Vocational Education in Israel

Wage Effects of the VocEd-Occupation Match

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ABSTRACT

In an earlier paper based on Israeli census data, the authors showed that vocational school completers achieved higher earnings than their counterparts who attended academic secondary schools, but only if they worked in occupations related to the vocational course of study pursued. These findings were challenged by Lawrence Hotchkiss; using U.S. follow-up data from the High School and Beyond survey, he argued that the wage advantage of vocational school completers working in related occupations stemmed from employment in a well-paid occupation (a possibility not examined in our earlier estimating model) and was not the result of the training received. In this paper, we replicate the U.S. study using our Israeli data base; the results strongly confirm those from our earlier study. How may the contrasting results for Israel and the United States be explained? We suggest that the U.S. study may be faulted; its focus on young workers in their first job after graduation, may have led to unduly pessimistic results with regard to the labor market outcomes of vocational schooling.

I. Introduction

There is now a sizeable literature addressing the issue of the efficacy of secondary vocational education (VocEd) in raising earnings.[1] The debate has been concerned with comparisons between vocational and general (academic) schools or between alternative education streams within the same, comprehensive school; it has focused on the labor market outcomes of these schooling alternatives.

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1. References to this literature is given in Middleton et al. (1993).

Vocational schooling is considerably more costly than general schooling.[2] Against this, it may serve many roles of societal importance. Advocates of vocational schooling see it, variously: as an effective means of supplying national manpower skills needs; as an appropriate educational alternative to general secondary schooling for students of weaker academic ability; as a framework for improving life-outcomes of unemployed youth and other social groups with special needs.[3] The debate in the literature, on how effective vocational schooling has been in meeting these objectives, has often been heated. However, ultimately, any consideration of the efficacy of vocational schooling must address two issues. First, how effective is vocational, in comparison with academic, schooling in providing better earnings and employment outcomes, over the long term as well as more immediately? Second, if net benefits do accrue from vocational education, are these sufficiently high to cover the higher costs of vocational schooling? Most of the empirical literature has concentrated on the first issue, usually with negative results.

In an earlier paper based on 1983 population census data, the present authors probed both issues in the context of the extensive system of vocational schooling in Israel (Neuman and Ziderman 1991).[4] We examined the second issue within a social cost-benefit framework; discounted earnings differentials of vocational over academic schooling exceeded discounted costs, for all combinations of plausible assumptions relating to lifetime earnings and costs streams.

On the first issue, our initial findings were consistent with the main thrust of previous empirical studies that have shown low or zero returns to vocational education: for workers who had attended secondary school and did not proceed to higher education, only a small earnings difference was found between the vocational and academic streams.[5] However, very different results were obtained when a term was included in the regression model for vocational school completers currently employed in occupations related to the vocational course that they studied; VocEd completers who worked in these training-related occupations, enjoyed a sizeable earnings advantage (of between 8 to 9.5 percent annually) over their counterparts, whether vocational completers employed in occupations not related to their training or graduates from academic schools.[6] These latter results, which put a new, more positive, gloss on the issue of vocational school effectiveness, have been echoed in other studies in the United States and in Hong Kong that have employed a broadly similar methodology;[7] these studies have been regarded as representing "a new wave" of empirical research on this question.

2. The literature on comparative costs of vocational and general schooling is reviewed in Tsang (1997).
3. These issues are reviewed critically in Middleton et al. (1993).
4. About a half of secondary school students are enrolled in vocational education programs in Israel.
5. We were unable to identify from the population census data tertiary level attenders/completers by type of high school attended, vocational or academic. Thus our analysis is limited to employed high school leavers who did not attend post-secondary schooling.
6. The term secondary school "completers" comprises all those in our sample who attended secondary school (but did not proceed to further formal study); it includes both those who did not complete the final grades of secondary school, as well as those who left high school without certification.
7. For references, see Neuman and Ziderman (1991). A possible shortcoming in these studies is that they did not take account of the higher option value, of academic over vocational secondary schooling, for entry to higher education.

