



**The Effect of Vocational Education on
Short- and Long-Term Outcomes of Students:
Evidence from the Arab Education System in Israel**

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**The opinions expressed in this paper do not necessarily reflect the position of
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**The Effect of Vocational Education on Short- and Long-Term Outcomes of Students:
Evidence from the Arab Education System in Israel**

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Abstract

This study examines the effect of vocational education on short- and long-term outcomes of students who were in the Arab education system in Israel in the 1990s. In order to overcome possible bias arising from the selection of students into vocational education, the study exploits a reform implemented in the Arab education system that led to the opening of new vocational tracks in localities that either had no vocational studies beforehand or had such studies but only on a small scale (treatment localities). These localities are compared to similar localities in which no new tracks were opened (comparison localities).

Difference-in-differences estimates show a 3–5 percentage point decrease in the probability of dropping out of high-school following the opening of the new tracks, which is about 20–35 (10–15) percent of the girls' (boys') mean dropout rate. There is also a 4–7 percentage point increase in the share of girls taking matriculation exams. However, the opening of the new tracks did not increase the matriculation eligibility rate of the students, with the rate even decreasing among boys according to several estimates. The opening of the vocational tracks had no significant long-term effect on the likelihood of the students acquiring a tertiary academic education, on being employed, or on their earnings in their adulthood. There was a significant increase in the number of women entering clerical professions, which is consistent with the popularity of the new clerical tracks. There was also a significant decrease in the share of girls marrying at a young age, probably due to the increase in the probability of their completing high school.

השפעת החינוך המקצועי במגזר הערבי על משתני תוצאה בטווח הקצר והארוך

אלעד דה מלאך ונעם זוסמן

תקציר

המחקר בוחן את השפעתו של החינוך המקצועי בתיכון על משתני תוצאה בטווח הקצר והארוך בקרב תלמידים מן המגזר הערבי בישראל בשנות התשעים. על מנת להתגבר על הסלקטיביות בבחירת נתיב הלימודים, המחקר מסתמך על תוכנית חומש שיושמה במגזר בתקופה הנחקרת, שבמהלכה נפתחו מגמות מקצועיות חדשות ביישובים שבהם לא היו כלל לימודים מקצועיים קודם לכן, או שהם היו בהיקף קטן (יישובי הטיפול). נעשה שימוש בשיטת "הפרש הפרשים" – השוואת השינוי במשתני התוצאה של התלמידים ביישובי הטיפול לשינוי ביישובים דומים שבהם לא נפתחו המגמות.

פתיחת המגמות המקצועיות הפחיתה את שיעורי הנשירה בתיכון ב-3—5 נקודות אחוז. מדובר בסדר גודל של 20—35 אחוזים משיעור הנשירה הממוצע של בנות בתקופה החקירה ו-10—15 אחוזים משיעור אצל הבנים. בקרב בנות היה גם גידול של 4—7 נקודות אחוז בשיעור הניגשות לבחינות הבגרות. עם זאת, פתיחת המגמות המקצועיות לא העלתה את הזכאות לתעודת בגרות, ולפי חלק מהאמידות בקרב הבנים היא אף פגעה בה.

מרבית האומדנים אינם מצביעים על השפעה מובהקת של פתיחת מגמות בחינוך המקצועי על רכישת השכלה אקדמית, על התעסוקה ועל השכר של התלמידים בחייהם הבוגרים. נרשם גידול משמעותי בשיעור הנשים העוסקות במשלחי יד פקידותיים, ממצא העולה בקנה אחד עם כך שחלק הארי של המגמות המקצועיות שנפתחו היו בתחום זה. לבסוף, נמצאה ירידה מובהקת בהסתברות של נשים להינשא בגיל צעיר, ככל הנראה בשל הגידול בסיכוייהן לסיים 12 שנות לימוד.

1. Introduction

The optimal education mix between vocational and general education is a question of great importance for policy decision makers, because of its long-term implications on human capital, labor skills, welfare, and economic growth. Various countries around the world use education systems that are different in various respects, such as level of separation between general and vocational education, curriculum, and age of tracking. About one-third of Israeli students receive a vocational education, compared to an average of about one-half of the students in OECD countries.

There is a long-standing controversy in the public arena as well as in the scientific community about the pros and cons of implementing a comprehensive vocational education system alongside a general one. The proponents of vocational education argue that it increases interest in studies among students whose skills are less academic, and therefore reduces their chances of dropping out of school. However, opponents of vocational education claim that the skills acquired from it are too specific, and therefore incompatible with a modern employment market subject to rapid technological change. Another argument raised by the opponents is that early-life vocational education tracking can significantly reduce the social mobility of its students, many of whom come from a weak socioeconomic background. However, the literature on the impact of vocational education on various outcomes (e.g., dropping out of school, academic achievement, pursuit of higher education, employment, and wages) is mixed.

The main challenge facing studies on vocational education is the selection problem. Students are not randomly assigned to vocational or general education, but according to their preferences or to an external tracking system. These factors may be largely affected by the personal characteristics of the students, which may also independently affect their outcomes. In order to deal with the selection problem, this study exploits a natural experiment: an extensive opening of new vocational tracks in high schools in Arab localities in Israel. Most of these localities either had never offered vocational tracks before or had done so but on a very small scale (“treatment localities”). The reform was part of a five-year plan by the Ministry of Education to increase the availability of vocational studies in the Arab sector. The opening of the tracks took place in several Arab localities, while no vocational tracks were opened in other localities (“comparison localities”).

This study uses the difference-in-differences methodology: the change in the outcomes of students who studied before and after the opening of the new vocational tracks in the

treatment localities is examined and compared to such change in the comparison localities, while controlling for students' background characteristics, cohort fixed effect, and locality of residence fixed effect. The identification assumption is that in the absence of the opening of the new vocational tracks, the changes in the outcomes of the students in the treatment localities during the study period would have been the same as the changes in the outcomes of the students in the comparison localities.

The study links Israeli high school students' data and three additional data sets associated with students' outcomes. The study's primary data set is administrative files on Israeli high school students from the Ministry of Education. This includes data on the students' social and demographic characteristics and on the type of education they receive (i.e., vocational or general). In order to link students' data with their outcomes, data on the students' matriculation exams was obtained from the Ministry of Education. Matriculation exams (called *bagrut* in Hebrew) are national exams taken by the majority of Israeli upper secondary school students to evaluate their academic ability in various subjects. A matriculation certificate is awarded to students who pass the exams and is a prerequisite for admission to Israeli universities. In addition to the Ministry of Education data on students and outcomes, the study uses data from the Central Bureau of Statistics on yearly earnings of employees and self-employed individuals, where the employment and wage rates of the students can be observed in their adulthood, as well as 2008 Population Census data on the tertiary education, occupation, and demographic characteristics (such as age of marriage and number of children) of the students at the time of the census.

The results show that the opening of the vocational tracks in Arab high schools during the 1990s reduced the probability of dropping out between the tenth and twelfth grade by about 3–5 percentage points, which is approximately 20–35 percent of the average girls' dropout rate in the period of study, and about 10–15 percent of the boys'.¹ There was also an increase of 4–7 percentage points in the share of girls who took the matriculation exam. However, no increase was found in the matriculation eligibility rate of the students, and some of the estimates even show a decrease in the share of the boys who were eligible for matriculation certificate. No statistically significant change in acquisition of higher education, employment, or wage rates was observed for either boys or girls in their adulthood. For boys, however, the

¹ The dropout rate before tenth grade cannot be directly observed, but the estimations show no change in the number of tenth-grade students in the cohort after the opening of the new tracks.

coefficients of the effect on employment and wage rates were always negative and sometimes not very far from being significant.

There was also a substantial increase in the share of women who worked in clerical occupations, which is consistent with the popularity of the new tracks in bookkeeping and secretarial studies. The opening of vocational tracks also increased the women's age of marriage by about half a year, probably due to the decrease that was found in the high school dropout rate.

The paper is organized as follows. Section 2 provides some background on the relative advantages and disadvantages of vocational education, and includes a review of the literature. Section 3 describes the data, the identification strategy, and the sample. Section 4 explains the empirical methodology. Section 5 presents the results. Section 6 discusses potential biases and provides several robustness tests. Section 7 concludes.

2. Theoretical Background and Literature Review

The contribution of vocational education versus general education to secondary school students is a controversial issue in the education policy debate as well as in the research literature. Proponents of vocational education argue that it may significantly benefit students with fewer academic skills by providing them with an opportunity to enter professions that are highly in demand in the labor market. In addition, vocational education may reduce high school dropout rates and their negative implications (e.g., Kulik, 1998). In the Israeli context, vocational education provides a skilled labor force to the military, and offsets the shortage of skilled manual labor in the Israeli economy, which may hinder growth (Nathanson et al., 2010; Goldstein, 2013).

Opponents of vocational education argue that general education is more valuable for general human capital by providing basic skills in a wide range of fields. Unlike vocational education, which focuses on skills that are more occupation-specific, general education helps individuals to engage in a wide range of occupations in the labor market and to cope with rapid technological change. Some argue that public investment in vocational education, instead of in general human capital, may hinder long-term economic growth (Krueger and Kumar, 2004).

Another criticism leveled at vocational education is related to vocational education tracking of students from a weak socioeconomic background at an early stage in their life. Such

tracking can harm their chances of switching to more general studies at a later stage and acquiring an academic education. As a result, tracking can reduce social mobility and increase economic inequality (Brunello and Checchi, 2006; Swirski and Dagan-Buzaglo, 2010). The earlier tracking takes place, the greater the chances are that students will be assigned to a track that is incompatible with their skills and preferences (Betts, 2011).

Up until the late 1980s, there was a near consensus in the literature that general education is more cost-effective than vocational education (e.g., Psacharopoulos, 1987; Tilak, 1988). In line with this perspective, in the twentieth century many Western countries expanded the general education system at the expense of the vocational one.

From the 1990s onward, however, a “new wave” of studies begins offering a new and more positive outlook on the issue of the effectiveness of vocational education (Arum and Shavit, 1995; Kang and Bishop, 1989). The positive effect of vocational education is evident when its graduates are employed in occupations that are related to the vocational courses that they studied (Neumann and Ziderman, 1991, 1999; Mane, 1999). However, the effectiveness of vocational education remains a debatable issue and other studies still find a negative or zero effect of vocational education on the labor market outcomes of students (Horowitz and Schnezler, 1999; Dearden et al., 2002; Newhouse and Suryadarma, 2009).

A common problem with the literature on vocational education is the selection problem. Most of the studies take into account various characteristics of students, such as place of residence, family background, and ethnic background. However, selection of a track is affected by various other unobservable characteristics of students, such as cognitive skills, manual skills, diligence, and self-motivation, all of which can independently affect the outcomes of students in adulthood. Therefore, comparing outcomes of students in the general and vocational tracks without taking selection into account can be biased. For example, Meer (2007) discovers a substantial phenomenon of self-selection among vocational as well as general education students. He finds that in most cases students chose the type of education that was best suited to their personal skills, and earned no less in adulthood than otherwise.

In order to deal with the selection problem, many recent studies use quasi-experimental methods that exploit random or pseudo-random variations in the type of education that the student receives. These methods enable a more reliable examination of the effect of vocational education on various outcomes. An example of such a variation is an increase in the academic content of the vocational syllabus due to an education reform. Another such example is a sudden addition of years of general education at the expense of vocational years due to a reform that postpones the age of tracking.

Meghir and Palme (2005) examined a national education reform in Sweden that replaced a tracking policy based on grades by a tracking policy based on free choice. The reform contributed to social mobility by increasing education and income, especially among students with less educated parents. Oosterbeek and Webbink (2006) evaluated a reform in the Netherlands during the 1970s that increased vocational education from three to four years. They found no significant effect on the students' earnings in their adulthood. Malamud and Pop-Eleches (2010) analyzed a reform in Romania that extended compulsory general education from eight to ten years, delaying the age of vocational education tracking by two years. They found that students were less likely to work in manual and craft-related occupations, but that there was no change in their employment and earnings. Accordingly, the authors concluded that the observed difference in earnings between general and vocational students was driven by selection bias rather than by a negative effect of vocational education. Hall (2012) examined a reform in Sweden implemented in the late 1980s that increased the academic content of the vocational syllabus and extended vocational education by one year. She found no effect on students' earnings or university enrollment.

Another possible method of identification is to employ a regression-discontinuity (RD) design based on a grade-point cutoff that completely or partially determines whether a student gets accepted to a certain track. Tsur and Zussman (2010) employed this design in a study of a high-stakes examination (called *seker* in Hebrew) that was given to all Jewish eighth-grade students in Israel at the end of the 1960s, where the grade-point cutoff was 70 (out of 100). The probability of students being accepted into the general track was significantly higher for students who got a grade slightly above 70 than for students who got a grade slightly below that. Students slightly above the cutoff attained more tertiary education, were employed in more prestigious occupations, and earned more than their counterparts who were slightly below the cutoff. Sauermann and Stenberg (forthcoming) used the GPA admission cutoffs of various vocational and general programs in upper secondary schools in Sweden. They found that vocational students enjoyed a short-term earnings advantage over general education students, but that there was no difference in earnings between students in the two tracks in the long term.

Dustmann et al. (2017) exploited the discontinuity in the age of school entry around the date-of-birth cutoff, and the fact that younger students (whose age is slightly below the cutoff) showed better academic achievements in early grades and were less likely to be tracked to vocational schools (in Germany, tracking takes place early upon completion of elementary

school). However, the authors did not find significant long-term effects of vocational education on students' earnings and employment in adulthood.

An additional method for tackling selection bias in tracking is to use geographic availability of vocational schools as an instrumental variable (IV). Chen (2009) employed the instrumental variable of the share of vocational schools near the student's village of residence in Indonesia. She found that vocational education led to significantly lower academic achievement as measured by national test scores, but found no significant effect on employment and earnings. Using a similar instrumental variable in Turkey, Torun and Tumen (2017) found no difference in employment probability between students in vocational and general education.

Recently, the literature started to focus on the effects of vocational education versus general education on employment and wages at different stages of the career trajectory. Hanushek et al. (2017) found that individuals with a vocational education were more likely to be employed at a younger age (before they are 26 years old), but that this advantage diminished over time and even turned into a disadvantage when their earnings were compared to the earnings of the oldest cohorts with a general education. Golsteyn and Stenberg (2017) found similar results for the earnings of individuals in Sweden.

In conclusion, the evidence from the debate on the superiority of vocational education versus general education is quite mixed. However, most of the results that were obtained by quasi-experimental methods – that are better at dealing with selection bias – did not find vocational education to have a significant causal effect on employment and earnings (relative to general education). A possible explanation is that such studies focus on the *marginal* effect of vocational education on outcomes.

The marginal aspect of the effect of vocational education derived either from the sample (e.g., “marginal” students who were slightly above and slightly below the grade-point cutoff of acceptance to general education) or from the educational content (e.g., a delay in the age of tracking, which caused students to gain "marginal" educational content from the general curriculum). In addition, when these studies did find evidence of a significant effect, they usually found that the employment and earnings of graduates of the vocational track were higher in the short term than those of graduates of the general track, but that this advantage diminished over time and was sometimes even overturned in the long term.

3. Data and Identification Strategy

3.1 Data

The study links several data sets containing information about Israeli students, schools, matriculation examinations, earnings, as well as data from the 2008 Population Census. The administrative files on the students were provided by the Israeli Ministry of Education. These files contain the social and demographic characteristics of all upper secondary school students for the years 1991–1998, such as locality of residence, number of years of parents' education, and number of siblings. The files also contain information about students' grade level, education (vocational/general), and curriculum. Finally, they contain information about schools' locality and type (general/vocational/comprehensive) for the years 1991–1998.

Three additional data sets were used to examine the students' outcomes. The first data set on students' outcomes contains test scores of matriculation exams (*bagrut*) for the period 1992–1998. In addition to students' test scores in the different subjects covered by the exams and the number of study units of each subject (the number of study units is a measurement of subject difficulty or workload), the data set contains indicators of whether the student took the exams and, if so, whether the student passed the exams and thereupon obtained a matriculation certificate. The second data set on students' outcomes is the Israeli tax authority registry of employees and self-employed individuals for the years 1995–2014. It contains information about earnings and the number of months of employment for each employee. The third data set on students' outcomes is the 2008 Population Census, which contains a wide range of demographic and socioeconomic outcomes of students, including education, employment, occupation, income, marital status, and fertility.

The sample consists of approximately 21,000 students from a limited group of localities and about 39,000 students from an extended group of localities (details below) who were in the tenth grade in the years 1989–1998.² Matriculation data exists for all students in the sample except for those who were in the tenth grade in 1989. Therefore, it is possible to estimate the effect of vocational education on the matriculation outcomes of approximately 20,000 students in the limited group of localities and 36,000 students in the extended group of localities. Data on students who dropped out of secondary school exists only for the cohorts who were in the tenth grade in the years 1991–1997, i.e., for about 16,000 students in the

² Data on students exists only from 1991 onward and therefore the tenth-grade cohorts in 1989 and 1990 are the students who studied in the eleventh and twelfth grades in 1991. Because the data on these cohorts does not include students who dropped out between the tenth and twelfth grades, they are not included in the estimation of the effect of vocational education on the probability of dropping out.

limited group of localities and about 29,000 students in the extended group of localities.³ Data on all students who studied in the tenth to twelfth grade in the years 1991–1998 is linked with data on the individuals who were sampled in the 2008 Population Census. All of the students who appear in the census, as well as a random sample of half of the students who do not appear in the census, are linked with the data on employees from 1995–2014 and the data on self-employed individuals from 1999–2014. Therefore, the effect of vocational education on labor market outcomes is estimated for approximately 12,000 students in the limited group of localities and 22,000 students in the extended group of localities.

3.2 Identification Strategy: Opening of New Vocational Tracks as Part of an Education Reform

The scope of vocational education in the Arab sector has changed beyond recognition in recent decades. Until the early 1990s, less than 20 percent of Arab students received a vocational education, whereas in 2015 the number stands at almost 50 percent (Figure 1).⁴ In the past, vocational studies were not an important component of the Arab education system, mainly due to a lack of resources and a skilled labor force for teaching and supervision. In the mid-1980s, efforts to expand vocational education in the Arab sector began to increase. The Second Arab Education Conference, held in May 1984, recommended expanding the vocational education system in an effort to curb the high secondary school dropout rate in the sector and to encourage talented students to aspire to prestigious technological professions. A year later, the Fund for the Advancement of Technological Education in the Arab Sector was established.

The process of expanding the vocational education system in the Arab sector reached its zenith in 1992, when the Ministry of Education began allocating a substantial budget to implement a five-year plan to advance vocational education in the Arab sector.

