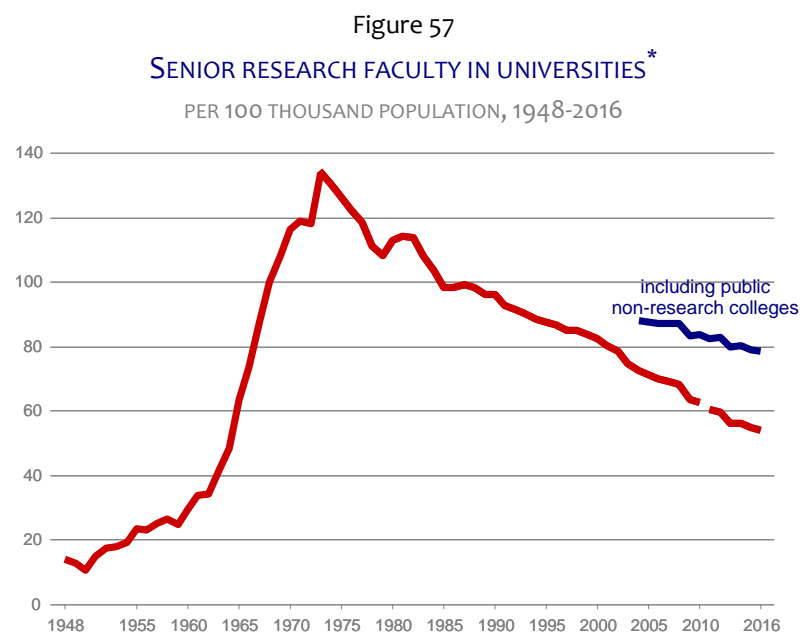
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University

Data: Israel's Central Bureau of Statistics and the Council for Higher Education

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 3), 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 57, 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%. The country, faced with tremendous economic hardships as it gathered in waves of new immigrants with little more than the clothes on their backs, 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



\* 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



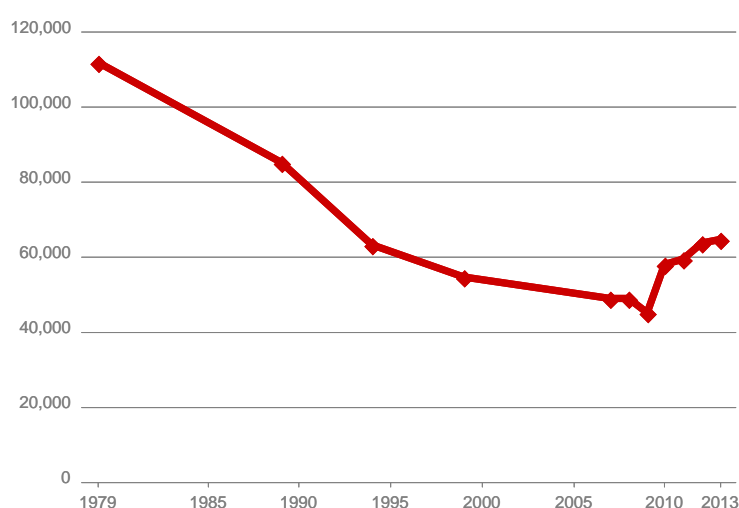
1973 – it has not built a single additional research university.<sup>5</sup> In fact, the number of university senior faculty per capita is today only 40% of what it was in 1973. Even when the public non-research colleges are included, the share of total senior faculty in Israel's population is considerably below the 1973 heights, and it is declining.

This shift in priorities extends far beyond relative numbers as a share of a rapidly growing population. Not only has the country not built another Technion, Hebrew University or Tel-Aviv University, the absolute number of positions in these three institutions is actually lower today than it was in 1973 (Ben-David, 2013).

A reflection of the shift in priorities is evident in the national higher education expenditures per student depicted in Figure 58. These expenditures steadily fell 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.