The favorable findings of the new wave literature have been challenged by Lawrence Hotchkiss (Hotchkiss 1993); his paper has been widely cited, approvingly.[8] Hotchkiss claims that our estimation model was misspecified in failing to include a separate term for training-related occupations (namely, occupations that are related to available VocEd courses).[9] He argues that the wage advantage of VocEd completers working in an occupation related to their training stems not from the training received, but from employment in training-related occupations that are well paid. Clearly, related VocEd is not a necessary condition for entry into a "training-related" occupation; academic and other vocational school completers may also be employed in such matched occupations after receiving the necessary skills at non-school training institutions or on-the-job. His empirical results using U.S. data support this view: in a number of regression runs, the coefficients on the training-related occupation term are generally positive, though the training term and an interaction term for training and employment in a training-related occupation are both insignificant.

Although we may accept the strictures of Hotchkiss concerning the absence of a term for training-related occupations in the regression model presented in our earlier paper, it is not established that our favorable results relating to VocEd are invalidated. Such a conclusion could follow only from a reestimation of the regression model using Israeli data, but with the addition of a variable representing training-related occupations. We provide this in the present paper.

The aim of this paper is twofold: substantive and critical. First, we provide new results for Israel. We revisited our Israeli data set and reestimated the regressions using the specification suggested by Hotchkiss. Our new findings are in close conformity with those from our previous paper and diverge dramatically from those of Hotchkiss for the United States. Again, we find that VocEd alone does not confer higher earnings; VocEd completers employed in occupations closely related to their courses of study earn more than other groups, even when a variable for VocEd-related occupation is included. Our second aim is more critical; in attempting to account for the contrasting findings of our work and that of Hotchkiss, we point to the problematic use by Hotchkiss of "wage of the first job after leaving high school" as the dependent variable.

The plan of the paper is as follows. In Section II we present formally the OLS regression models to be estimated and Section III provides our main results based on Israeli data; some criticisms of data use by Hotchkiss follow in Section IV.

II. Alternative Models

Traditional studies of the wage effects of VocEd have used a basic equation of the following form.[10]

$$(1) \quad y = a'x + bVOC + u$$

8. For example in Ashton and Green (1996) and Winkelmann (1997).
9. Hotchkiss uses the term "training" as a synonym for "vocational education"; we adopt a similar usage.
10. Adapted from Hotchkiss (1993).

where: y is wage (ln); x is a vector of exogenous variables; u is the error term; *VOC* is a dummy variable for those who had taken VocEd courses (with academic school completers constituting the excluded term); and a and b are coefficients. The effects of vocational education (*VOC*) are usually small, insignificant or negative.

Our earlier study replaced *VOC* with two dummy variables: *VOCM* represents VocEd completers that were employed in jobs related to the VocEd program they studied, while *VOCN* relates to VocEd completers not employed in VocEd-related jobs (with academic school completers the excluded term).

$$(2) \quad y = a'x + bVOCM + cVOCN + u.$$

The *VOCM* term was found to be positive and highly significant though *VOCN* was not significant.

In the present paper we follow the two basic specifications suggested by Hotchkiss.[11]

$$(3) \quad y = a'x + bVOC + cVOCM.ROCC + u$$

where *VOC* relates to all those who had taken VocEd courses at secondary school, and *ROCC* (VocEd-related occupations) comprises those occupations for which relevant VocEd courses are available. The term *VOCM.ROCC*, equivalent to the term *VOCM* in Equation 2, comprises those VocEd completers who are employed in VocEd-related occupations that are equivalent to their courses of study. It should be noted that the *VOCM.ROCC* term excludes those VocEd completers employed in *ROCC* that is not directly related to the actual VocEd courses studied; this group, which could be defined as *VOCN.ROCC*, is a subset of *VOCN* that appears in Equation 2. A diagrammatic representation of all the various subsets is provided in Appendix Figure 1

$$(4) \quad y = a'x + bVOC + cROCC + dVOCM.ROCC + u.$$

Equation 4 is parallel to 3, but with the addition of the separate dummy variable *ROCC*; Hotchkiss argues that the inclusion of *ROCC* is the appropriate specification for the purpose of testing the efficacy of VocEd in augmenting earnings above those received by academic school attenders.