The plan set goals to increase within five years the proportion of Arab students studying a vocation to 35 percent of all secondary school students in the Arab sector, and to develop and equip new vocational tracks in Arab schools (Ministry of Education and Culture, 1992).

³ Since students' data for the year 1999 is available, it is possible to observe the dropout rate of students who were in the tenth grade in 1997. The 1999 data is missing many important characteristics, and therefore is not used elsewhere in the study.

⁴ In contrast to the growing popularity of vocational education in the Arab sector, the share of Jewish students receiving a vocational education fell from about 55% in 1980 to about 36% in 2015 (Figure 1). This stemmed partially from an increase in the share of ultra-Orthodox students out of all high school students studying in the Jewish education system (from 4 percent in 1980 to 25 percent in 2015). Assuming that all students in ultra-Orthodox schools were getting a general education, the share of vocational students among non-ultra-Orthodox students declined from about 57% in 1980 to about 44% in 2015.

One of the main channels of implementation of the reform was an extensive opening of new vocational tracks in many localities that previously had only general studies available (hereinafter, the treatment localities). The opening of the tracks provided a convenient opportunity for local students to acquire a vocational education without bearing the cost of attending a school outside the locality. Figure 2 reports the shares of students enrolled in vocational and general education programs in all localities that introduced vocational tracks between 1991 and 1998. The figure shows that the opening of the new tracks led to a significant increase in the share of students receiving a vocational education.⁵ The treatment localities will be compared to similar localities in which there was a school but no new vocational tracks were opened during the same period (hereinafter, the comparison localities).

The group of localities consists of nine treatment localities, in which there was no vocational education until the new tracks were opened, and nine comparison localities, in which there was no vocational education during the whole period of this study (1991–1998). The advantage of this group of eighteen localities (hereinafter, the limited group) is that the treatment and comparison localities are “clean,” in the sense that they approach the ideal format of a “laboratory experiment.” However, its main drawback is the small number of localities, which may decrease the statistical power and external validity of the results.

In the extended group of localities, seven more localities are added to the treatment and comparison localities. The extended group includes treatment localities in which vocational education existed on a small scale before the new tracks were opened, and comparison localities in which vocational education existed during the period of study, but the proportion of vocational students as well as the number of tracks hardly changed. The extended group of localities doubles the sample of the study, thereby increasing its statistical power.

Another advantage of the extended group is that it adds to the sample students who received a vocational education before the opening of the new tracks, as well as students who received a vocational education in the comparison localities during the period of study. Since these students received a vocational education for endogenous reasons (unrelated to the exogenous opening of the new vocational tracks), it is possible to conduct naive OLS estimations of the returns to vocational versus general education and to compare their estimates to those obtained by the more reliable instrumental variable (IV) estimations discussed in Section 5.⁶

⁵ A small share of the students studied outside their locality of residence.

⁶ Table A1 in the Appendix lists the treatment and comparison localities. Figure A1 in the Appendix shows the share of students studying in the general and vocational tracks in each of the localities that were added to the extended group of localities.

It should be noted that it is not possible to classify many Arab localities as belonging unequivocally to either the treatment group or the comparison group, e.g., localities that had extensive vocational studies prior to the period of study, or localities in which vocational studies were gradually expanded. Therefore, many localities in the Arab sector are not included in the sample.

Figure 3 presents the geographic distribution of the treatment and comparison localities in the limited group of localities.⁷ The study focuses on localities in the north and the center of Israel because many other trends occurred in the (Bedouin) Arab localities in the south during the period of study, wherefore the estimates in that population are less reliable.

Figure 4 shows that an absolute majority of vocational students in the treatment localities studied in low-tech tracks and a minority of them in high-tech tracks (such as Electronics and Electricity).⁸ Furthermore, while a considerable proportion of boys studied in high-tech tracks, very few girls enrolled in those tracks. Courses in bookkeeping and secretarial studies were the most popular new tracks.

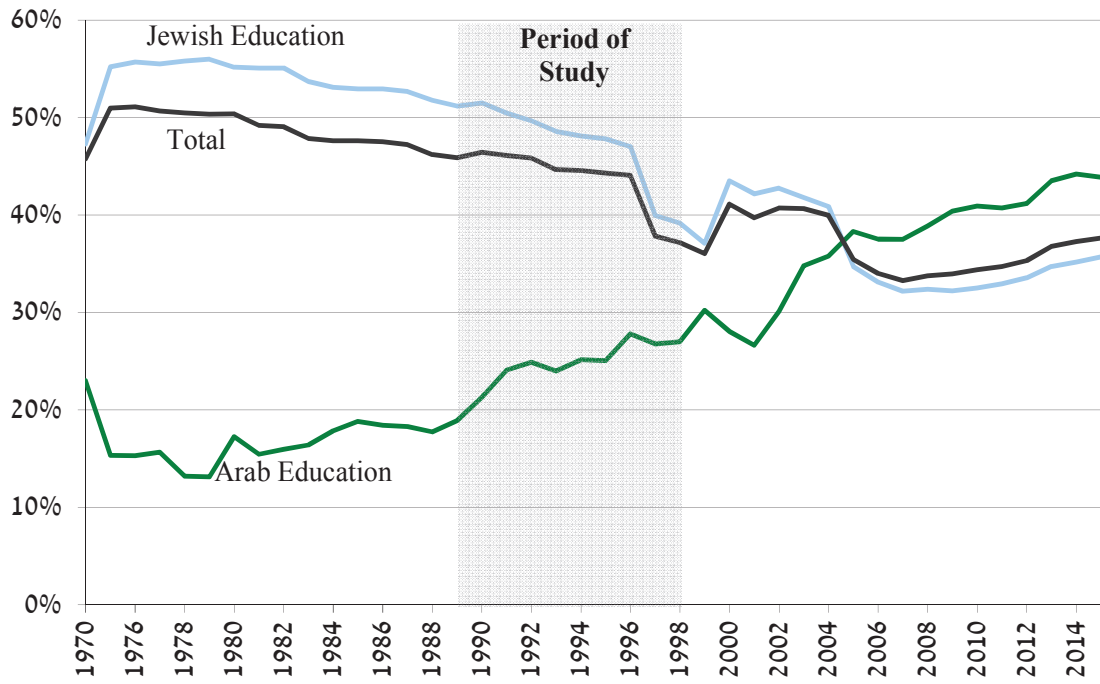
Table 1 presents the background characteristics of tenth-grade students in 1998 who received a vocational versus a general education in the treatment localities in which vocational tracks were opened.⁹ The education of the parents was lower among the vocational students. Therefore, it is reasonable to assume that the students who studied in the newly introduced vocational tracks ("treatment compliers") were weaker on average than the students who remained in the general education system in the treatment localities ("treatment non-compliers").

⁷ Figure A2 in the Appendix shows a similar map for the extended group.

⁸ Figure A3 in the Appendix shows similar graphs for the extended group.

⁹ For the limited group of localities. Table A3 in the Appendix presents characteristics for the extended group of localities.

Figure 1: Share of Vocational Students by Sector, 1970-2015¹

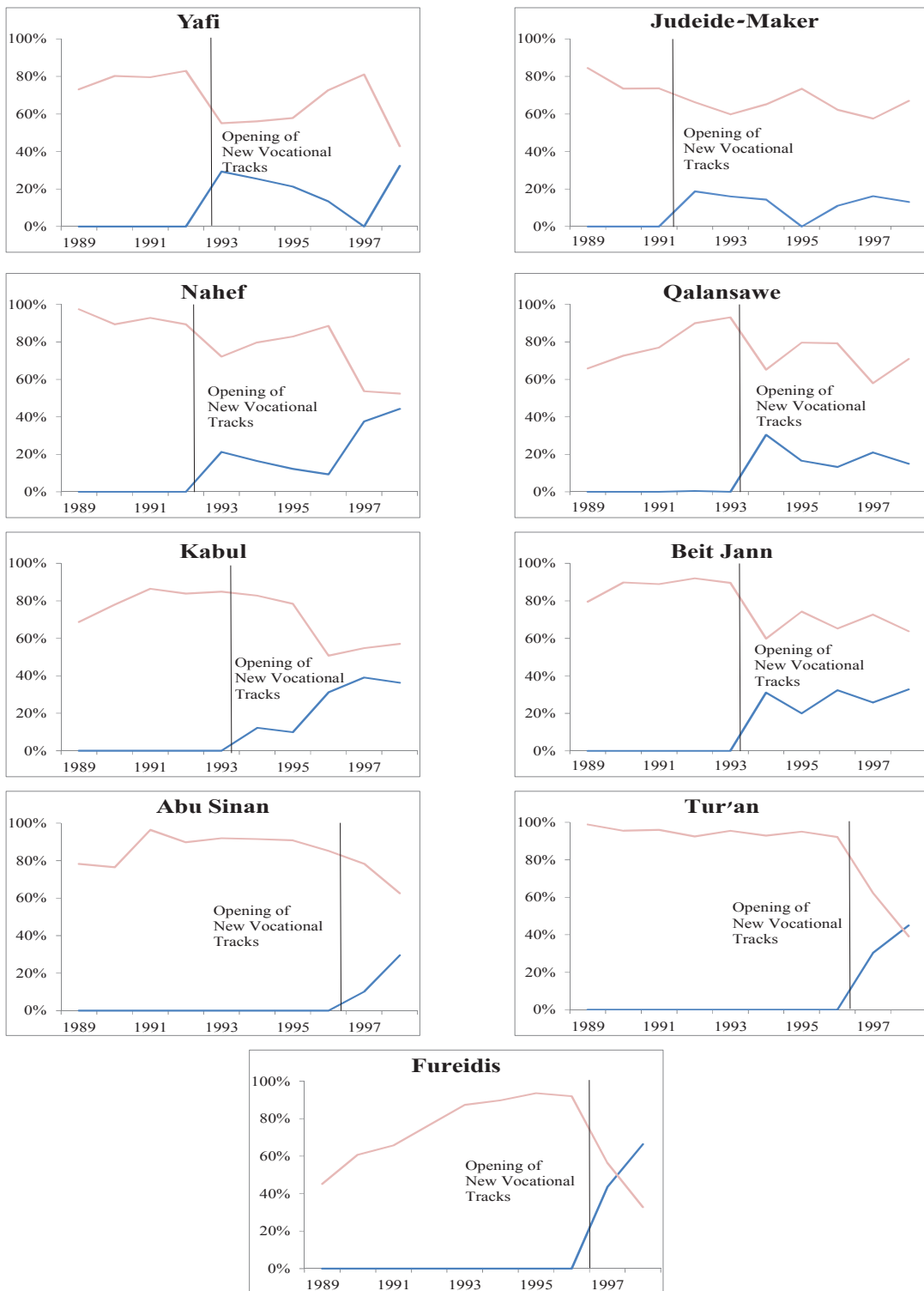


Source: Central Bureau of Statistics – Statistical Abstract of Israel (Various Years) and the authors' calculations.

(1) The Jewish education includes the secular, Orthodox, and ultra-Orthodox education systems.

Figure 2: Share of Students in Vocational and General Education Programs in the Treatment Localities¹

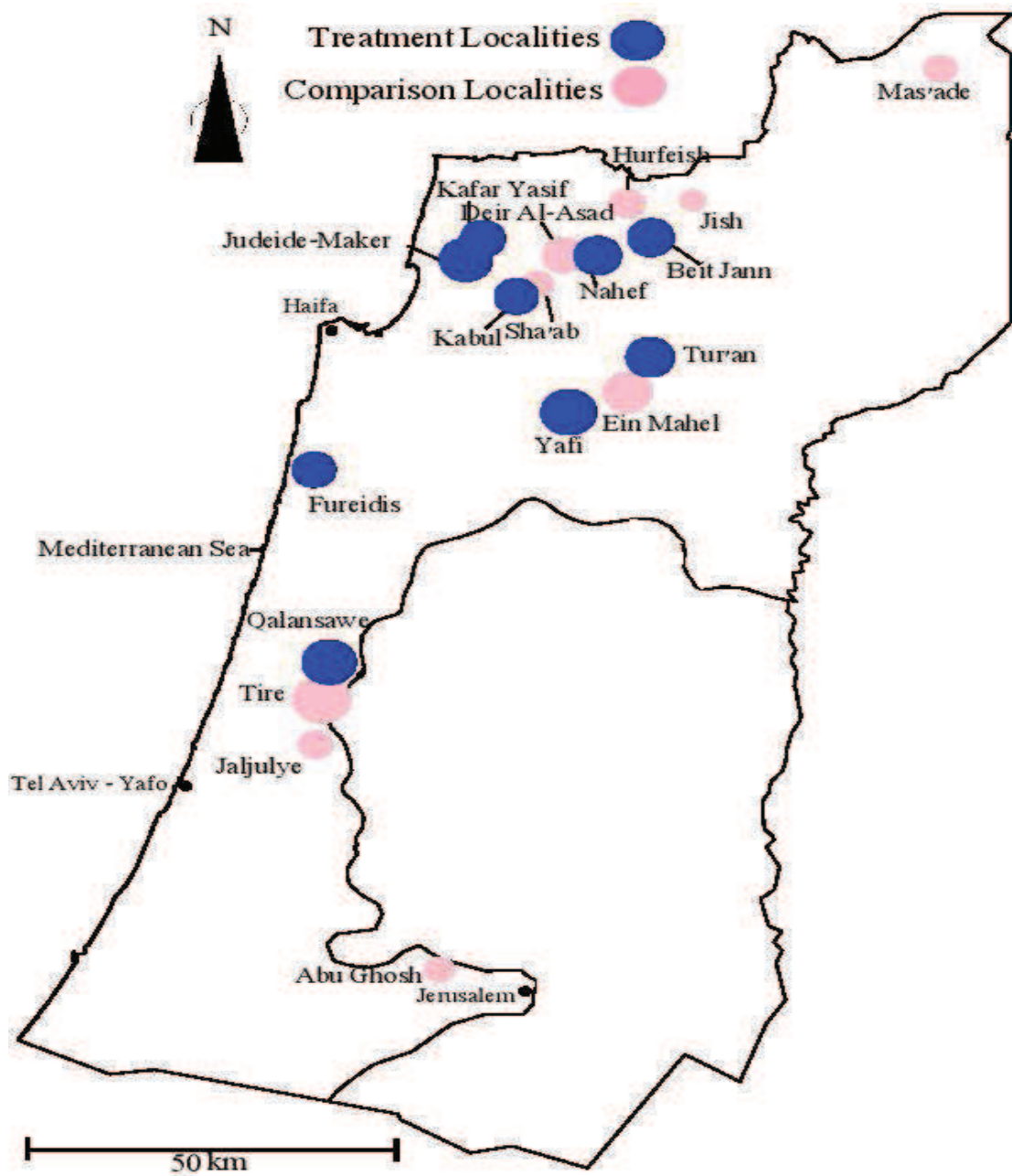
— Vocational Education
— General Education



Source: Ministry of Education and the authors' calculations.

(1) The limited group of localities.

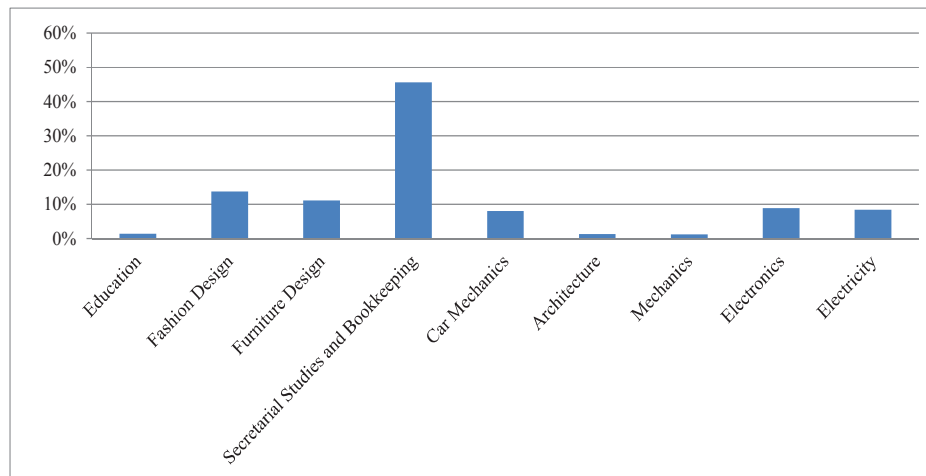
Figure 3: Geographic Distribution of Treatment and Comparison Localities¹



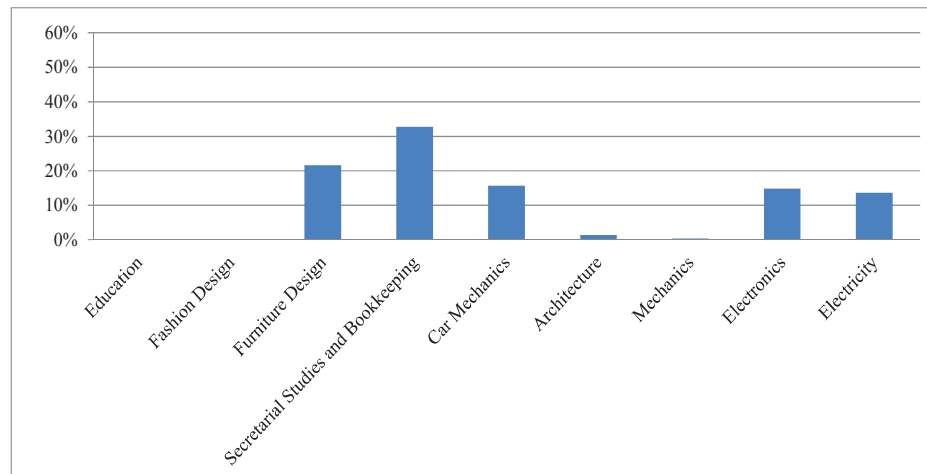
(1) Comparison and treatment localities in the limited group.

Figure 4: Distribution of Students in Newly Opened Vocational Tracks

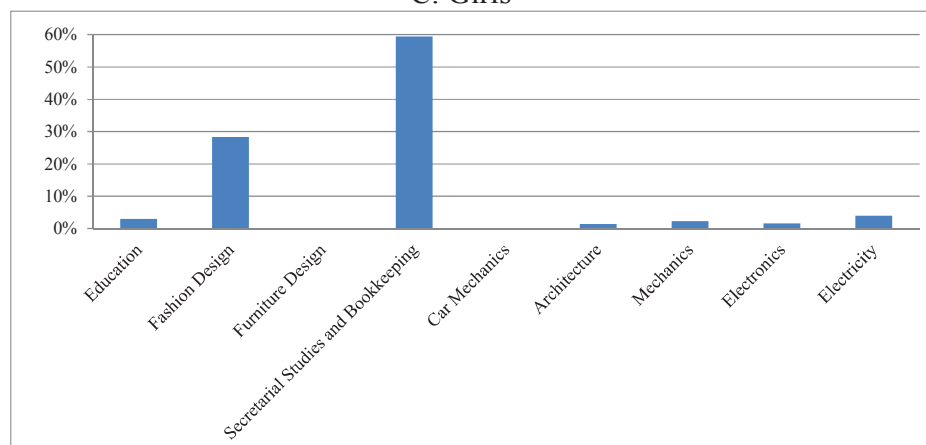
A. All Students



B. Boys



C. Girls



Source: Ministry of Education and the authors' calculations.