Figure 58  
**NATIONAL HIGHER EDUCATION EXPENDITURES PER STUDENT**  
IN 2010 SHEKELS, 1979-2013



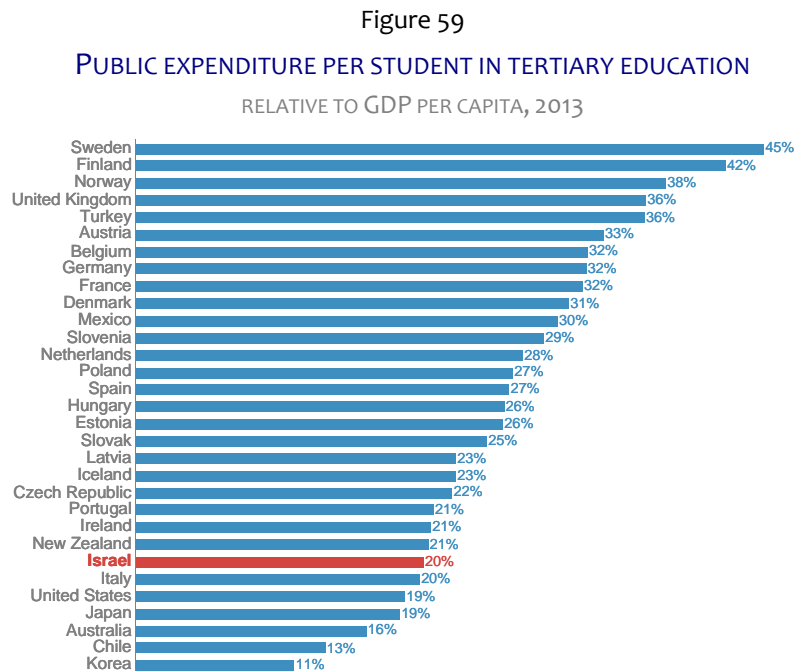
Source: Dan Ben-David, Shoresh Institution and Tel-Aviv University  
Data: Israel's Central Bureau of Statistics

<sup>5</sup> The issue of the West Bank college in Ariel being renamed a university in recent years was due to political considerations that had nothing to do with research prowess. Politicians forced the purportedly independent Council for Higher Education, responsible for academia in the country, to accept this decision.

Consequently, Israel's public expenditure per student in tertiary education is one of the lowest in the OECD (Figure 59). 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. A particularly unique Israeli trait is the multi-year military service that the country requires of its young people (though a large and growing population share receives exemptions for religious reasons), followed by decades of annual reserve service in the army. The deferment of academic studies until after military discharge means a later entry into the labor market and fewer total years of employment over the life cycle – with the earlier truncation (in terms of total years) occurring when experience and seniority tend to yield the



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

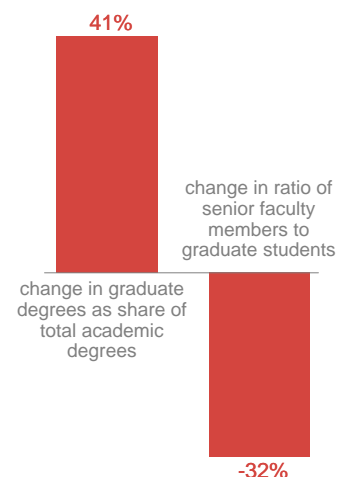
highest annual incomes. In other words, the high personal economic price that Israel requires its citizens to pay for the defense of the country needs to also be taken into account when determining how much of an additional cost those same shoulders should bear to attain a higher education that also benefits the entire nation.

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 a country's future sources of research and innovation – 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 occurred. In 1999, there was one senior faculty member for every 7.2 graduate students (Figure 60). 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. However, there are less mentors to provide the necessary personal guidance so important for students at these

Figure 60  
**THE EVOLUTION OF GRADUATE TRAINING AT UNIVERSITIES\***  
CHANGES FROM 1999 TO 2014



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

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.

There is another, potentially problematic, aspect of the rapid increase in the number of graduate students. With a primary and secondary education that has become one of the worst in the developed world, a greater number of this system's graduates head toward academia with inadequate preparation. As a result, the teaching of such undergraduate students – invariably in the non-research colleges – has meant a substantial lowering of the bar in these instances (literally so, in the case of law students, as shown in Figure 28). When a large number of these students then apply for graduate studies in the universities, legal arguments are often provided for why various academic departments cannot screen them out using exams, such as the GRE.<sup>6</sup> Thus, an increasing number of persons are admitted to university graduate schools on the basis of high grades from their undergraduate colleges, without possessing a minimum level of math or English (for example) that will enable them to study at the highest international levels.

The result is a conundrum faced by departments (at the micro level) and by universities (at the macro level). They are responsible for maintaining the highest academic qualitative levels, while the primary key for their funding is based on the quantity of students that they teach. In and of itself, this is not necessarily a bad basis for determining public funding of higher education since there is a question of whether public funds should be provided to departments that students choose not to study in.

However, two major caveats are in order. The first has to do with fields that a nation feels are cardinal from a cultural, societal and/or economic perspective, requiring a continuation of research and study regardless of the number of students that register. In such instances, it is possible to consolidate such disciplines into one or two universities and continue their funding irrespective of enrollment.

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<sup>6</sup> There are only a few exceptions to this rule, among them GMAT exams that business schools began requiring many years ago that have since been grandfathered in.