Estimating variations of Equation 4, using data for the United States, Hotchkiss found that the *ROCC* variable was positive in a number of cases, though the *VOC* and *VOCM.ROCC* terms were generally insignificant. The results of a similar regression model run on Israeli data are presented in the following section.

III. Testing on Israeli Data—the Main Results

A. Data

The data set used was the 20 percent subsample of the 1983 Israeli Census of Population and Housing. For individuals whose education terminated at the secondary school level, information was available on type of schooling received: vocational or academic. For this research, our sample was restricted to full-time, Jewish male

11. In addition to OLS regressions, Hotchkiss also estimated an endogenous switching regression model; the switching regressions yielded results generally consistent with the OLS estimates.

Table 1
Numbers of Vocational School Completers and Percentage Employed in Training-Related Occupations, by Field of Study (Full time, male, salaried workers, 1983)

Subject of Vocational Study	Number of Vocational School Completers	Of which, Employed in Related Occupation	Percentage
Agriculture	1,011	61	6.1
Electricity	1,385	588	42.5
Electronics	700	342	48.9
Metalwork	4,377	1,656	37.8
Auto mechanics	1,982	851	42.9
Clerical and bookkeeping	332	170	51.2
Sewing and fashion	20	4	20.0
Hotel trades and home economics	93	38	40.9
Total	9,900	3,710	37.5

workers, aged 25–49, who had attended secondary school in Israel (and who would have at least three years of labor market experience following compulsory military service). In all, the sample included nearly 9,900 VocEd attenders and some 4,000 individuals who had attended general secondary schools.[12]

The census identified eight fields of VocEd study, as follows (sample numbers in parentheses): Agriculture (1,011), Electricity (1,385), Electronics (700), Metal work (4,377), Auto mechanics (1,982), Clerical and bookkeeping (332), Sewing and fashion (20), and Hotel trades (93). Two-digit occupational codes were compared with the eight VocEd fields of study to identify ROCC (VocEd related occupations). For example, the occupational category "Electricians/Electronic Fitters" is defined as related to the VocEd subject "Electricity."[13] If a VocEd completer was working in an occupation related to his course of VocEd study, then he was included within VOCM.ROCC. Table 1 shows the number of VocEd attenders employed in corresponding occupations, for each of the eight fields of study. In total, 3,710 VocEd completers (37.5 percent of all VocEd completers in the sample) were defined as working in occupations related to the VocEd course they had studied.

In all, 8,375 workers were defined as employed in VocEd related occupations (ROCC). In addition to the 3,710 matched VocEd attenders, there were two addi-

12. For fuller information on the data set and sample, see Neuman and Ziderman (1991).
13. These matchings were defined as "direct" matches in the earlier paper, in which we also identified "wider" occupational matchings. For details of these matching regimes, see the Appendix in Neuman and Ziderman (1991). As both matching regimes gave similar results, we use only the direct matchings in the present paper.

tional groups of secondary school completers employed in ROCC occupations: 2,615 nonmatched VocEd completers from other VocEd fields of study and 2,050 academic school completers.

Mincer-type earnings functions were estimated; the log of monthly wages received was regressed on dummy variables VOC, ROCC and VOCM.ROCC described in Model 4 above, as well as on a series of other schooling variables, work related variables and personal background variables.[14] The full set of other variables and sample means are provided in Table 2; detailed definitions may be found in our earlier paper.