(1) Similar tracks were grouped into a single category. For more details see Table A2 in the Appendix.

Table 1: Sociodemographic Characteristics of Students from the Treatment Localities in the General and Vocational Tracks in 1998¹

	General Education Students	Vocational Education Students	Difference ²	t-statistic	p-value
Father's years of education	9.3	8.7	-0.6* (0.3)	-2.11	0.07
Mother's years of education	8.2	7.7	-0.4 (0.2)	-1.76	0.12
Number of siblings	5.0	5.1	0.1 (0.2)	0.70	0.50
Number of students	908	576			

Source: Ministry of Education and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

(1) Tenth-grade students in the limited group of localities.

(2) Standard errors in parentheses are clustered at the locality level. The difference in the table is not necessarily identical to the difference between the reported values of the general and vocational education students because of a rounding of digits.

3.3 Sample Description

In order to examine possible differences between the socioeconomic and demographic characteristics of the comparison and treatment localities prior to the opening of the vocational tracks, balance tests were conducted in the limited group of localities (Table 2).¹⁰

The residents of the treatment localities have a lower socioeconomic index. However, when level of income, education, share of vehicle owners, and share of income support recipients are each looked at separately, it can be seen that the residents of the treatment localities have weaker characteristics, but not significantly so. The comparison and treatment groups are balanced in their religious composition.

The observed difference between the treatment and comparison localities suggests that the opening of the vocational tracks was not random, but was correlated with permanent differences in the characteristics of the localities. However, the identification assumption is that apart from the opening of the vocational tracks, there were no differential *changes* in the treatment and comparison localities that might have affected the outcomes during the period of study (parallel trends assumption). If the differences in the socioeconomic characteristics presented in Table 2 indeed remained stable during the period of study, it is possible to gain an unbiased estimate of the effect of the opening of the vocational tracks on the outcomes (difference-in-differences methodology).

¹⁰ Table A4 in the Appendix presents balance tests for the extended group.

Figure 5 presents the trends in various socioeconomic characteristics in the limited treatment and comparison localities during the period of study, namely, parents' education and number of siblings of the tenth-grade students in the sample. The figure also shows trends in the monthly average wage, share of unemployment benefits recipients, and share of vehicle owners among the residents of the localities. The trends are very similar in all characteristics in the treatment and comparison localities, in line with the assumption that no differential changes occurred in the treatment and comparison localities that would make it difficult to identify the effect of the opening of vocational tracks on the outcomes.¹¹

Figure 6 displays common trends in the outcomes (in 2014) of the cohorts of tenth graders living in the treatment and comparison localities in 1989–1991, before the opening of the vocational tracks. The trends in the employment rate¹², number of months of employment, and monthly and yearly wage are very similar in both the comparison and treatment localities.¹³

¹¹ Figure A4 in the Appendix presents similar trends for the extended group of localities.

¹² Working employees are defined as individuals whose monthly wage in 2014 was above 1,250 NIS. This value was calculated according to the wage threshold in the 2008 employee data, which gave the same employment rate as was reported in the survey in the 2008 Population Census, inflated to 2014 by the changes in the minimum wage during those years. For self-employed individuals the annual earnings threshold was set to 15,000 NIS (12 X 1,250).

¹³ Figure A5 in the Appendix presents similar trends for the extended group of localities.

**Table 2: Demographic and Socioeconomic Characteristics of
Treatment and Comparison Localities¹ in 1991²**

	Treatment Localities	Comparison Localities	Difference ³	t-statistic	p-value
Socioeconomic index ⁴	-0.90	-0.59	-0.31*** (0.10)	-3.11	0.01
Yearly wage (NIS)	1,939	1,998	-59 (81)	-0.73	0.47
Income support Recipients (per 1,000 residents)	67.9	62.0	5.9 (8.6)	0.69	0.49
Unemployment benefits recipients (per 1,000 residents)	6.4	6.6	-0.3 (1.8)	-0.18	0.85
Number of vehicles (per 1,000 residents)	73.0	78.4	-5.3 (7.8)	-0.68	0.51
Father's years of Education	5.8	6.3	-0.4 (1.0)	-0.45	0.66
Mother's years of Education	4.3	4.9	-0.6 (-1.0)	-0.67	0.51
Number of siblings	3.7	3.9	-0.2 (0.6)	-0.38	0.71
Share of Muslims	0.795	0.824	-0.029 (0.145)	-0.20	0.84
Share of Christians	0.085	0.039	0.046 (0.050)	0.92	0.37
Share of Druze	0.119	0.135	-0.017 (0.139)	-0.12	0.90
Number of localities	9	9			
Number of students (1991)	1,305	822			
Total number of students	12,814	8,377			

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

(1) The table presents characteristics of localities in the limited group.

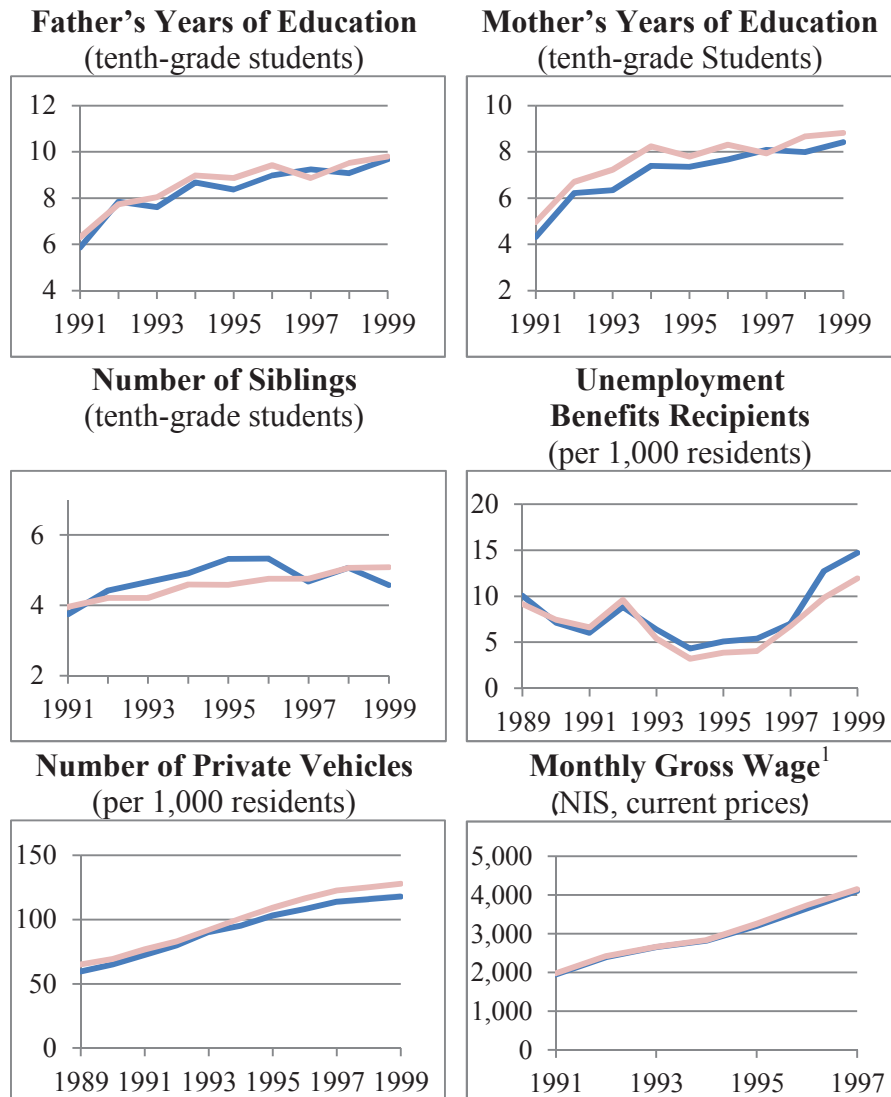
(2) Socioeconomic index and religiosity data are from 1995.

(3) Standard errors in parentheses are clustered at the locality level. The difference in the table is not necessarily identical to the difference between the reported values of the general and vocational education students because of a rounding of digits.

(4) The socioeconomic index according to the 1995 Population Census, calculated by the Central Bureau of Statistics. The continuous value of the index is its distance from the country's average in units of standard deviations.

Figure 5: Trends in Characteristics of Treatment and Comparison Localities during the Period of Study

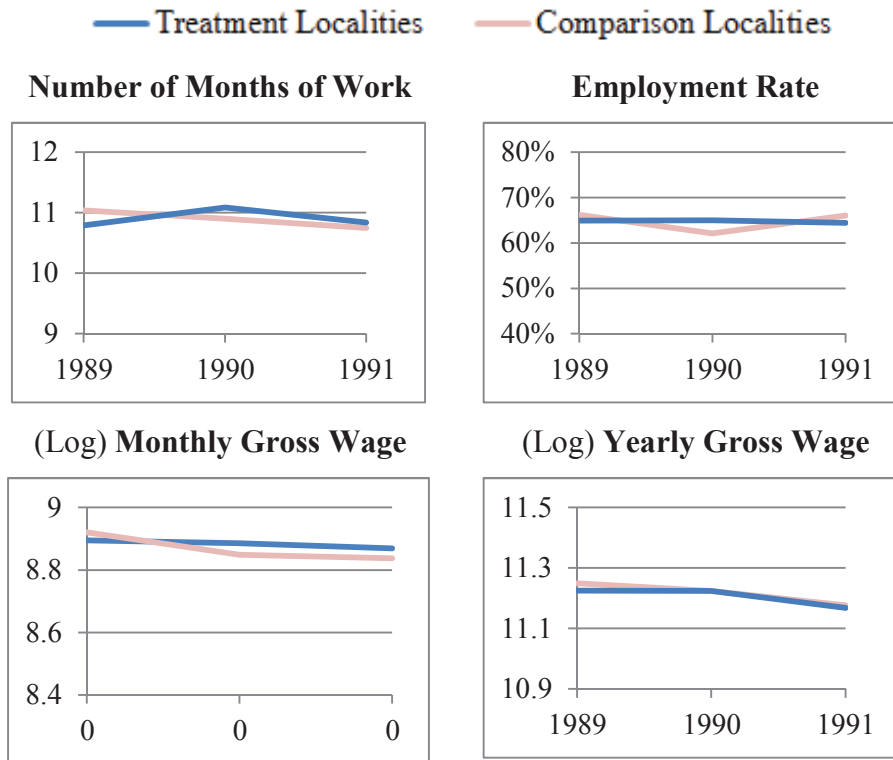
— Treatment Localities — Comparison Localities



Source: Central Bureau of Statistics and the authors' calculations.

(1) CBS data for monthly gross wage (per month of work) is missing for some of the localities in 1998-1999.

Figure 6: Pre-Trends in Outcomes (2014) among Tenth-Grade Students in Treatment and Comparison Localities



Source: Central Bureau of Statistics and the authors' calculations

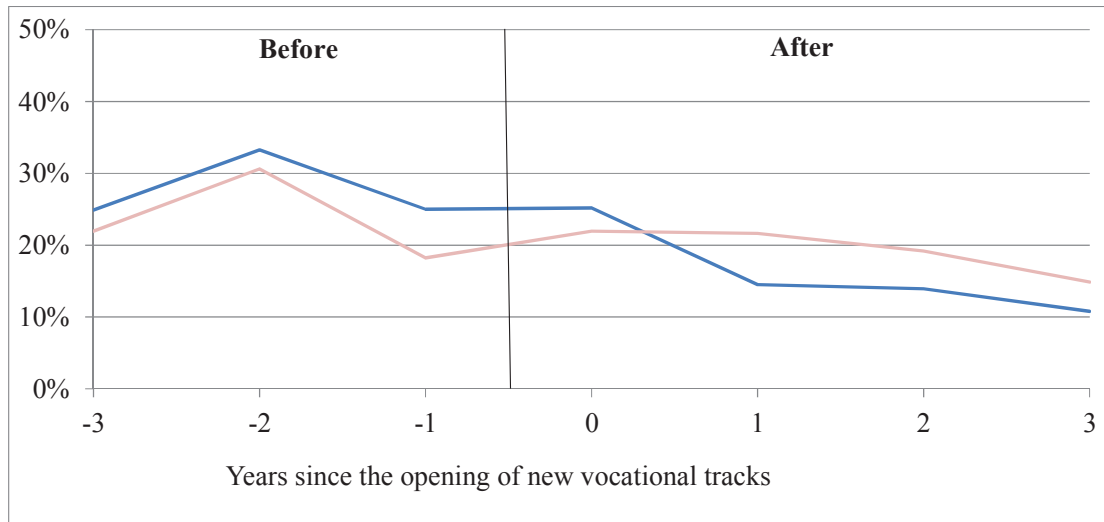
It is now possible to conduct a preliminary examination of the changes in outcomes after the opening of the vocational tracks in the treatment localities. Figure 7 shows the dropout rates (between the tenth and twelfth grade) before and after the opening of the vocational tracks in the treatment and comparison localities. For the comparison localities a fictitious year was set so that it would be identical to the opening year in a similar treatment locality. The fictitious year was determined according to the Nearest Neighbor Matching methodology.¹⁴ The dropout rate decreased significantly in the treatment localities, much more than in the comparison localities (Figure 7a). However, when a similar check was performed for a long-term outcome, e.g., the students' wage in adulthood, no significant change was found after the opening of the new tracks in the comparison and treatment localities (Figure 7b).

¹⁴ Table 2 reports the demographic and socioeconomic characteristics that were used to find the nearest neighbor.

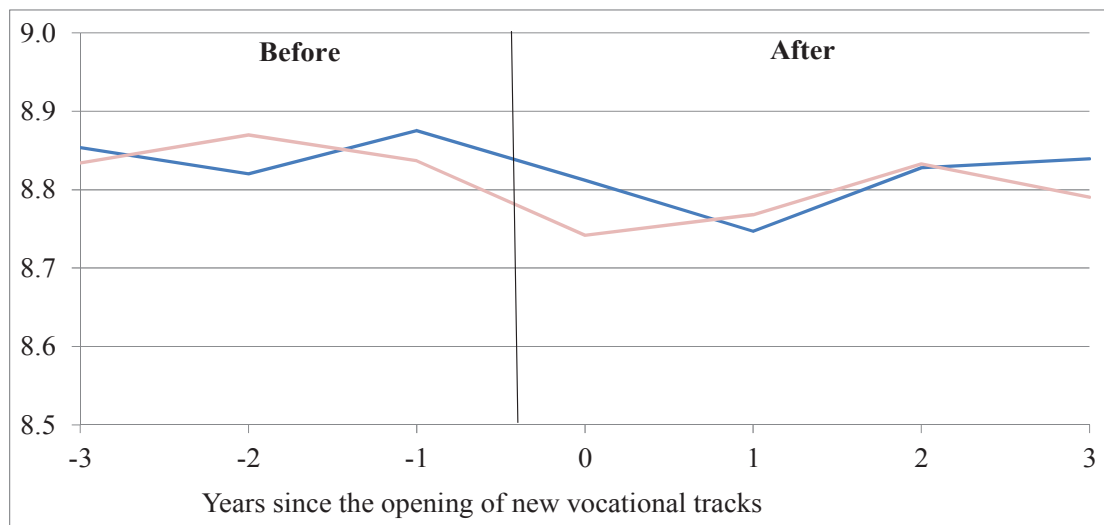
Figure 7: Students' Outcomes in Relation to the Timing of the Opening of the New Vocational Tracks in the Locality¹

— Treatment Localities — Comparison Localities

A. High School Dropout Rate²



B. (Log) Monthly Gross Wage



Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

(1) In order for outcomes three years before and three years after the opening of the new vocational tracks to be examined, only localities in which new vocational tracks were opened between 1992 and 1995 are included. The comparison localities were matched according to a Nearest Neighbor Matching methodology.

(2) Dropout rate between the tenth and twelfth grades.

4. Methodology

The effect of the opening of the new vocational tracks on various outcomes of the students was estimated using a difference-in-differences reduced-form specification:

$$Y_{isc} = \beta_0 + \beta_1 \mathbf{Post} \times \mathbf{Treatment}_{sc} + \beta_2 X_{isc} + \beta_3 U_{sc} + \delta_s + \lambda_c + \epsilon_{isc} \quad (1)$$

- Y_{isc} - Outcome of tenth-grade student i in locality s in cohort c .
The outcomes are:
Dropping out of secondary school between tenth and twelfth grade, taking the matriculation exams, eligibility for a matriculation certificate, acquisition of academic degree, employment, number of months of work, wage, probability of working in a certain occupation, age of marriage, probability of having children, and number of children.
- $\mathbf{Post} \times \mathbf{Treatment}_{sc}$ - Interaction variable that takes the value 1 if the student studied in the tenth grade in a locality in which a new vocational track was opened, and 0 otherwise.
- X_{isc} - Student's background characteristics: father's and mother's years of education, number of siblings, school sector (Arab/Druze).
- U_{sc} - Number of recipients of unemployment benefits (per 1,000 residents) in the student's locality of residence in the year when the student was in the tenth grade.
- δ_s - Locality of residence fixed effect.
- λ_c - Cohort fixed effect.
- ϵ_{isc} - Idiosyncratic error.

The β_1 coefficient represents the effect of the opening of vocational tracks in the student's locality on outcomes in the short and long term. The estimations are conducted separately for males and females, and for limited and extended groups of localities.

Furthermore, the causal effect of getting a vocational education in comparison to a general education can be estimated in a 2SLS equation, where the interaction variable of the opening of new vocational tracks is an exogenous instrumental variable for getting a vocational education.

The first-stage equation is:

$$E_{isc} = \alpha_0 + \alpha_1 \mathbf{Post} \times \mathbf{Treatment}_{sc} + \alpha_2 X_{isc} + \alpha_3 U_{sc} + \delta_s + \lambda_c + \eta_{isc} \quad (2)$$

The dummy variable E_{isc} takes the value of 1 if student i in locality s in cohort c receives a vocational education, and 0 otherwise. The rest of the variables are identical to those in equation (1). $\mathbf{Post} \times \mathbf{Treatment}_{sc}$ is the exogenous instrumental variable (IV) for getting a vocational education.