The second caveat pertains not just to the public institutions of higher learning, but to Israel's various governmental institutions in general. There tends to be a major disconnect between accountability for outcomes and the authority to determine fundamental operational details. The top-down approach in Israel's governmentally funded bodies does not confine itself to setting targets and providing necessary oversight to ensure that these are met. It also includes micro-management in operations and the use of budgets.

In such an environment, it becomes a race to the bottom as universities and colleges vie for the same students, rather than providing universities with the ability to maintain and even augment their reputation for rigor and excellence. This can, and should be, the universities' main selling point – and, in the final analysis, such institutions are what a country needs if it is to remain at humanity's technological frontier.

While the top-down approach has a primarily negative impact on outcomes, there is one area that it could be useful. As noted earlier, there is a considerable amount of deception in the public advertisements by many of the colleges, with some even blatantly telling prospective students that there is no longer a need to decide between universities and colleges. As a result, many prospective students who can get accepted to universities opt for convenience and short term economic benefit by choosing to live at home – saving on rent and other costs – and studying at nearby colleges. They tend not to be aware of the decisive difference that this choice will make on where they will be able to work in the future and the type of income that they will have (Figure 29 above is just one example of this). The high end of the private sector certainly knows how to make these distinctions, and it does so without compunction.

To shift the competition between higher education institutions to one of quality rather than quantity, the Council for Higher Education should require all such institutions to provide prospective applicants with a comparative table showing annual average earnings by discipline of each institution's graduates over time. Such information can be compiled by the Central Bureau of Statistics on the basis of their surveys and the administrative data that is available to it.

Such information will enable prospective students to receive a more accurate understanding of the implications of their choices. Not only will universities vie for the best students, colleges will also have a major incentive to upgrade their standards to try and enlarge the pool of individuals wishing to get degrees with them. Most importantly, this will create a win-win outcome at the national level that will preserve, and even improve, Israel's overall academic levels of education.

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? 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, also 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 OECD countries and to five-year intervals since 1975. As 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 comparative analysis, rather than on an absolute one.

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 61 compares Israel to the OECD average, as well as to the average for the G7 countries. In light

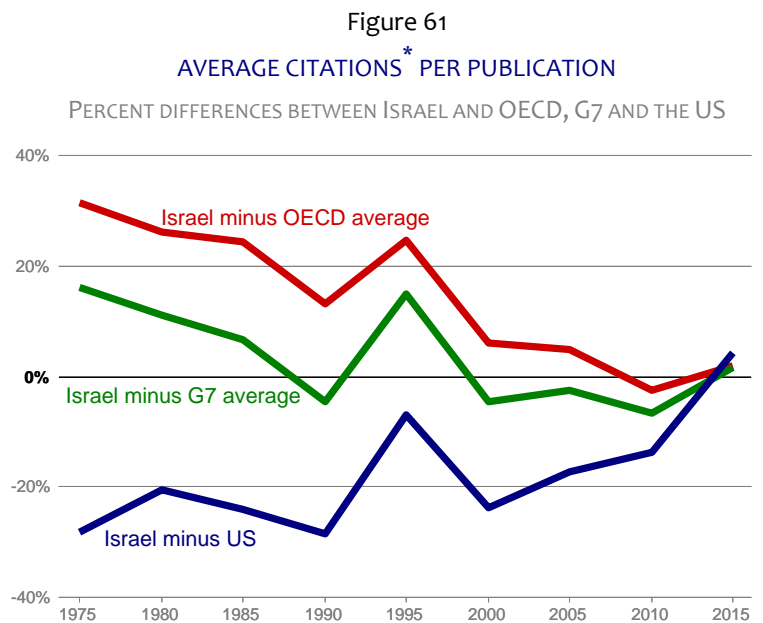
of the fact that the world's top universities tend to be located in the United States, such a comparison between Israel and the U.S. is included, as well.

The gaps between Israel and the others 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 particular 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. Publications of a university refers to articles published by its faculty members. 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. Since the



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

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

Data: Web of Science



goal is to determine a country's most important academic institutions in the chosen fields, the size of an institution also matters.