Table 2 shows that workers with an academic high school background earn more, and have had more years of labor market experience, than workers from vocational high schools. The two groups have similar levels of education (years of schooling), however, and work inputs (in terms of average hours and weeks worked). The distribution of the two groups by economic sector and occupation category are broadly similar. Although there are more Jews of Eastern origin among VocEd completers, fewer VocEd completers have achieved Bagrut (maturity) certification, a necessary condition for entry to higher education.

B. Results

Our central results, based on Model 4, are presented in Table 3. Its main features are the insignificance of the VOC term; a highly positive coefficient on VOCM.ROCC (0.081) and a positive ROCC term (0.04).[15] These results indicate that earnings of VocEd completers working in occupations related to their courses of study are augmented by some 8 percent; working in a training-related occupation has an independent, though very much smaller, effect in raising earnings (by about 4 percent).[16]

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14. An alternative specification is to define hourly wages as the dependent variable, dropping *HOURS* and perhaps *WEEKS* from the right-hand side: this is particularly appropriate when part-time workers are included in the sample. But the Census provided information on monthly wages and we restricted our analysis to full-time workers (35 hours plus weekly). We ran alternative regressions with the log of hourly earnings as the dependent variable; the results are virtually the same as those presented subsequently in this paper.

15. Using the log of hourly wages as the dependent variable, as discussed in footnote 14, produces virtually identical results, as follows. *VOC*: −0.0138 (1.14), *ROCC*: 0.0436 (2.78), *VOCM.ROCC*: 0.0861 (5.82).

16. A referee's comment on an earlier version of the paper noted some overlap between the occupational categories and the dummy variable *ROCC* and pointed to the possibility that some of the effects of *ROCC* have been siphoned off into the occupation categories.

ROCC is composed of 19 two-digit occupations out of 88 occupations. The eight occupation dummies are defined for the nine one-digit occupation categories. Three out of the nine categories do not include any *ROCC* occupations (Scientific and Academic Workers, Administrators and Managers, Unskilled Workers), though the other six include some *ROCC* occupations. The occupation Clerical Workers contains the maximum number of six *ROCC* occupations (out of ten). Although this does result in some degree of multicolinearity the overlap is rather limited. The *ROCC* variable combines trade/industry jobs with clerical jobs—two categories which might have quite different average wages. The inclusion of the occupation dummies controls for these differences in the wage structures of the different professions. This is why we believe they should not be omitted from the regressions.

We took up the referee's suggestion and reran the regressions, excluding the occupational dummies; the results even strengthen our case. For example, a replication of Model 4 results in the following coefficients. *VOC*: −0.005 (0.41), *VOCM.ROCC*: 0.10 (7.60), *ROCC*: −0.056 (5.07). A comparison with the parallel results in Tables 3 and 4 shows an increase in the positive effect of *VOCM.ROCC* (from 0.081 to 0.101), though the positive coefficient on *ROCC* is now reversed to a negative effect (from 0.040 to −0.056)—indicating that *ROCC* occupations pay lower wages than other occupations.

Table 2
Variables: Definitions and Means (Standard deviations in parentheses) (Full time, male, salaried workers, 1983)

Variables	Vocational School Completers	Academic School Completers
Monthly earnings (ln)	10.371 (0.58)	10.412 (0.61)
Schooling (*YRS.SCH*)	11.131 (1.04)	11.342 (1.07)
Experience (*EXP*)	16.033 (6.36)	17.807 (7.31)
Hours of work per week (*HOURS*)	49.718 (7.78)	49.655 (8.03)
Weeks of work per year (*WEEKS*)	50.194 (6.77)	50.087 (7.20)
Eastern ethic origin (*ETHNIC*) (%)	58.31	45.92
Economic sector (%)		
Industry (*IND*)	38.91	26.75
Electricity and water (*ELECT*)	3.29	1.72
Commerce (*COMM*)	10.76	12.81
Financing and business services (*FIN*)	5.20	14.42
Transport, storage and communication (*TRANS*)	11.39	11.18
Public and community services (*PUB*)	15.93	20.93
Personal and other services (*PRIV*)	4.88	3.07
Construction (*CONST*)	6.58	5.72
Agriculture (reference group)	3.06	3.40
Occupation (%)		
Scientific and academic workers (*ACAD*)	0.45	0.65
Professional and technical workers (*TECH*)	8.39	7.62
Administrators and Managers (*MANAG*)	6.85	12.36
Clerical workers (*CLER*)	12.19	26.11
Sales workers (*SALES*)	6.64	9.05
Service workers (*SERV*)	6.47	7.90
Unskilled workers (*UNSKILL*)	2.46	2.37
Skilled workers (*SKILL*)	55.09	32.43
Agricultural workers (reference group)	1.46	1.51
Certification (%)		
High school certificate (S.CERT)	67.51	45.92
Maturity Certificate: Bagrut (BAG)	6.94	23.93
Sample size	9,900	4,175