In the second stage, the effect of getting a vocational education on students' outcomes is estimated:

$$Y_{isc} = \gamma_0 + \gamma_1 \hat{E}_{isc} + \gamma_2 X_{isc} + \gamma_3 U_{sc} + \delta_s + \lambda_c + u_{isc} \quad (3)$$

The predicted probability of getting a vocational education \hat{E}_{isc} is estimated in the first stage (equation (2)). The estimations are done separately for males and females. The obtained 2SLS estimates will be compared to naive OLS estimates that are similar to equation (3), where the predicted probability of getting a vocational education is replaced by a dummy variable for *actually* getting a vocational education. In the literature, such multivariate OLS regressions are a common way of estimating the effect of a vocational education on students' outcomes (e.g., Blank et al., 2016). However, the OLS estimates are biased if there is selection, and so the unobservable characteristics of students who receive a vocational education are systematically different from the unobservable characteristics of students who receive a general education (as detailed in Section 2). Because the 2SLS estimations overcome the selection problem, the 2SLS coefficients are compared to the OLS coefficients in order to check whether there exists a bias in a naive OLS regression of the correlation between studying in the vocational tracks and the outcomes. Comparison between the estimates that are obtained by OLS and 2SLS methods is meaningful only if there are also students who received a vocational education due to endogenous reasons (unrelated to the exogenous opening of the vocational tracks) when only the OLS method takes these students into account. E.g., students in the treatment and comparison localities who studied in vocational tracks which existed before the reform, or in vocational tracks outside their locality of residence. Due to the fact that a substantial amount of such students is missing in the limited group, estimations of equation (3) are conducted only for the extended group of localities.¹⁵

¹⁵ In the sample of the *limited* group of localities, the 2SLS estimates will be virtually near identical to the OLS estimates, because no vocational tracks existed prior to the reform. Therefore, almost all vocational students receive their type of education due to the exogenous opening of the new vocational tracks.

5. Results

Table 3 reports strong first-stage effects (equation (2)). The estimates show a significant increase in the probability of a student getting a vocational education once new vocational tracks are opened in his/her locality of residence. Specifically, the opening of new vocational tracks increased the probability of a student in the locality getting a vocational education by 19–23 percentage points. The results are consistent with those in Figure 2 above.

Table 3: Effect of Opening Vocational Tracks in the Locality on Probability of Getting a Vocational Education, by Gender¹

A. Limited group of localities			
	Boys	Girls	All
	(1)	(2)	(3)
Post × Treatment	0.218***	0.194***	0.206***
	(0.022)	(0.032)	(0.025)
Student characteristics ²	V	V	V
School sector	V	V	V
Share of unemp. benefits recipients	V	V	V
Locality fixed effect	V	V	V
Cohort fixed effect	V	V	V
Mean outcome	0.153	0.143	0.145
Number of localities	18	18	18
Number of observations	10,170	11,021	21,191
Adjusted R ²	0.264	0.278	0.263
B. Extended group of localities			
	Boys	Girls	All
	(1)	(2)	(3)
Post × Treatment	0.230***	0.224***	0.229***
	(0.024)	(0.032)	(0.027)
Student characteristics ²	V	V	V
School sector	V	V	V
Share of unemp. benefits recipients	V	V	V
Locality fixed effect	V	V	V
Cohort fixed effect	V	V	V
Mean outcome	0.265	0.235	0.263
Number of localities	25	25	25
Number of observations	19,046	20,362	39,408
Adjusted R ²	0.295	0.270	0.276

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Results based on the specification in equation (2).

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Table 4 presents the effect of the opening of vocational tracks on students' short- and long-term educational outcomes. The table shows a significant 4 percentage point decrease in the dropout probability of the boys, which is about 15 percent of the mean dropout rate for boys during the period of study. The decline in the dropout rate did not lead to a significant increase in the share of matriculation examinees among boys. Moreover, after the opening of the vocational tracks, there was a decrease of 5 percentage points in the rate of eligibility for a matriculation certificate among boys. Furthermore, Table 4 shows a 5 percentage point decrease in the dropout rate for girls, which is about 34 percent of the mean dropout rate during the period of study. The girls' share of matriculation examinees increased by about 8 percentage points (10 percent); however, no significant change was observed in the rate of eligibility of matriculation certificate among girls. The opening of the vocational tracks had no significant long-term effect on the probability of either gender acquiring an academic degree. Nor did it significantly affect the probability of employment or the wages of either gender in adulthood (in 2014) (Table 5). However, the negative estimate of the effect on the men's wages was not far from being significant (Columns 3 and 4): the level of significance was 17% for the annual wage and 18% for the monthly wage.

In order to examine the consistency of the results, similar estimations were made for the educational and labor outcomes in the extended group of localities (Tables 6 and 7). For the girls, the results are similar to those obtained for the limited group of localities: the effect of reducing the dropout rate and increasing the share of matriculation examinees is still significant, although the size is smaller (Table 6, Columns 6 and 8). The results for the boys are similar (Table 6, Columns 2 and 4) except that no significant effect was found on their rate of eligibility for a matriculation certificate and on their chances of dropping out (Table 6, Column 10). The effects of the vocational tracks on labor market outcomes are all insignificant in the extended group (Table 7), in line with previous results.

For robustness, additional estimations were conducted to check the effect of the opening of the vocational tracks on labor market outcomes. There are various ways to define who is employed. In previous estimations, an employee was defined as an individual with monthly earnings above 1,250 NIS (for further details see footnote 12). However, in the additional estimations an employee is also defined as any individual with positive annual earnings. As for the number of months of employment, previous estimations were conducted only for employees. However, in some of the additional estimations individuals who did not work at all are also included. As for self-employed individuals, they were not included in previous estimations. However, in the additional estimations the probability of being self-employed,

business income, and total income (from wages and business) are examined. These additional estimations were conducted for the years 2009 and 2014 to check for the possibility that the effect of the opening of vocational tracks changed between these years, as the students gets more experience in the labor market. Tables 8 and 9 show that the coefficients of all these additional estimations are not significant, and therefore they are consistent with the baseline results.¹⁶

Table 4: Effect of Opening Vocational Tracks on Educational Outcomes¹

	Boys			
	Dropped out of High School	Matriculation Examinations	Matriculation Certificate	Academic Degree
	(1)	(2)	(3)	(4)
Post × Treatment	-0.039* (0.022)	0.023 (0.026)	-0.052** (0.019)	-0.019 (0.041)
Student characteristics ²	V	V	V	V
School sector	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V
Locality fixed effect	V	V	V	V
Cohort fixed effect	V	V	V	V
Mean outcome	0.256	0.694	0.333	0.241
Number of localities	18	18	18	18
Number of observations ³	7,576	9,455	9,455	1,380
Adjusted R ²	0.064	0.064	0.063	0.036
	Girls			
	Dropped out of High School	Matriculation Examinations	Matriculation Certificate	Academic Degree
	(1)	(2)	(3)	(4)
Post × Treatment	-0.054* (0.027)	0.076** (0.030)	-0.039 (0.038)	0.010 (0.044)
Student characteristics ²	V	V	V	V
School sector	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V
Locality fixed effect	V	V	V	V
Cohort fixed effect	V	V	V	V
Mean outcome	0.158	0.783	0.399	0.252
Number of localities	18	18	18	18
Number of observations ³	8,079	10,225	10,225	1,547
Adjusted R ²	0.046	0.058	0.074	0.099

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1). The estimations are done for the limited group of localities.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(3) Data on academic degrees is from the 2008 Population Census. Therefore, the number of observations is small.

¹⁶ Tables A5 and A6 in the Appendix present the same results for the extended group of localities, and are rarely significant.

Table 5: Effect of Opening of Vocational Tracks on Labor Market Outcomes (2014)¹

	Men			
	Employment	Months of Work	(Log) Annual Wage	(Log) Monthly Wage
	(1)	(2)	(3)	(4)
Post × Treatment	-0.008 (0.020)	-0.109 (0.098)	-0.065 (0.045)	-0.050 (0.035)
Student characteristics ²	V	V	V	V
School sector	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V
Locality fixed effect	V	V	V	V
Cohort fixed effect	V	V	V	V
Mean outcome	0.749	10.863	11.281	8.952
Number of localities	18	18	18	18
Number of observations	5,849	4,380	4,380	4,380
Adjusted R ²	0.002	0.005	0.024	0.029
	Women			
	Employment	Months of Work	(Log) Annual Wage	(Log) Monthly Wage
	(1)	(2)	(3)	(4)
Post × Treatment	-0.032 (0.027)	-0.110 (0.142)	-0.057 (0.073)	-0.029 (0.059)
Student characteristics ²	V	V	V	V
School sector	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V
Locality fixed effect	V	V	V	V
Cohort fixed effect	V	V	V	V
Mean outcome	0.561	10.536	10.913	8.626
Number of localities	18	18	18	18
Number of observations	6,297	3,531	3,531	3,531
Adjusted R ²	0.022	0.014	0.054	0.071

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1). The estimations are done for the limited group of localities.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Table 6: Effect of Opening Vocational Tracks on Educational Outcomes: Limited and Extended Group of Localities¹

	Boys				Girls			
	Dropped out of High School Limited (1)	Dropped out of High School Extended (2)	Matriculation Examinations Limited (3)	Matriculation Examinations Extended (4)	Dropped out of High-School Limited (5)	Dropped out of High-School Extended (6)	Matriculation Examinations Limited (7)	Matriculation Examinations Extended (8)
Post × Treatment	-0.039* (0.022)	-0.027 (0.024)	0.023 (0.026)	0.002 (0.025)	-0.054* (0.027)	-0.033* (0.019)	0.076** (0.030)	0.039* (0.023)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.256	0.254	0.694	0.681	0.158	0.153	0.783	0.772
Number of localities	18	25	18	25	18	25	18	25
Number of observations	7,576	14,059	9,455	17,646	8,079	14,860	10,225	18,806
Adjusted R ²	0.064	0.063	0.064	0.073	0.046	0.054	0.058	0.068
	Matriculation Certificate				Academic Degree			
	Limited (9)	Extended (10)	Limited (11)	Extended (12)	Limited (13)	Extended (14)	Limited (15)	Extended (16)
Post × Treatment	-0.052** (0.019)	-0.002 (0.021)	-0.019 (0.041)	0.020 (0.036)	-0.039 (0.040)	0.028 (0.040)	0.010 (0.044)	0.013 (0.036)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.333	0.317	0.241	0.236	0.399	0.389	0.252	0.252
Number of localities	18	25	18	25	18	25	18	25
Number of observations ³	9,455	17,646	1,380	2,429	10,225	18,806	1,547	2,656
Adjusted R ²	0.063	0.069	0.036	0.047	0.074	0.088	0.099	0.097

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1).

(2) Parents' years of education and number of siblings. Missing values are imputed in Appendix 1.

(3) Data on academic degrees is from the 2008 Population Census. Therefore, the number of observations is small.

Table 7: Effect of Opening Vocational Tracks on Labor Market Outcomes: Limited and Extended Group of Localities¹

	Men				Women			
	Limited (1)	Employment Extended (2)	(Log) Yearly Wage Limited (3)	Employment Limited (5)	(Log) Yearly Wage Limited (7)	Employment Extended (6)	(Log) Yearly Wage Extended (8)	
Post × Treatment	-0.008 (0.020)	-0.015 (0.015)	-0.050 (0.035)	-0.032 (0.027)	-0.029 (0.059)	-0.019 (0.022)	0.026 (0.039)	
Student characteristics ²	V	V	V	V	V	V	V	
School sector	V	V	V	V	V	V	V	
Share of unemp. benefits recipients	V	V	V	V	V	V	V	
Locality fixed effect	V	V	V	V	V	V	V	
Cohort fixed effect	V	V	V	V	V	V	V	
Mean outcome	0.749	0.746	8.952	0.561	8.626	0.571	8.639	
Number of localities	18	25	18	18	18	25	25	
Number of observations	5,849	10,871	4,380	6,297	3,531	11,491	6,556	
Adjusted R ²	0.002	0.003	0.029	0.022	0.071	0.027	0.080	

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Labor market outcomes in 2014. Results are based on the specification in equation (1).

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

**Table 8: Effect of Opening of Vocational Tracks on Labor Market Outcomes (2014):
Robustness Tests¹**

	Men (1)	Women (2)
Employment		
Employed=monthly wage above 1,250 NIS	-0.008 (0.020)	-0.032 (0.027)
Employed=annual positive labor income	-0.005 (0.019)	-0.018 (0.021)
Employed=annual positive labor and business income	-0.016 (0.013)	-0.019 (0.023)
Number of months of work		
Number of months of work among employees (monthly wage above 1,250 NIS)	-0.109 (0.098)	-0.110 (0.142)
Number of months of work (including non-employed individuals)	-0.166 (0.257)	-0.225 (0.249)
Wage		
(Log) yearly wage (employees with wage above 1,250 NIS)	-0.065 (0.045)	-0.057 (0.073)
(Log) yearly wage (employees with positive annual labor income)	-0.078 (0.052)	-0.085 (0.106)
Probability of self-employment		
Self-employed= annual positive business income	-0.006 (0.014)	0.004 (0.009)
Self-employed= annual yearly income above 15,000 NIS	-0.008 (0.014)	0.009 (0.009)
Self-employment Income²		
(Log) business income (self-employed with annual yearly business income above 15,000 NIS)	-0.103 (0.088)	- -
(Log) business income (self-employed with positive annual yearly business income)	-0.152 (0.159)	- -
Total income		
Total income from labor and business (individuals with positive income)	-0.055 (0.038)	-0.098 (0.099)
Total income from labor and business (individuals who neither work nor are self-employed=0 income)	-5,929 (3,443)	-2,452 (-3,707)

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1). The estimations control for the following characteristics: parents' years of education, number of siblings, school sector, share of unemployment benefits recipients in the locality, locality fixed effect, and cohort fixed effect. Missing values are imputed according to Appendix 1. The estimations are done for the limited group of localities.

(2) Estimation of the effect on business income is done only for men due to a small number of women who had a business income in the localities of the study.

Table 9: Coefficient Estimates of Effect of Opening of Vocational Tracks on Labor Market Outcomes (2009): Robustness Tests¹

	Men (1)	Women (2)
Employment		
Employed=monthly wage above 1,250 NIS	0.006 (0.020)	-0.024 (0.032)
Employed=annual positive labor income	0.001 (0.020)	-0.028 (0.034)
Employed=annual positive labor and business income	0.020 (0.014)	-0.036 (0.034)
Number of months of work		
Number of months of work among employees (monthly wage above 1,250 NIS)	-0.158 (0.148)	0.016 (0.182)
Number of months of work (including non-employed individuals)	-0.106 (0.267)	-0.299 (0.339)
Wage		
(Log) yearly wage (employees with wage above 1,250 NIS)	-0.061 (0.037)	0.025 (0.057)
(Log) yearly wage (employees with positive annual labor income)	-0.042 (0.035)	0.010 (0.082)
Probability of self-employment		
Self-employed=annual positive business income	-0.018 (0.026)	0.015 (0.009)
Self-employed=annual yearly income above 15,000 NIS	-0.014 (0.033)	-0.128 (0.180)
Self-employment Income²		
(Log) business income (self-employed with annual yearly business income above 15,000 NIS)	-0.054 (0.080)	- -
(Log) business income (self-employed with positive annual yearly business income)	0.026 (0.210)	- -
Total income		
Total income from labor and business (individuals with positive income)	-0.005 (0.035)	0.022 (0.083)
Total income from labor and business (individuals who neither work nor are self-employed=0 income)	-1,195 (2,411)	-663 (2,615)

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

- (1) Results are based on the specification in equation (1). The estimation controls for the following characteristics: parents' years of education, number of siblings, school sector, share of unemployment benefits recipients in the locality, locality fixed effect, and cohort fixed effect. Missing values are imputed according to Appendix 1. The estimation is done for the limited group of localities.
- (2) Estimation of the effect on business income is done only for men due to a small number of women who had a business income in the localities of the study.

Additional estimations were conducted to examine the effect of the opening of vocational tracks on outcomes among same-sex siblings, using a parents fixed effect. Because siblings are similar to each other in terms of their innate cognitive ability¹⁷ and the environment in which they were raised, estimations that are based on differences between siblings are better at handling the selection problem described above. The results are shown in Tables 10 and 11 and are similar to previous results in their signs, and in most cases significance is also similar.¹⁸

Another outcome that could be affected by vocational education is the occupation of the students in their adulthood. Occupation data exists only for students who were sampled in the 2008 Population Census, which is a representative sample of about 13 percent of the population. The effect of the opening of vocational tracks was estimated for three groups of occupations. The first group includes the “white collar” occupations of academics, engineers, and managers; the second group includes the “blue collar” occupations for which the new vocational tracks provided training; the third group consists of clerical occupations.¹⁹

Table 12 shows that the opening of vocational tracks did not significantly affect the probability of pursuing a “white collar” profession, and surprisingly it did not significantly affect the probability of pursuing a “blue collar” occupation that the new vocational tracks provided training for. There was a significant increase of about 14 percentage points in the share of girls who turned to clerical occupations in the treatment localities. This is consistent with the popularity of the bookkeeping and secretarial tracks, as was observed in Figure 4. By contrast, men experienced a slight decline in their share of engagement in clerical occupations. Tables A10 and A11 in the Appendix present the results on the effect of the opening of vocational tracks on the probabilities of engaging in a specific occupation; all occupations are grouped under eight different comprehensive occupation categories. Surprisingly, there was an increase in the probability of men engaging in manual occupations that were not taught in the vocational tracks that were opened. In addition, Tables A10 and A11 show that the observed increase in women's probability of engaging in clerical occupations came at the expense of a decrease in their probability of engaging in education and care occupations.

¹⁷ According to the literature, the correlation in IQ between siblings is about 0.44 (Sacerdote, 2010).

¹⁸ Tables A7 and A8 in the Appendix present the results of the estimations for the extended group of localities.

¹⁹ Table A9 in the Appendix presents a breakdown of the occupations in each category.

Vocational education may also affect demographic outcomes. For example, the decrease in the dropout rate may be responsible for an increase in the age of marriage. Table 13 reports that the average age of marriage for women in the treatment localities increased by more than half a year after the opening of the new vocational tracks; in particular, the probability of women marrying until the age of 18 decreased, most likely due to the observed decline in the girls' dropout rate. No significant effect was found on the age of marriage of men, the probability of having children of women, or the number of children of women.²⁰

In addition, Tables 14 and 15 present OLS estimates of the effect of vocational education (versus general education) on various outcomes of students in the extended group of localities.²¹ These OLS estimates may be biased due to the problem of selection of students into vocational education (as discussed in Section 2). The tables also present the equivalent 2SLS estimates (equations (2) and (3) in Section 4) that use the opening of vocational tracks as an instrumental variable to overcome the selection problem, and therefore these estimates are more reliable.