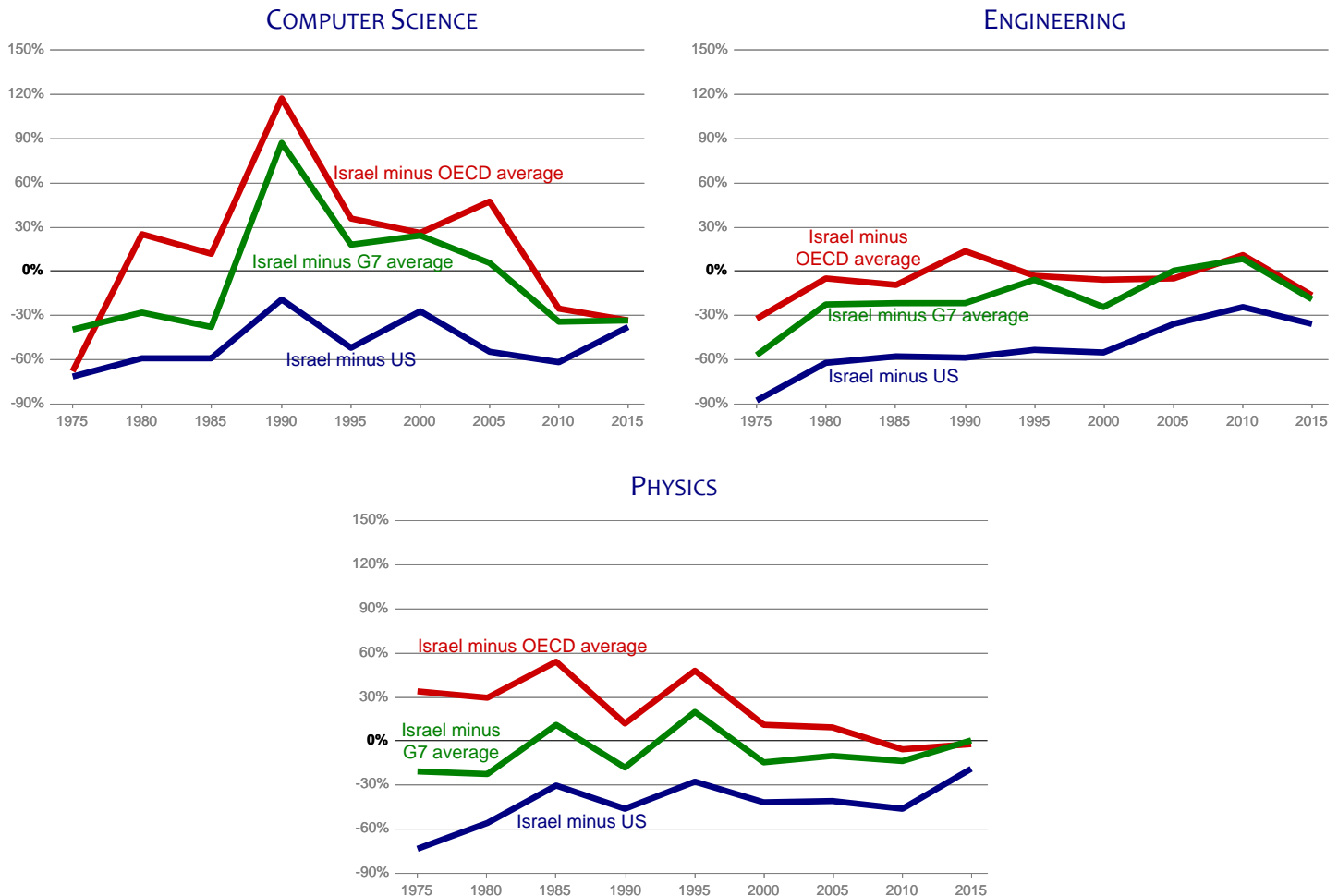
Some universities in a few of the countries attained high rankings on the basis of just a few publications. Hence, the median number of publications was used to reduce the presence of the outlier institutions. Any university ranked among the top five that did not produce at least the median number of 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 62 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 and the average of the top five universities in the G7 countries. The Israeli universities were similarly far below 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 lag while the lag vis-à-vis the United States in 2015 was roughly 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 – sometime slightly pulling ahead and sometimes falling slightly behind. 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.

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

Figure 62  
CITATIONS PER PUBLICATION\* IN EACH COUNTRY'S TOP 5 ACADEMIC INSTITUTIONS  
PERCENT DIFFERENCES BETWEEN ISRAEL AND OTHERS IN SELECTED FIELDS, 1975-2015



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

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

Data: Web of Science

G7 averages converged and the gaps nearly eliminated entirely. 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 the G7 countries for decades. 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 by far the fastest growing in Israel – participated in the exams, the national results would have been even poorer.

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. 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.

In academic education, what students study – and where – has a major impact on their occupational choices and 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 academic institution. 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 has 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 number of designated disciplines also indicates a substantial reduction in the gap over the past several decades.

The situation described in this paper does not appear to be sustainable over the long run. If Israel's primary and secondary school feeders into its 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 ever 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's self-preservation.

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