The OLS estimates show that vocational education is negatively correlated with most of the outcome variables (after controlling for observables). However, in the 2SLS estimations all the coefficients that were significant in the OLS estimations are no longer significant with the same signs, and sometimes the coefficients are even significant with the opposite sign. These results weaken the claim that the observed negative correlation between vocational education and outcomes in the OLS estimations is causal. The effect of the opening of vocational tracks on the dropout rate for girls turns from significantly positive to significantly negative (Table 14, Columns 5 and 6), whereas its effect on the probability of taking the matriculation exam for girls turns from significantly negative to significantly positive (Table 14, Columns 7 and 8). Thus, students who were more likely to drop out engaged in vocational education; however, the opening of vocational tracks had no negative causal effect on the probability that these students would complete high school. On the contrary, among girls it even significantly increased the probability of completing 12 years of education and taking the matriculation exams.

²⁰ Table A12 presents similar results for the extended group of localities: the directions are similar although the coefficients are not always significant.

²¹ The OLS and 2SLS estimations were conducted only for the extended group of localities for the reasons detailed in Section 4.

Table 10: Effect of Opening New Vocational Tracks on Educational Outcomes: Locality and Parents Fixed Effects¹
A. Boys

	Dropped out of High School		Matriculation Examinations		Matriculation Certificate		Academic Degree	
	Locality Fixed Effect (1)	Parents Fixed Effect (2)	Locality Fixed Effect (3)	Parents Fixed Effect (4)	Locality Fixed Effect (5)	Parents Fixed Effect (6)	Locality Fixed Effect (7)	Parents Fixed Effect (8)
Post × Treatment	-0.039* (0.022)	-0.056** (0.022)	0.023 (0.019)	0.019 (0.030)	-0.052** (0.019)	-0.098*** (0.021)	-0.019 (0.041)	-0.075 (0.058)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.256 18	0.248 18	0.694 18	0.705 18	0.333 18	0.336 18	0.241 18	0.226 18
Number of localities	18	18	18	18	18	18	18	18
Number of observations ³	7,576	3,402	9,455	4,875	9,455	4,875	1,380	592
Adjusted R ²	0.064	0.004	0.064	0.006	0.063	0.020	0.036	0.023

B. Girls

	Dropped out of High School		Matriculation Examinations		Matriculation Certificate		Academic Degree	
	Locality Fixed Effect (1)	Parents Fixed Effect (2)	Locality Fixed Effect (3)	Parents Fixed Effect (4)	Locality Fixed Effect (5)	Parents Fixed Effect (6)	Locality Fixed Effect (7)	Parents Fixed Effect (8)
Post × Treatment	-0.054* (0.027)	-0.037 (0.031)	0.076** (0.036)	0.068** (0.029)	-0.039 (0.038)	0.016 (0.054)	0.010 (0.044)	0.018 (0.080)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.158 18	0.152 18	0.783 18	0.789 18	0.399 18	0.407 18	0.252 18	0.247 18
Number of localities	18	18	18	18	18	18	18	18
Number of observations ³	8,079	3,961	10,225	5,681	10,225	5,681	1,547	328
Adjusted R ²	0.046	0.023	0.058	0.018	0.074	0.017	0.099	0.049

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1). The estimation is done for the limited group of localities.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(3) Data on academic degrees is from the 2008 Population Census. Therefore, the number of observations is small.

Table 11: Effect of Opening New Vocational Tracks on Labor Market Outcomes: Locality and Parents Fixed Effects¹

	A. Men				B. Women				
	Employment		Months of Work		(Log) Annual Wage		(Log) Monthly Wage		
	Locality	Parents	Locality	Parents	Locality	Parents	Locality	Parents	
	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Post × Treatment	-0.008 (0.020)	0.004 (0.055)	-0.109 (0.098)	-0.063 (0.199)	-0.065 (0.045)	-0.008 (0.070)	-0.050 (0.035)	-0.007 (0.052)	
Student characteristics ²	V		V		V		V		
School sector	V		V		V		V		
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V	
Cohort fixed effect	V	V	V	V	V	V	V	V	
Mean outcome	0.749	0.750	10.863	10.979	11.281	11.330	8.952	8.981	
Number of localities	18	18	18	18	18	18	18	18	
Number of observations	5,849	3,167	4,380	1,332	4,380	1,332	4,380	1,332	
Adjusted R ²	0.002	0.007	0.005	0.011	0.024	0.014	0.029	0.024	
B. Women									
	Employment		Months of Work		(Log) Annual Wage		(Log) Monthly Wage		
	Locality	Parents	Locality	Parents	Locality	Parents	Locality	Parents	
	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Post × Treatment	-0.032 (0.027)	0.004 (0.051)	-0.110 (0.142)	0.036 (0.442)	-0.057 (0.073)	-0.033 (0.146)	-0.029 (0.059)	-0.041 (0.091)	
Student characteristics ²	V		V		V		V		
School sector	V		V		V		V		
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V	
Cohort fixed effect	V	V	V	V	V	V	V	V	
Mean outcome	0.561	0.563	10.536	10.804	10.913	11.052	8.626	8.726	
Number of localities	18	18	18	18	18	18	18	18	
Number of observations	6,297	3,609	3,531	990	3,531	990	3,531	990	
Adjusted R ²	0.022	0.003	0.014	0.020	0.054	0.013	0.054	0.006	

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1). The estimation is done for the limited group of localities.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Table 12: Effect of Opening New Vocational Tracks on Probability of Pursuing Various Occupations, by Category^{1,2}

	“White Collar” Occupations (academics, engineers, and managers)		“Blue Collar” Occupations (compatible with new vocational tracks)		Clerical Occupations	
	Men (1)	Women (2)	Men (3)	Women (4)	Men (5)	Women (6)
Post × Treatment	-0.003 (0.036)	0.042 (0.066)	-0.032 (0.022)	-0.002 (0.012)	-0.042* (0.024)	0.139** (0.055)
Student characteristics ³	V	V	V	V	V	V
School sector	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V
Mean outcome	0.130	0.133	0.099	0.003	0.066	0.150
Number of localities	18	18	18	18	18	18
Number of observations	1,151	573	1,151	573	1,151	573
Adjusted R ²	0.042	0.005	-0.001	-0.011	0.001	0.003

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Occupations at the time of the 2008 Population Census. The full breakdown of occupations is shown in Table A9 in the Appendix.

(2) Results are based on the specification in equation (1). The estimation is done for the limited group of localities.

(3) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Table 13: Effect of Opening New Vocational Tracks on Age of Marriage and Fertility^{1,2}

	Men	Women			
	Age of Marriage (1)	Age of Marriage (2)	Married until Age 18 (3)	Have Children (4)	Number of Children (5)
Post × Treatment	0.102 (0.309)	0.591* (0.324)	-0.048** (0.020)	0.010 (0.046)	-0.141 (0.217)
Student characteristics ³	V	V	V	V	V
School sector	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V
Locality fixed effect	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V
Mean outcome	26.182	21.647	0.047	0.795	2.263
Number of localities	18	18	18	18	18
Number of observations	950	1,313	1,313	1,543	1,543
Adjusted R ²	0.073	0.022	0.013	0.006	0.107

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) At the time of the 2008 Population Census.

(2) Results are based on the specification in equation (1). The estimation is done for the limited group of localities.

(3) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

**Table 14: Effect of Vocational Education versus General Education on Educational Outcomes:
OLS Compared to 2SLS Estimates¹**

	Boys				Girls			
	Dropped out of High-School OLS (1)	Dropped out of High-School 2SLS (2)	Matriculation Examinations OLS (3)	Matriculation Examinations 2SLS (4)	Dropped out of High-School OLS (5)	Dropped out of High-School 2SLS (6)	Matriculation Examinations OLS (7)	Matriculation Examinations 2SLS (8)
Vocational Education (vs General Education)	0.072* (0.043)	-0.135 (0.116)	-0.155*** (0.055)	0.007 (0.104)	0.051** (0.021)	-0.155* (0.094)	-0.149*** (0.040)	0.173* (0.104)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.254	0.254	0.681	0.681	0.153	0.153	0.772	0.772
Number of localities	25	25	25	25	25	25	25	25
Number of observations	14,059	14,059	17,646	17,646	14,860	14,860	18,806	18,806
Adjusted R ²	0.086	0.055	0.105	0.088	0.045	0.111	0.031	0.120
	Boys				Girls			
	Dropped out of High-School OLS (9)	Dropped out of High-School 2SLS (10)	Academic Degree OLS (11)	Academic Degree 2SLS (12)	Matriculation Certificate OLS (13)	Matriculation Certificate 2SLS (14)	Academic Degree OLS (15)	Academic Degree 2SLS (16)
Vocational Education (vs General Education)	-0.181*** (0.049)	-0.010 (0.092)	-0.142*** (0.034)	0.081 (0.152)	-0.154*** (0.031)	0.121 (0.174)	-0.129*** (0.026)	0.051 (0.133)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.317	0.317	0.241	0.241	0.317	0.317	0.252	0.252
Number of localities	25	25	25	25	25	25	25	25
Number of observations ³	17,646	17,646	1,380	1,380	18,806	18,806	1,547	1,547
Adjusted R ²	0.107	0.088	0.134	0.131	0.103	0.103	0.011	0.009

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Coefficient estimates of the relationship between studies in vocational education and the outcome variables according to OLS estimations, compared to the corresponding estimates in 2SLS estimations of equations (2) and (3). The estimation is done for the extended group of localities.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(3) Data on academic degrees is from the 2008 Population Census. Therefore, the number of observations is small.

**Table 15: Effect of Vocational versus General Education on Labor Market Outcomes:
OLS Compared to 2SLS Estimates¹**

	Men				Women			
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (7)	2SLS (8)
Vocational Education (vs General Education)	-0.011 (0.013)	-0.062 (0.061)	-0.095** (0.035)	-0.138 (0.117)	-0.053** (0.021)	-0.080 (0.090)	-0.082** (0.035)	0.125 (0.189)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.746	0.746	8.965	8.965	0.571	0.571	8.639	8.639
Number of localities	25	25	25	25	25	25	25	25
Number of observations	10,871	10,871	8,112	8,112	11,491	11,491	6,556	6,556
Adjusted R ²	0.011	0.009	0.011	0.010	0.047	0.046	0.063	0.062

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Coefficient estimates of the relationship between studies in vocational education and the outcome variables according to OLS estimations, compared to the corresponding estimates in 2SLS estimations of equations (2) and (3). The estimation is done for the extended group of localities.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

6. Potential Challenges and Robustness Tests

Several robustness checks were conducted in order to tackle possible problems and biases in the estimations. First, it can be argued that opening the vocational tracks decreased the dropout rate before upper secondary school, i.e., between the ninth and tenth grade (rather than the dropout rate between the tenth and twelfth grade, which was checked in the estimations of the previous section). If such a phenomenon had existed, it would have changed the composition of the sample of tenth-grade students after the opening of vocational tracks, by increasing the proportion of students who were more likely to drop out. In such circumstances, the estimates in the previous section may reflect changes in the initial characteristics of the treatment students rather than the causal effect of the vocational tracks, and therefore the results may be biased. Unfortunately, no data on ninth-grade students exists for the period of study, and so the argument that the dropout *rate* from ninth to tenth grade decreased cannot be directly tested. However, it is possible to follow the *number* of tenth-grade students in each cohort. If opening the vocational tracks significantly decreased the dropout rate before the tenth grade, then it should have increased the number of students in the tenth grade who appear in the sample (above and beyond natural increase). Figure 8 and Column 1 in Table 16 indicate that no such significant change occurred in the number of tenth-grade students after the opening of the vocational tracks.

Second, the opening of new vocational tracks may have resulted in the opening of new classes and hence a decrease in the average number of students per class. It is noteworthy that the literature shows that academic achievement may be better in smaller classes.²² In other words, the estimates in the previous section may reflect not only changes in the type of education the students received, but also changes in class size. Figure 9 shows that after the opening of the vocational tracks there was a slight decrease in the average class size. Moreover, a difference-in-differences estimate of the effect of the opening of vocational tracks on the average size of classes in the locality (Table 16, Column 2), is negative (2.5 students per class) but insignificant. Therefore, changes in class size cannot significantly explain the observed estimates in the previous section.

Third, the estimates in the previous section may have reflected unobserved differential changes that may have occurred in the treatment and control localities

²² For a recent review of the literature see Chingos (2013).

during the period of study, rather than reflecting the effect of the opening of the vocational tracks. In order to check this possibility, two placebo tests are conducted: replacing the true opening time of the vocational tracks with a fictitious placebo timing. In the first test, estimations were done only for the early years 1989–1994 and a fictitious opening year was set to 1992. In the second test, estimations were done for the full period of study, and the fictitious opening year of the vocational track was set arbitrarily.²³ The coefficients of the placebo effect on all outcomes were mostly insignificant and close to zero (Tables 17 and 18). Therefore, the estimates in the previous section are unlikely to reflect unobserved trends that are not related to the vocational tracks.

A fourth limitation of the estimates in the previous section is that the sample was not always identical, but varied according to the availability of the data on the outcome variables.²⁴ Table A13 in the Appendix shows an estimation of a uniform sample in which information on all the outcome variables is available. The results are similar to those obtained in the previous section, except for the effect on the dropout rate of boys, which remains negative but is now slightly insignificant at the 10% level.

Finally, the estimations in the study use clustered standard errors at the level of the locality in order to account for the correlation between observations in the same locality. However, the number of localities is relatively small: 18 localities in the limited group and 25 localities in the extended group. In a situation where the number of clusters is relatively small, standard errors may be biased downwards (see, e.g., Green and Vavreck, 2007). Therefore, Wild Cluster bootstrap-t method (Cameron and Gelbach, 2008) is used, which is more suitable for a small sample of clusters. Tables A14 to A16 in the Appendix report the results of the estimations.

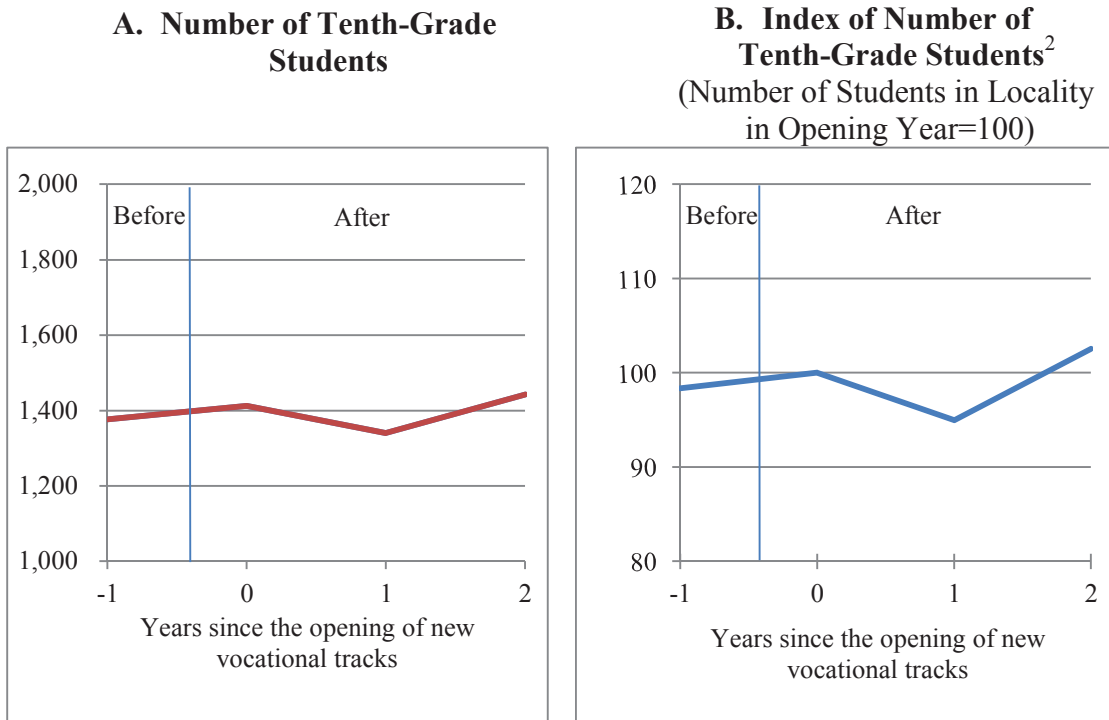
The results show that the coefficients remain significant in most cases where they were significant in the previous section's estimations. However, in a few cases their significance dropped to slightly above the 10% levels, whereas they were previously significant at the 5%–10% levels.²⁵

²³ The year 1993 is defined as the opening year for localities in which tracks were opened in 1992 and vice versa. A similar substitution was made between the years 1994 and 1997. No vocational tracks were opened in the years 1989–1991, 1995, 1996, and 1998.

²⁴ For example, data on the dropout rate does not exist for tenth-grade students in 1989–1990, matriculation data is available only from 1992 and onwards (i.e., for tenth-graders from 1990 and onwards), and wage data is available only for slightly more than a half of the population. Also, some of the outcome variables exist only for individuals surveyed in the 2008 Population Census.

²⁵ See, e.g., the case of the dropout rate of boys in Column 1 of Table A14.

Figure 8: Number of Tenth-Grade Students in Treatment Localities Before and After Opening of Vocational Tracks¹

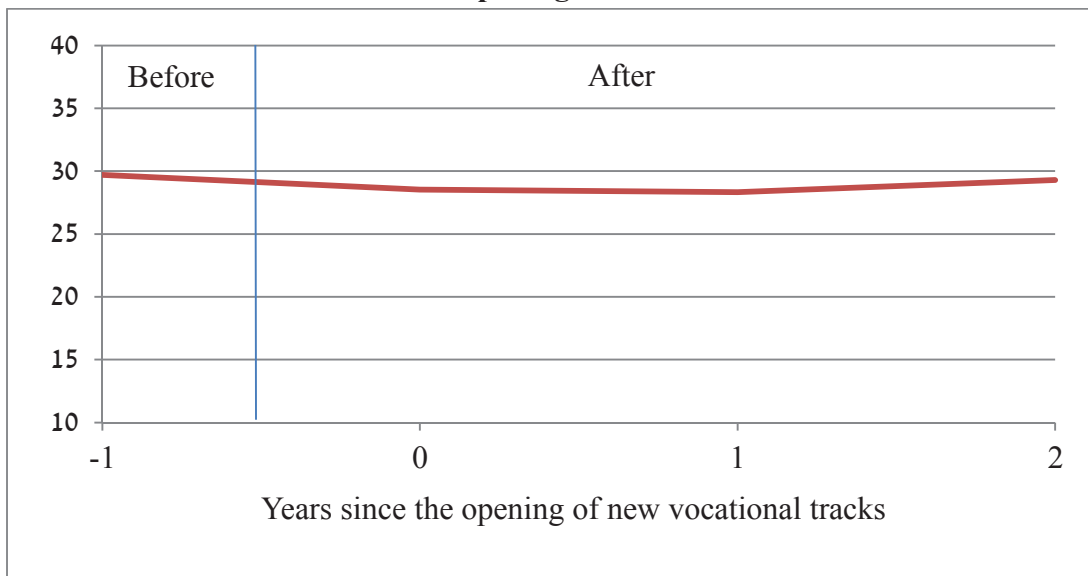


Source: Ministry of Education and the authors' calculations.

(1) Limited group of localities.

(2) The index is not weighted by the number of students in the localities.

Figure 9: Average Class Size in Tenth-Grade in Treatment Localities Before and After Opening of Vocational Tracks¹



Source: Ministry of Education and the authors' calculations.

(1) Limited group of localities.

Table 16: Effect of Opening Vocational Tracks in a Locality on Number of Tenth-Grade Students and on Average Class Size¹

	Number of Students in Tenth Grade (1)	Average Class Size in Tenth Grade (2)
Post × Treatment	1.878 (6.754)	-2.531 (1.467)
Share of unemp. benefits recipients	V	V
Locality fixed effect	V	V
Cohort fixed effect	V	V
Mean outcome	147.439	28.542
Number of localities	18	18
Number of observations	144	144
Adjusted R ²	0.110	0.034

Source: Ministry of Education and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Limited group of localities.

**Table 17: Effect of Opening New Vocational Tracks on Educational and Labor Market Outcomes:
Placebo Test – Setting Opening Year to 1992 and Period of Study to 1989–1994¹**

A. Men

	Dropped out of High- School	Matriculation Examinations	Matriculation Certificate	Academic Degree	Employment	Months of Work	(Log) Annual Wage	(Log) Monthly Wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × Treatment	0.023 (0.050)	-0.000 (0.067)	0.023 (0.048)	0.057 (0.069)	0.024 (0.028)	0.188 (0.203)	0.075 (0.070)	0.046 (0.048)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.280	0.670	0.318	0.243	0.730	10.977	11.323	8.977
Number of localities	18	18	18	18	18	18	18	18
Number of observations ³	4,350	5,107	5,107	659	3,328	2,428	2,428	2,428
Adjusted R ²	0.078	0.070	0.059	0.036	0.000	0.003	0.021	0.025

B. Women

	Dropped out of High- School	Matriculation Examinations	Matriculation Certificate	Academic Degree	Employment	Months of Work	(Log) Annual Wage	(Log) Monthly Wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × Treatment	0.052 (0.045)	0.016 (0.052)	0.039 (0.055)	-0.060 (0.065)	-0.025 (0.050)	-0.092 (0.241)	0.020 (0.077)	0.036 (0.061)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.186	0.746	0.361	0.218	0.553	10.702	10.955	8.647
Number of localities	18	18	18	18	18	18	18	18
Number of observations ³	4,455	5,286	5,286	712	3,479	1,924	1,924	1,924
Adjusted R ²	0.053	0.050	0.059	0.097	0.014	0.005	0.045	0.061

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1). The estimation is done for the limited group of localities. The fictitious year of treatment (opening of the vocational tracks) is 1992 for all the treatment localities, while the estimation for the tenth-grade students was for the years 1989–1994.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(3) Data on academic degrees is from the 2008 Population Census. Therefore, the number of observations is small.

**Table 18: Effect of Opening New Vocational Tracks on Educational and Labor Market Outcomes:
Placebo Test – Setting an Arbitrary Opening Year¹**

A. Men								
	Dropped out of High-School (1)	Matriculation Examinations (2)	Matriculation Certificate (3)	Academic Degree (4)	Employment (5)	Months of Work (6)	(Log) Annual Wage (7)	(Log) Monthly Wage (8)
Post × Treatment	-0.001 (0.030)	-0.024 (0.036)	-0.025 (0.030)	0.080 (0.051)	0.004 (0.016)	0.100 (0.110)	0.027 (0.039)	0.006 (0.029)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.256 18	0.694 18	0.333 18	0.241 18	0.749 18	10.863 18	11.281 18	8.952 18
Number of observations ³	7,576	9,455	9,455	1,380	5,849	4,380	4,380	4,380
Adjusted R ²	0.063	0.064	0.062	0.039	0.002	0.005	0.024	0.029

B. Women								
	Dropped out of High-School (1)	Matriculation Examinations (2)	Matriculation Certificate (3)	Academic Degree (4)	Employment (5)	Months of Work (6)	(Log) Annual Wage (7)	(Log) Monthly Wage (8)
Post × Treatment	0.019 (0.027)	0.002 (0.038)	-0.026 (0.032)	0.063 (0.044)	-0.009 (0.027)	-0.067 (0.148)	-0.006 (0.067)	0.003 (0.050)
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.158 18	0.783 18	0.399 18	0.252 18	0.561 18	10.536 18	10.913 18	8.626 18
Number of observations ³	8,079	10,225	10,225	1,547	6,297	3,531	3,531	3,531
Adjusted R ²	0.044	0.055	0.074	0.039	0.022	0.014	0.054	0.071

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1). The estimation is done for the limited group of localities. The fictitious year of treatment (opening of the vocational tracks) was set arbitrarily. The year of opening was set at 1993 for localities in which the tracks were opened in 1992 and vice versa. Similar substitutions were performed for the years 1994–1997. Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(3) Data on academic degrees is from the 2008 Population Census. Therefore, the number of observations is small.

7. Conclusions

The effect of vocational education versus general education on various outcomes is a highly debated issue in public policy as well as in the literature. Obtaining an unbiased estimate of the effect is a challenge due to the selection problem: students who receive a vocational education have different characteristics from students who receive a general education. In order to overcome the selection problem, the study exploits the implementation of an education reform in the Arab sector in Israel during the 1990s that led to an extensive opening of vocational tracks in localities where vocational education had never been offered before or where it had been offered but on a very small scale (treatment localities).

Using a difference-in-differences methodology, changes over time in the outcome variables are estimated for students in treatment localities compared to students in similar Arab localities in which vocational tracks were not opened (comparison localities). The study uses administrative files from the Ministry of Education that include data on students, schools, and matriculation examinations. This education data was then linked with earnings data and data from the 2008 Population Census.

Among girls in the treatment localities, it is found that the probability of dropping out between the tenth and twelfth grades decreased by 3–5 percentage points (i.e., a decline of 20–35 percent in the average dropout rate in the treatment localities in the period of study) and the share of matriculation examinees increased by 4–7 percentage points. However, there was no change in the share of female students who passed the matriculation exams and were eligible to receive a matriculation certificate. Among boys the probability of dropping out also significantly decreased (i.e., a decline of 10–15 percent in the boys' average dropout rate). Moreover, there was no change in the share of male students who took the matriculation exams, and some of the estimates even show a decrease in the share of boys who passed the exams and were eligible to receive a matriculation certificate.

The opening of vocational tracks had no significant effect on the acquisition of higher education, employment, and earnings for either gender, although the coefficient estimates for men were mostly negative and not far from being significant. Also, the popularity of the clerical tracks among girls was consistent with the probability of girls engaging in clerical occupations in adulthood. However, the opening of the “blue collar” track had no significant effect on the career choices of either gender.

The opening of the new vocational tracks was also used as an instrumental variable for estimating the effect of receiving a vocational education on various outcomes. To this end, a 2SLS

estimation was conducted and the results were compared to those obtained in a naive OLS estimation. It turns out that the OLS estimates of the effect of vocational education on outcomes were usually negatively biased.

The study has several drawbacks. First, it focuses only on Arab education because a similar extensive opening of vocational tracks did not occur in the Jewish education system. Second, the number of Arab localities included in the study is limited because of the difficulty of classifying many Arab localities as treatment or control localities. Also, Israeli vocational education has undergone many changes since the 1990s in an effort to replace traditional low-tech tracks with high-tech ones. In addition, the opening of new vocational tracks resulted in peer effects among students in the treatment localities. Specifically, the opening of new vocational tracks attracted students of less educated parents ("treatment compliers"), which caused them to have weaker peers, whereas the students who stayed with general education ("treatment non-compliers") gained relatively stronger peers.

The study finds that the introduction of vocational education into the Arab sector in the 1990s decreased the high school dropout rate, and also increased the number of girls who took matriculation exams. Yet, despite these positive outcomes, it is still worth asking whether the high cost of vocational education per student, about 50 percent higher than the cost of general education,²⁶ is justified, given that the introduction of vocational education into the Arab sector did not contribute to the probability that its graduates would gain a matriculation certificate, acquire higher education, find employment, increase their earnings, or engage in any of the "blue collar" occupations for which they had trained.

²⁶ The 2000 annual budget of the Ministry of Education per high school student in general education, based on the costs of instruction time and materials, was approximately 10.1 thousand NIS, while the budget per student in vocational education (weighted by the distribution of students in the different tracks in 1998) was about 15.1 thousand NIS.

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Appendix

Appendix 1: Imputation of Missing Values

1. Missing data for background characteristics

Some of the data on the following background characteristics is missing:

- A. Father's years of education (9% in the limited group of localities and 10% in the extended group of localities).
- B. Mother's years of education (15% in the limited group of localities and 13% in the extended group of localities).
- C. Number of siblings (7% in the limited group of localities and 9% in the extended group of localities).

For the missing data, the most common characteristics in the locality of residence in the year that the student was in the tenth grade were imputed.

2. Missing data for students' locality of residence

Data is missing on the locality of residence for a substantial portion of tenth-grade students for the year 1997 (21% of the cohort in the limited group of localities and 39% in the extended group of localities). The missing data was imputed in the following stages:

- A. All students who did not drop out between the tenth and eleventh grades appear in the students' data for 1998. Thus, their locality of residence in the eleventh grade was imputed (89% of the missing data in the limited and extended groups of localities).
- B. Among the students who dropped out, a substantial portion of them had a sibling in the 1991–1999 students' data. For these students, the locality of residence of the siblings who appear in the year that is closest to 1997 was imputed.
- C. For the remaining 2% of the tenth-grade students in 1997, the most common locality of residence of eighth graders was imputed by their school and year of study .

Table A1: Localities of the Study

Limited Group of Localities

Treatment Localities	Comparison Localities
Abu Sinan	Abu Ghosh
Beit Jann	Jaljulye
Judeide-Maker	Jish (Gush Halav)
Tur'an	Deir Al-Asad
Yafi	Hurfeish
Kabul	Tire
Nahef	Mas'ade
Fureidis	Ein Mahel
Qalansawe	Sha'ab

Extended Group of Localities

(in addition to the localities in the limited group)

Treatment Localities	Comparison Localities
Kafar Qasem	Tayibe
Majd Al-Kurum	Kafar Qara
Ar'ara	Sakhnin
	Shefar'am

Table A2: Classifying the Vocational Tracks

Name of the Track in the Study	Original Name of the Track (Ministry of Education)
Electronics	Electronic Systems
Education	Education
Electricity	Power Systems Command and Control Systems
Furniture Design	Woodworking Furniture Manufacturing and Design
Secretarial Studies and Bookkeeping	Computerized Secretarial Management Computerized Bookkeeping
Car Mechanics	Car Mechanics Systems
Plumbing and Building	Plumbing and Building Systems
Mechanics	Manufacturing and Design Systems
Fashion Design	Fashion Design Clothing Systems

Table A3: Sociodemographic Characteristics of Students in the General and Vocational Tracks in 1998 in the *Extended* Group of Localities

	General Education Students	Vocational Education Students	Difference ¹	t-statistic	p-value
Father's years of education	9.3	8.9	-0.4* (0.2)	-2.07	0.06
Mother's years of education	8.3	8.0	-0.4* (0.2)	-1.99	0.07
Number of siblings	4.9	5.0	0.1 (0.2)	0.47	0.65
Number of students	1,191	890			

Source: Ministry of Education and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

(1) Standard errors in parentheses are clustered at the locality level. The difference in the table is not necessarily identical to the difference between the reported values of the general and vocational education students because of a rounding of digits.

Table A4: Demographic and Socioeconomic Characteristics of the Treatment and Comparison Localities in 1991¹ in the *Extended* Group of Localities

	Treatment Localities	Comparison Localities	Difference ²	t-statistic	p-value
Socioeconomic Index ³	-0.85	-0.65	-0.19** (0.09)	-2.09	0.047
Yearly wage (NIS)	1,949	1,997	-47 (57)	-0.83	0.42
Income support recipients (per 1,000 residents)	61.8	45.8	15.9** (9.1)	2.10	0.05
Unemployment benefits recipients (per 1,000 residents)	6.4	7.5	-1.5 (1.3)	-1.13	0.27
Number of vehicles (per 1,000 residents)	70.7	86.1	-15.4* (7.7)	-2.00	0.06
Father's years of education	6.2	6.1	0.1 (0.7)	0.12	0.90
Mother's years of education	4.7	4.4	0.3 (0.8)	0.38	0.71
Number of siblings	3.9	4.3	-0.3 (0.4)	-0.82	0.42
Share of Muslims	0.860	0.857	0.003 (0.098)	0.03	0.98
Share of Christians	0.058	0.067	-0.009 (0.047)	-0.19	0.86
Share of Druze	0.081	0.074	0.006 (0.080)	0.08	0.94
Number of localities	12	13			
Number of students (1991)	1,916	2,117			
Total number of students	18,237	21,171			

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

- (1) Socioeconomic index and religious data are from 1995.
- (2) Standard errors in parentheses are clustered at the locality level. The difference in the table is not necessarily identical to the difference between the reported values of the general and vocational education students because of a rounding of digits.
- (3) The socioeconomic index according to the 1995 Census, calculated by the Central Bureau of Statistics. The continuous value of the index is its distance from the country's average in units of standard deviations.

Table A5: Coefficient Estimates of Effect of Opening of Vocational Tracks on Labor Market Outcomes (2014): Robustness Tests¹ in the *Extended* Group of Localities

	Men (1)	Women (2)
Employment		
Employed=monthly wage above 1,250 NIS	-0.015 (0.015)	-0.019 (0.022)
Employed=annual positive labor income	-0.012 (0.015)	-0.008 (0.019)
Employed=annual positive labor and business income	-0.017* (0.009)	-0.014 (0.019)
Number of months of work		
Number of months of work among employees (monthly wage above 1,250 NIS)	-0.059 (0.089)	0.043 (0.111)
Number of months of work (including the non-employed)	-0.172 (0.199)	-0.045 (0.215)
Wage		
(Log) yearly wage (employees with wage above 1,250 NIS)	-0.043 (0.035)	0.021 (0.051)
(Log) yearly wage (employees with positive annual labor income)	-0.056 (0.038)	-0.012 (0.067)
Probability of self-employment		
Self-employed=annual positive business income	-0.005 (0.010)	0.000 (0.007)
Self-employed=annual yearly income above 15,000 NIS	-0.001 (0.009)	-0.002 (0.008)
Self-employment Income²		
(Log) business income (self-employed with annual yearly business income above 15,000 NIS)	-0.099 (0.089)	-
(Log) business income (self-employed with positive annual yearly business income)	-0.184 (0.110)	-
Total income		
Total income from labor and business (individuals with positive income)	-0.053 (0.032)	-0.004 (0.066)
Total income from labor and business (individuals who neither work nor are self-employed=0 income)	-5,196* (2,989)	303 (2,707)

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

- (1) Results are based on the specification in equation (1). The estimation controls for characteristics such as parents' years of education, number of siblings, school sector, share of unemployment benefits, recipients in the locality, locality fixed effect, and cohort fixed effect. Missing values are imputed according to Appendix 1.
- (2) Estimation of the effect on business income is done only for men due to a small number of women who had a business income in the localities of the study.

Table A6: Coefficient Estimates of Effect of Opening of Vocational Tracks on Labor Market Outcomes (2009): Robustness Tests¹ in the *Extended* Group of Localities

	Men (1)	Women (2)
Employment		
Employed=monthly wage above 1,250 NIS	-0.004 (0.016)	-0.010 (0.023)
Employed=annual positive labor income	-0.007 (0.016)	0.003 (0.029)
Employed=annual positive labor and business income	0.014 (0.012)	0.004 (0.028)
Number of months of work		
Number of months of work among employees (monthly wage above 1,250 NIS)	-0.078 (0.097)	-0.122 (0.165)
Number of months of work (including the non-employed)	-0.120 (0.204)	-0.090 (0.303)
Wage		
(Log) yearly wage (employees with wage above 1,250 NIS)	-0.034 (0.022)	-0.052 (0.052)
(Log) yearly wage (employees with positive annual labor income)	-0.024 (0.021)	-0.131* (0.074)
Probability of self-employment		
Self-employed=annual positive business income	-0.010 (0.015)	-0.002 (0.008)
Self-employed=annual yearly income above 15,000 NIS	-0.006 (0.020)	-0.003 (0.011)
Self-employment Income²		
(Log) business income (self-employed with annual yearly business income above 15,000 NIS)	0.026 (0.074)	- -
(Log) business income (self-employed with positive annual yearly business income)	-0.039 (0.161)	- -
Total income		
Total income from labor and business (individuals with positive income)	0.014 (0.027)	-0.121 (0.073)
Total income from labor and business (individuals who neither work nor are self-employed=0 income)	-1,195 (2,411)	-2,058 (2,010)

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

- (1) Results are based on the specification in equation (1). The estimation controls for characteristics such as parents' years of education, number of siblings, school sector, share of unemployment benefits, recipients in the locality, locality fixed effect, and cohort fixed effect. Missing values are imputed according to Appendix 1.
- (2) Estimation of the effect on business income is done only for men due to a small number of women who had a business income in the localities of the study.

Table A7: Effect of Opening New Vocational Tracks on Educational Outcomes in the *Extended* Group of Localities: Locality and Parents Fixed Effects¹

A. Boys

	Dropped out of High-School		Matriculation Examinations		Matriculation Certificate		Academic Degree	
	Locality Fixed Effect (1)	Parents Fixed Effect (2)	Locality Fixed Effect (3)	Parents Fixed Effect (4)	Locality Fixed Effect (5)	Parents Fixed Effect (6)	Locality Fixed Effect (7)	Parents Fixed Effect (8)
Post × Treatment	-0.027 (0.024)	-0.052** (0.021)	0.002 (0.021)	0.019 (0.025)	-0.002 (0.021)	0.010 (0.045)	0.020 (0.036)	-0.049 (0.058)
Student characteristics ²	V		V		V		V	
School sector	V		V		V		V	
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.254	0.246	0.681	0.698	0.317	0.324	0.236	0.224
Number of localities	25	25	25	25	25	25	25	25
Number of observations ³	14,059	6,314	17,646	9,101	17,646	9,101	2,429	1,001
Adjusted R ²	0.063	0.002	0.073	0.007	0.069	0.007	0.047	0.014

B. Girls

	Dropped out of High-School		Matriculation Examinations		Matriculation Certificate		Academic Degree	
	Locality Fixed Effect (1)	Parents Fixed Effect (2)	Locality Fixed Effect (3)	Parents Fixed Effect (4)	Locality Fixed Effect (5)	Parents Fixed Effect (6)	Locality Fixed Effect (7)	Parents Fixed Effect (8)
Post × Treatment	-0.033* (0.019)	-0.011 (0.025)	0.039* (0.025)	0.023 (0.036)	0.028 (0.040)	0.032 (0.054)	0.013 (0.036)	0.027 (0.069)
Student characteristics ²	V		V		V		V	
School sector	V		V		V		V	
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.153	0.152	0.772	0.775	0.389	0.396	0.252	0.271
Number of localities	25	25	25	25	25	25	25	25
Number of observations ³	14,860	7,273	18,806	10,344	18,806	10,344	2,656	509
Adjusted R ²	0.054	0.012	0.068	0.014	0.088	0.012	0.097	0.003

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1).

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(3) Data on academic degrees is from the 2008 Census. Therefore, the number of observations is small.

**Table A8: Effect of Opening New Vocational Tracks on Labor Market Outcomes in the Extended Group of Localities:
Locality and Parents Fixed Effects¹**

	A. Men						B. Women									
	Employment		Months of Work		(Log) Annual Wage		(Log) Monthly Wage		Employment		Months of Work		(Log) Annual Wage		(Log) Monthly Wage	
	Locality Fixed Effect (1)	Parents Fixed Effect (2)	Locality Fixed Effect (3)	Parents Fixed Effect (4)	Locality Fixed Effect (5)	Parents Fixed Effect (6)	Locality Fixed Effect (7)	Parents Fixed Effect (8)	Locality Fixed Effect (1)	Parents Fixed Effect (2)	Locality Fixed Effect (3)	Parents Fixed Effect (4)	Locality Fixed Effect (5)	Parents Fixed Effect (6)	Locality Fixed Effect (7)	Parents Fixed Effect (8)
Post × Treatment	-0.015 (0.015)	-0.033 (0.039)	-0.059 (0.089)	0.095 (0.206)	-0.043 (0.035)	0.049 (0.049)	-0.032 (0.026)	0.036 (0.040)								
Student characteristics ²	V		V		V		V									
School sector	V		V		V		V									
Share of unemp. benefits recipients	V	V	V	V	V	V	V	V								V
Cohort fixed effect	V	V	V	V	V	V	V	V								V
Mean outcome	0.746	0.748	10.842	10.943	11.293	11.329	8.966	8.986								
Number of localities	25	18	25	25	25	25	25	25								25
Number of observations	10,871	5,868	8,112	2,446	8,112	2,446	8,112	2,446								2,446
Adjusted R ²	0.003	0.006	0.003	0.013	0.023	0.014	0.032	0.012								0.012

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.

(1) Results are based on the specification in equation (1).

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Table A9: CBS Occupation Classification of the Occupation Groups

Occupation Group	CBS Occupation Classification (2 Digits)¹
"White Collar" Occupations (academics, managers, and engineers)	Biologists, Pharmacologists and Related Professionals
	Chemists, Physicists, Mathematicians and Related Professionals
	Directors General and Chief Executives
	Economists, Psychologists, Accountants and Related Professionals
	Engineers and Architects
	Humanities Professionals
	Judges and Lawyers
	Legislators and Executives
	Managers
	Medical Doctors, Pharmacists and Veterinarians
	Post-Secondary and Post-Primary Teaching
	Religious Sciences Professionals
	Secretaries of Local Authorities and Other
Senior Managers	
"Blue Collar" Occupations (compatible with the new vocational tracks)	Electrical, Electronic, Mechanical and Other Engineering
	Electrical and Electronics Equipment Mechanics
	Engineering Technicians n.s. ²
	Machinery Mechanics and Fitters
	Power Production and Water Treatment Plant
	Plumbers and Pipe Workers
	Skilled Workers n.s. ²
Technicians and Associate Professionals	
Additional "Blue Collar" Occupations	Articles Foremen
	Builders and Construction Workers
	Chemical Processing Plant Operators (except plastic and rubber)
	Civil Engineering Technicians and Associate Professionals
	Communications and Medical Equipment
	Concrete Casters and Non-Metal Mineral Products
	Diamond Workers
	Drivers
	Earth Moving, Paving and Lifting Plant Operators
	Food Processing and Related Workers
	Goldsmiths
	Medical Laboratory Workers, Nurses and Other
	Miners and Quarry Workers
	Natural Sciences Technicians and Associate Professionals
	Operators
	Operators and Photographers
	Packing Machine Operators
	Painters
Paper and Carton and Their Products Production	
Paramedical clinics	
Paramedical Professionals	

	Plastic, Rubber and Their Products Processors
	Potters, Glass Makers and Related Workers
Clerical Occupations	Auditors and Bookkeepers
	Accounts Workers
	Cashiers, Bank Clerks and Credit Company Clerks
	Clerks n.s. ²
	Customer Service Clerks and Office Equipment
	Customs, Tax and Licensing Clerical Workers
	Mail Clerks
	Operators
	Other Clerks
	Religious Associate Professionals
	Secretaries and Keyboard Operating Clerks
Fashion Occupations	Shoemakers and Other Leather Production
	Spinners, Weavers, Knitters and Fiber Preparers
	Tailors and Dressmakers
Education and Care Occupations	Personal Care Workers
	Teaching Associate Professionals in Primary Schools and in Kindergartens, and Social Counselors
Trade and Sales Occupations	Agents n.s. ²
	Financial and Business Services Agents
	Salespersons and Models
	Tour Guides and Stewards
	Wholesalers and Trade Dealers
Unskilled Workers	Workers in Lodging and Restaurant Services
	Domestic and Related Helpers, Cleaners and Janitors, Caretakers and Other Cleaners
	Launderers
	Other Unskilled Workers
	Porters and Dockers
	Sorting and Goods Arranging
	Street Vendors and Other Street Services
	Unskilled Agricultural Laborers and Road
	Unskilled Workers in Fruit Picking, Packing, and Sorting and Goods Arranging
Agricultural Occupations	Animal Producers
	Crop and Animal Producers, and Others
	Crop Growers
	Fishery and Hunting Workers
	Skilled Forestry Workers
Other Occupations	Journalists and Workers in Arts and Sports
	Other Services Workers
	Protective Workers

(1) According to Central Bureau of Statistics (1994).

(2) The abbreviation “n.s.” (not specified) indicates that the occupation is not completely defined, or the description is not complete and the occupation cannot be classified with certainty.

Table A10: Effect of Opening New Vocational Tracks on Probability of Engaging in Various Categories of Occupations in the *Limited* Group of Localities^{1,2}:

All Occupation Categories

A. Men

	“White Collar” Occupations (Academics, Engineers, and Managers) (1)	“Blue Collar” Occupations (Compatible with the New Vocational Tracks) (2)	“Blue Collar” Occupations (Additional) (3)	Clerical (4)	Fashion (5)
Post × Treatment	-0.003 (0.036)	-0.032 (0.022)	0.091** (0.032)	-0.042* (0.024)	0.017 (0.013)
Mean outcome	0.130	0.099	0.353	0.066	0.016
No. of Localities	18	18	18	18	18
No. of Observations	1,151	1,151	1,151	1,151	1,151
	Education and Care (6)	Trade and Sales (7)	Unskilled Workers (8)	Agriculture (9)	Other (10)
Post × Treatment	-0.008 (0.016)	0.013 (0.039)	0.005 (0.027)	-0.020 (0.013)	-0.020 (0.020)
Mean outcome	0.053	0.114	0.061	0.014	0.095
No. of Localities	18	18	18	18	18
No. of Observations	1,151	1,151	1,151	1,151	1,151

B. Women

	“White Collar” Occupations (Academics, Engineers, and Managers) (1)	“Blue Collar” Occupations (Compatible with the New Vocational Tracks) (2)	“Blue Collar” Occupations (Additional) (3)	Clerical (4)	Fashion (5)
Post × Treatment	0.042 (0.066)	-0.002 (0.012)	-0.018 (0.032)	0.139** (0.055)	0.023 (0.028)
Mean outcome	0.133	0.003	0.047	0.150	0.023
No. of Localities	18	18	18	18	18
No. of Observations	573	573	573	573	573
	Education and Care (6)	Trade and Sales (7)	Unskilled Workers (8)	Agriculture (9)	Other (10)
Post × Treatment	-0.150 (0.087)	-0.001 (0.035)	-0.020 (0.033)	-0.003 (0.004)	-0.010 (0.035)
Mean outcome	0.490	0.065	0.042	0.002	0.045
No. of Localities	18	18	18	18	18
No. of Observations	573	573	573	573	573

Source: Central Bureau of Statistics, Ministry of Education and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Occupations at the time of the 2008 Population Census. The categories contain all the possible occupations of the population of study. The full breakdown of occupations is shown in Table A9 in the Appendix.

(2) Results are based on the specification in equation (1). The estimations controls for student characteristics: father's and mother's years of education, number of siblings, cohort fixed effect, and locality of residence fixed effect. Missing values are imputed according to Appendix 1.

**Table A11: Effect of Opening New Vocational Tracks on Probability of Engaging in Various Categories of Occupations in the *Extended Group of Localities*^{1,2}:
All Occupation Categories**

A. Men					
	“White Collar” Occupations (Academics, Engineers, and Managers)	“Blue Collar” Occupations (Compatible with the New Vocational Tracks)	“Blue Collar” Occupations (Additional)	Clerical	Fashion
	(1)	(2)	(3)	(4)	(5)
Post × Treatment	0.025 (0.027)	-0.011 (0.023)	0.052* (0.029)	-0.017 (0.019)	0.005 (0.009)
Mean outcome	0.132	0.124	0.326	0.070	0.010
No. of Localities	25	25	25	25	25
No. of Observations	2,043	2,043	2,043	2,043	2,043
	Education and Care	Trade and Sales	Unskilled Workers	Agriculture	Other
	(6)	(7)	(8)	(9)	(10)
Post × Treatment	-0.021 (0.017)	-0.000 (0.031)	-0.003 (0.020)	-0.026** (0.010)	-0.004 (0.018)
Mean outcome	0.058	0.115	0.052	0.019	0.094
No. of Localities	25	25	25	25	25
No. of Observations	2,043	2,043	2,043	2,043	2,043
B. Women					
	“White Collar” Occupations (Academics, Engineers, and Managers)	“Blue Collar” Occupations (Compatible with the New Vocational Tracks)	“Blue Collar” Occupations (Additional)	Clerical	Fashion
	(1)	(2)	(3)	(4)	(5)
Post × Treatment	0.049 (0.050)	-0.001 (0.004)	-0.010 (0.025)	0.076* (0.044)	-0.001 (0.021)
Mean outcome	0.154	0.002	0.057	0.154	0.016
No. of Localities	25	25	25	25	25
No. of Observations	1,033	1,033	1,033	1,033	1,033
	Education and Care	Trade and Sales	Unskilled Workers	Agriculture	Other
	(6)	(7)	(8)	(9)	(10)
Post × Treatment	-0.110 (0.071)	-0.011 (0.028)	0.015 (0.027)	-0.002 (0.003)	-0.006 (0.023)
Mean outcome	0.467	0.069	0.037	0.002	0.043
No. of Localities	25	25	25	25	25
No. of Observations	1,033	1,033	1,033	1,033	1,033

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) Occupations at the time of the 2008 Population Census. The categories contain all the possible occupations of the population of study. The full breakdown of occupations is shown in Table A9 in the Appendix.

(2) Results are based on the specification in equation (1). The estimations control for student characteristics: father's and mother's years of education, number of siblings, cohort fixed effect, and locality of residence fixed effect. Missing values are imputed according to Appendix 1.

**Table A12: Effect of Opening New Vocational Tracks on Demographic Outcomes
in the *Extended Group of Localities*^{1,2}**

	Men	Women			
	Age of Marriage (1)	Age of Marriage (2)	Married Until Age 18 (3)	Have Children (4)	Number of Children (5)
Post × Treatment	0.326 (0.235)	0.303 (0.266)	-0.023 (0.017)	0.024 (0.041)	-0.121 (0.175)
Student characteristics ³	V	V	V	V	V
School sector	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V
Locality fixed effect	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V
Mean outcome	26.369	21.855	0.042	0.798	2.216
Number of localities	25	25	25	25	25
Number of observations	1,630	2,272	2,272	2,651	2,651
Adjusted R ²	0.063	0.023	0.005	0.020	0.120

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Standard errors in parentheses are clustered at the locality level.

(1) At the time of 2008 Population Census.

(2) Results are based on the specification in equation (1).

(3) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Table A13: Effect of Opening New Vocational Tracks on Educational and Labor Market Outcomes: Uniform Sample¹

	A. Men						
	Dropped out of High-School (1)	Matriculation Examinations (2)	Matriculation Certificate (3)	Employment (4)	Months of Work (5)	(Log) Annual Wage (6)	(Log) Monthly Wage (7)
Post × Treatment	-0.034 (0.026)	0.023 (0.031)	-0.045* (0.024)	0.005 (0.024)	-0.144 (0.142)	-0.083 (0.058)	-0.061 (0.039)
Student characteristics ²	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V
Mean outcome	0.256	0.675	0.335	0.752	10.857	11.280	8.953
Number of localities	18	18	18	18	18	18	18
Number of observations ³	4,343	4,343	4,343	4,343	3,266	3,266	3,266
Adjusted R ²	0.060	0.057	0.053	0.000	0.002	0.018	0.023
	B. Women						
	Dropped out of High-School (1)	Matriculation Examinations (2)	Matriculation Certificate (3)	Employment (4)	Months of Work (5)	(Log) Annual Wage (6)	(Log) Monthly Wage (7)
Post × Treatment	-0.062* (0.033)	0.076** (0.030)	-0.039 (0.038)	-0.011 (0.023)	-0.077 (0.188)	-0.056 (0.072)	-0.032 (0.056)
Student characteristics ²	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V
Mean outcome	0.158	0.775	0.400	0.547	10.562	10.913	8.621
Number of localities	18	18	18	18	18	18	18
Number of observations ³	4,620	4,620	4,620	4,620	2,528	2,528	2,528
Adjusted R ²	0.046	0.059	0.075	0.023	0.011	0.048	0.065

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. Standard errors in parentheses are clustered at the locality level.
 (1) Results are based on the specification in equation (1). The sample in columns (1)-(4) consists all of the individuals in the limited group of localities that appear in the data without any missing values in all the observed outcomes. Columns (5)-(7) consist all of the individuals who meet this condition and are also employed.
 (2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.
 (3) Data on academic degrees is from the 2008 census. Therefore, the number of observations is small.

**Table A14: Effect of Opening New Vocational Tracks on Educational and Labor Market Outcomes:
Wild Cluster Bootstrap-t Hypothesis Testing¹**

A. Men								
	Dropped out of High-School (1)	Matriculation Examinations (2)	Matriculation Certificate (3)	Academic Degree (4)	Employment (5)	Months of Work (6)	(Log) Annual Wage (7)	(Log) Monthly Wage (8)
Post × Treatment	-0.039 p-value=0.112	0.023 p-value=0.449	-0.052** p-value=0.020	-0.019 p-value=0.605	-0.008 p-value=0.914	-0.109 p-value=0.293	-0.065 p-value=0.164	-0.050 p-value=0.189
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.256 18	0.694 18	0.333 18	0.241 18	0.749 18	10.863 18	11.281 18	8.952 18
Number of localities	7,576	9,455	9,455	1,380	5,849	4,380	4,380	4,380
Number of observations ³	0.064	0.064	0.063	0.036	0.002	0.005	0.024	0.029
Adjusted R ²	0.095	0.388	0.015	0.659	0.684	0.281	0.167	0.178
Baseline estimations p-value								
B. Women								
	Dropped out of High-School (1)	Matriculation Examinations (2)	Matriculation Certificate (3)	Academic Degree (4)	Employment (5)	Months of Work (6)	(Log) Annual Wage (7)	(Log) Monthly Wage (8)
Post × Treatment	-0.054* p-value=0.084	0.076** p-value=0.044	-0.039 p-value=0.349	0.010 p-value=0.866	-0.032 p-value=0.281	-0.110 p-value=0.409	-0.057 p-value=0.449	-0.029 p-value=0.623
Student characteristics ²	V	V	V	V	V	V	V	V
School sector	V	V	V	V	V	V	V	V
Share of unemp. benefits	V	V	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V	V	V
Mean outcome	0.158 18	0.783 18	0.399 18	0.252 18	0.561 18	10.536 18	10.913 18	8.626 18
Number of localities	8,079	10,225	10,225	1,547	6,297	3,531	3,531	3,531
Number of observations ³	0.046	0.058	0.074	0.075	0.022	0.014	0.054	0.071
Adjusted R ²	0.060	0.022	0.320	0.824	0.241	0.449	0.447	0.625
Baseline estimations p-value								

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

p-values are calculated according to the Wild Cluster bootstrap-t procedure (Cameron, Gelbach, and Miller, 2008) with 499 repetitions.

(1) Results are based on the specification in equation (1).

(2) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

(3) Data on academic degrees is from the 2008 Census. Therefore, the number of observations is small.

Table A15: Effect of Opening New Vocational Tracks on Probability of Engaging in Various Categories of Occupations^{1,2}
Wild Cluster Bootstrap-t Hypothesis Testing¹

	“White Collar” Occupations (Academics, Engineers, and Managers)		“Blue Collar” Occupations (Compatible with the New Vocational Tracks)		Clerical Occupations	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treatment	Men	Women	Men	Women	Men	Women
	-0.003	0.042	-0.032	-0.002	-0.042*	0.139*
p-value	0.846	0.681	0.172	0.950	0.052	0.052
Student characteristics ³	V	V	V	V	V	V
School sector	V	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V	V
Locality fixed effect	V	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V	V
Mean outcome	0.130	0.133	0.099	0.003	0.066	0.150
Number of localities	18	18	18	18	18	18
Number of observations	1,151	573	1,151	573	1,151	573
Adjusted R ²	0.042	0.005	-0.001	-0.011	0.001	0.003
Baseline estimations p-value	0.930	0.534	0.174	0.889	0.090	0.021

Source: Central Bureau of Statistics, Ministry of Education, and the authors' calculations.

*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. p-values are calculated according to the Wild Cluster bootstrap-t procedure (Cameron, Gelbach, and Miller, 2008) with 499 repetitions.

(1) Occupations at the time of the 2008 Population Census. The full breakdown of the occupations is shown in Table A9 in the Appendix.

(2) Results are based on the specification in equation (1). The estimation is done for the limited group of localities.

(3) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Table A16: Effect of Opening New Vocational Tracks on Age of Marriage and Fertility^{1,2}

	Men	Women			
	Age of Marriage (1)	Age of Marriage (2)	Married Until Age 18 (3)	Have Children (4)	Number of Children (5)
Post × Treatment	0.102	0.591	-0.048*	0.010	-0.141
p-value	0.798	0.160	0.072	0.822	0.269
Student characteristics ³	V	V	V	V	V
School sector	V	V	V	V	V
Share of unemp. benefits recipients	V	V	V	V	V
Locality fixed effect	V	V	V	V	V
Cohort fixed effect	V	V	V	V	V
Mean outcome	26.182	21.647	0.047	0.795	2.263
Number of localities	18	18	18	18	18
Number of observations	950	1,313	1,313	1,543	1,543
Adjusted R ²	0.073	0.022	0.013	0.006	0.107
Baseline estimations p-value	0.745	0.086	0.030	0.832	0.524

Source: Central Bureau of Statistics, Ministry of Education and the authors' calculations.

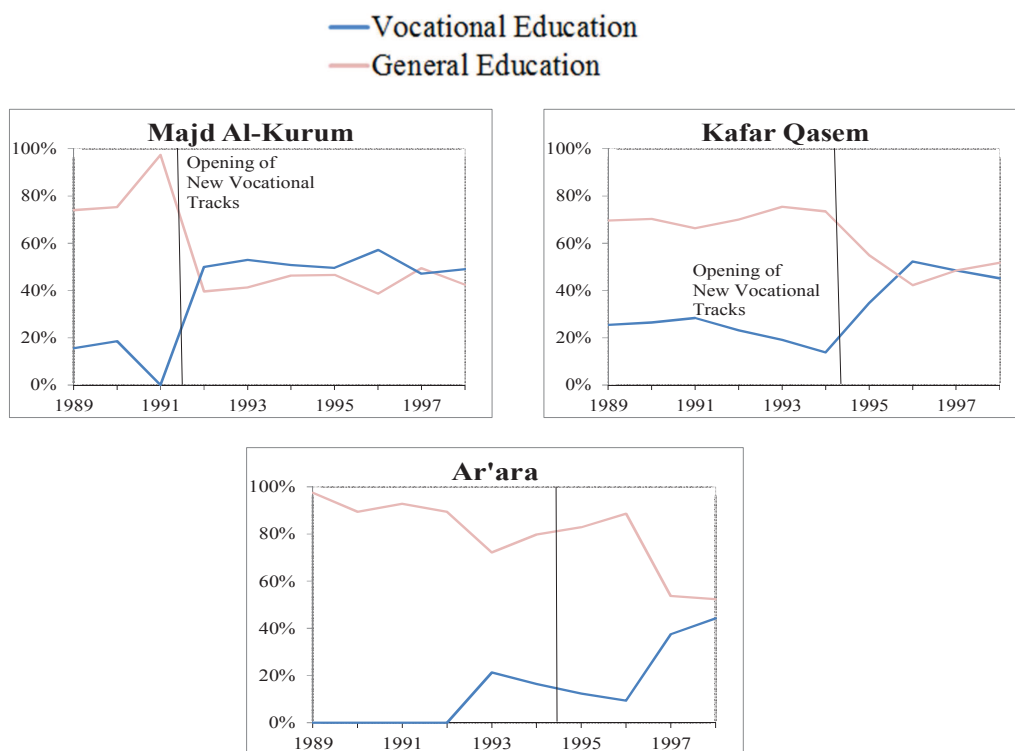
*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. p-values are calculated according to the Wild Cluster bootstrap-t procedure (Cameron, Gelbach, and Miller, 2008) with 499 repetitions.

(1) At the time of the 2008 Population Census.

(2) Results are based on the specification in equation (1). The estimation is done for the limited group of localities.

(3) Parents' years of education and number of siblings. Missing values are imputed according to Appendix 1.

Figure A1: Share of Students in Vocational and General Education Programs in Treatment Localities That Were Added to the Extended Group of Localities



Source: Ministry of Education and the authors' calculations.

Figure A2: Geographic Distribution of Treatment and Comparison Localities in the Extended Group

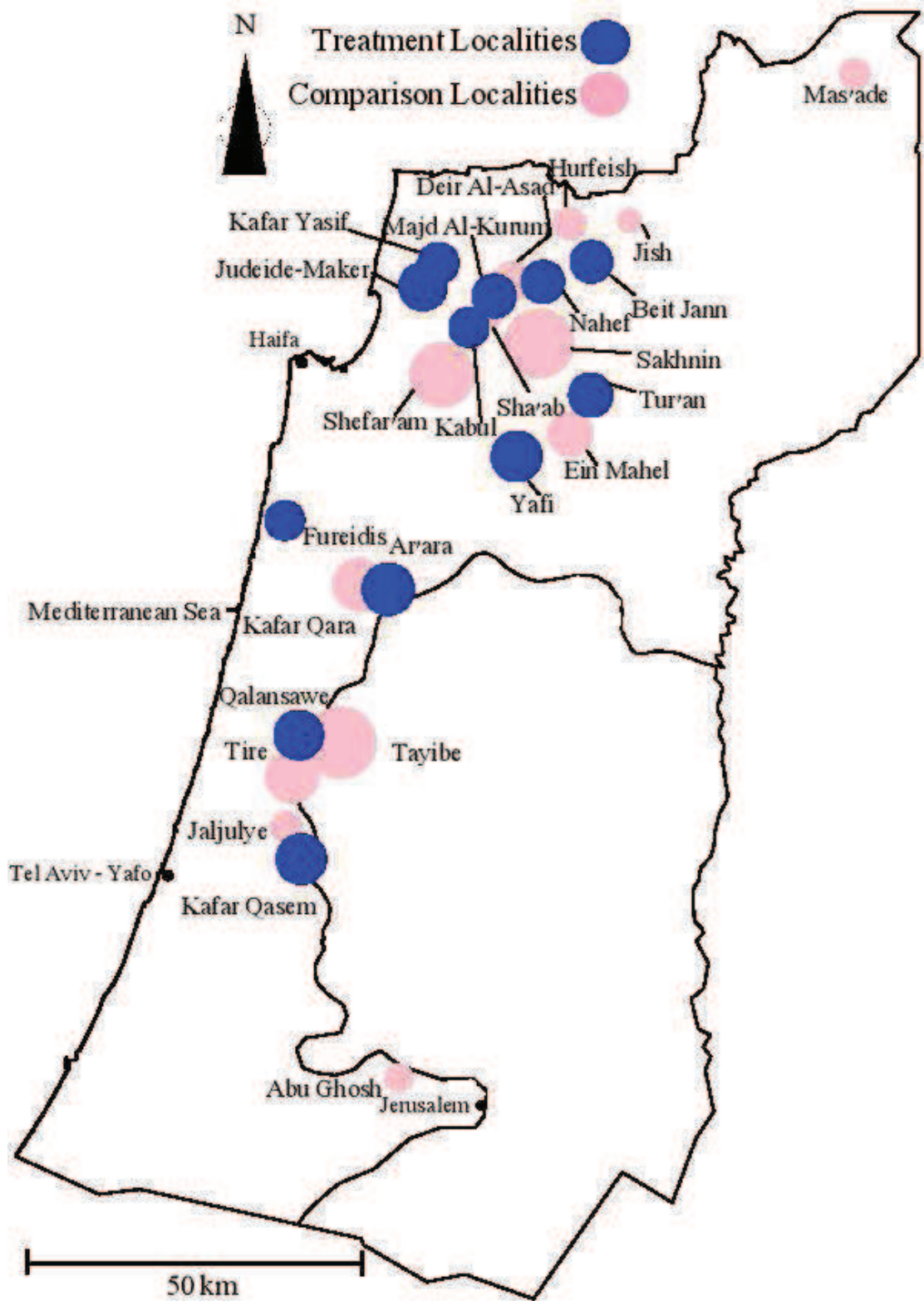
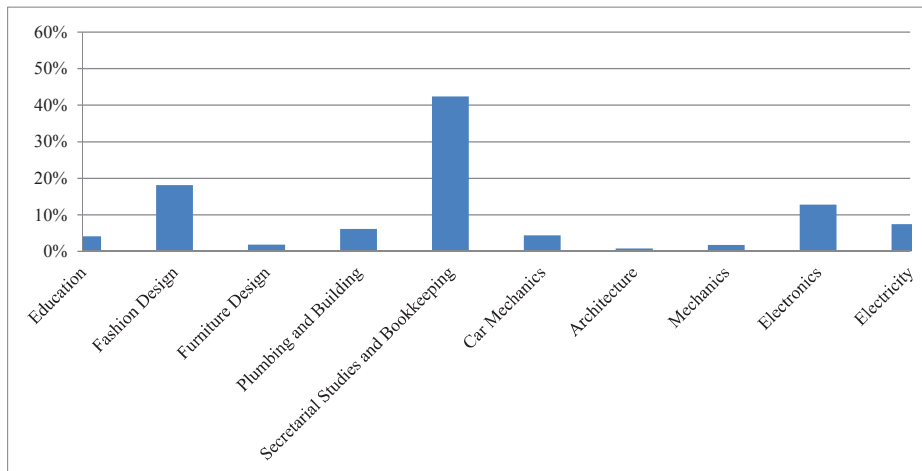
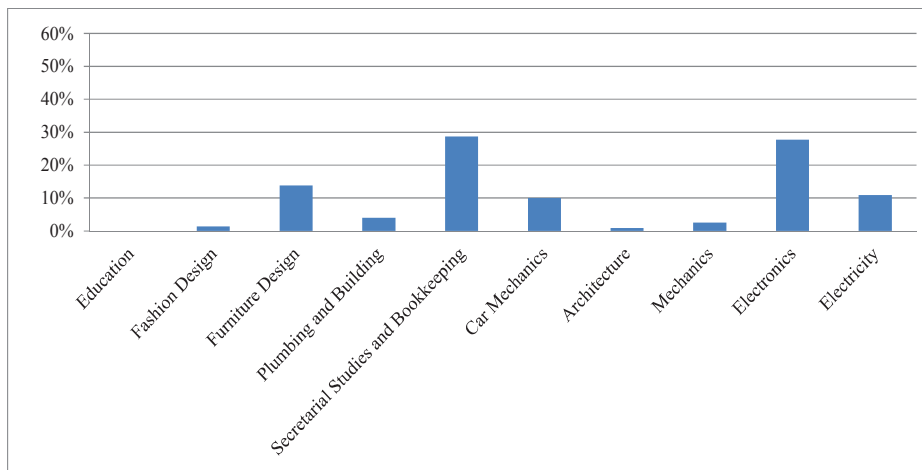


Figure A3: Distribution of Students in Newly Opened Vocational Tracks in the Extended Group of Localities¹

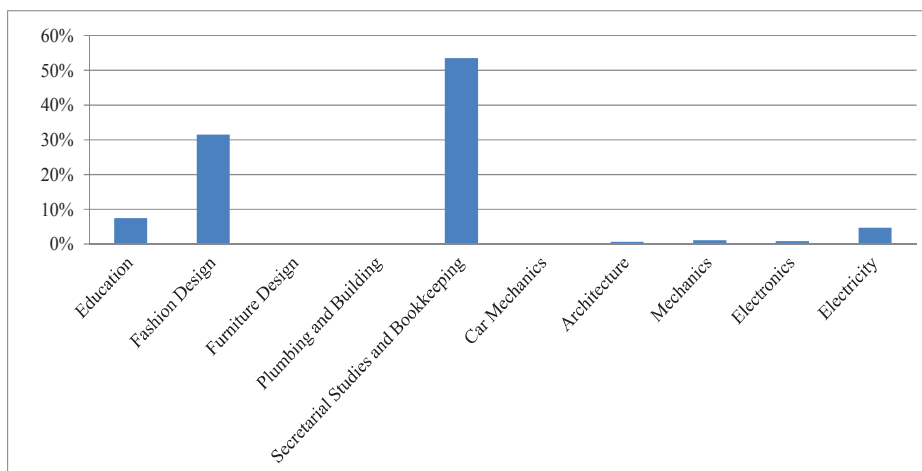
A. All Students



B. Boys



C. Girls

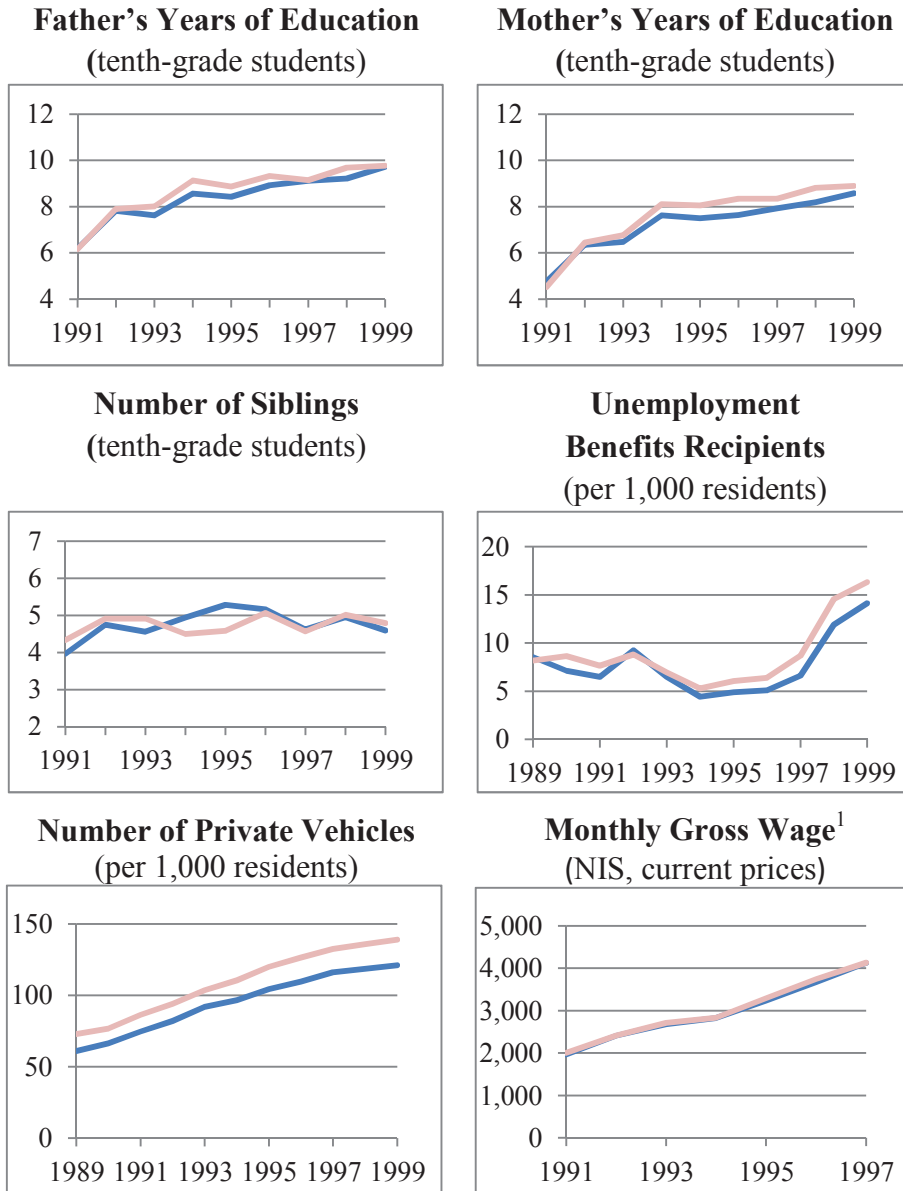


Source: Ministry of Education and the authors' calculations.

(1) Similar tracks were grouped to a single category. For details see Table A2 in the Appendix.

Figure A4: Trends in Characteristics of Treatment and Comparison Localities During Period of Study

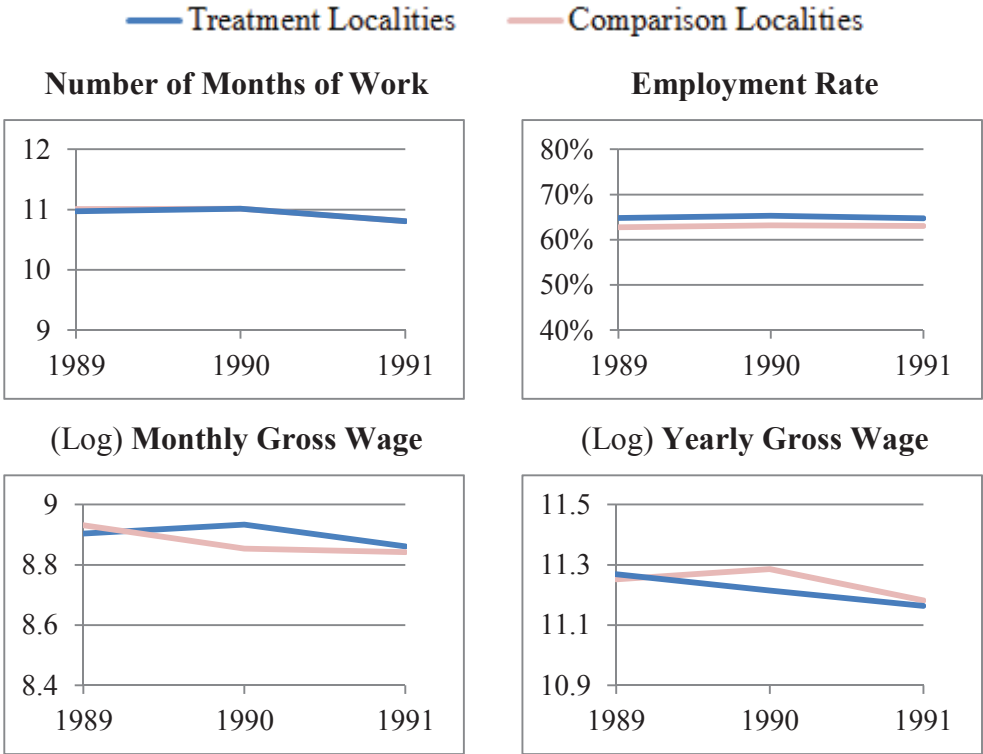
— Treatment Localities — Comparison Localities



Source: Central Bureau of Statistics and the authors' calculations.

(1) CBS data for Monthly Gross Wage (per month of work) is missing for some of the localities in 1998-1999.

Figure A5: Pre-Trends in Outcomes (2014) among Tenth-Grade Students in Treatment and Comparison Localities



Source: Central Bureau of Statistics and the authors' calculations.