Table 3
Model 4: Regression of Monthly Earnings (ln) (Full-time, male, salaried workers, general and vocational school completers, 1983) (n = 14,049)

Independent Variables	Coefficient	*t*-statistic
YRS.SCH	0.016	1.29
EXP	0.034	3.55
EXP^2	−0.0008	7.45
*EXP * YRS.SCH*	0.001	1.89
WEEKS (ln)	0.312	16.77
HOURS (ln)	0.309	9.60
ETHNIC	−0.130	13.70
Economic Sector		
IND	0.079	2.66
ELECT	0.258	6.59
COMM	−0.028	0.89
FIN	0.133	4.02
TRANS	0.077	2.44
PUB	−0.023	0.75
PRIV	−0.065	1.82
CONST	0.016	0.46
Occupation		
ACAD	0.306	3.98
TECH	0.362	8.07
MANAG	0.550	11.96
CLER	0.202	4.65
SALES	0.252	5.34
SERV	0.230	4.95
UNSKILL	0.156	3.00
SKILL	0.172	4.03
Certification		
S.CERT	0.065	5.24
BAG	0.111	5.93
VOC	−0.003	0.25
ROCC	0.040	2.73
VOCM.ROCC	0.081	5.84
Intercept	6.936	32.04
R^2	0.1736	

Table 4
OLS Estimates of Effects of Vocational Education and VocEd Related Occupation on Monthly Earnings

Independent Variables	Coefficient	*t*-statistic
Model 3		
VOC	−0.004	0.36
VOCM.ROCC	0.099	7.96
Model 4		
VOC	−0.003	0.25
ROCC	0.040	2.73
VOCM.ROCC	0.081	5.84

These results are highly supportive of those presented in our earlier paper for Israel, but at odds with those reported by Hotchkiss (1993) for the United States.[17] In Neuman and Ziderman (1991), we reported only a small earnings advantage (about 2.5 percent) for VocEd over academic schooling based on Model 1; using Model 2, VocEd graduates employed in occupations related to their training (VOCM) enjoyed enhanced earnings of up to 9.5 percent. We also estimated Model 3 above for comparison with Model 4 results; the coefficient on the VOCM.ROCC is 0.099, though the VOC term was insignificant. Summary results, for the key variables, are shown in Table 4.

Our estimates for Model 4 show that, in the Israeli context, training-related occupation (ROCC) does have an independent effect in raising earnings as Hotchkiss argues; however, the major part of enhanced earnings of vocational school completers, compared with those from academic schools, is explained by the VOCM.ROCC term, as argued in our earlier paper. This term was insignificant in the Hotchkiss paper.

How may we explain the divergent results from our present study and that of Hotchkiss? There are, broadly, two possible sets of explanations, one substantive, the other methodological. One possibility (also noted by Hotchkiss) is that major differences in the educational and labor market environments in the United States and Israel affect differentially the efficacy of VocEd in the two countries.

However, the differing results may stem (alternatively or in addition) from differences in the data sets and methods used in the two studies. In commenting on an early draft of the Hotchkiss paper (Neuman and Ziderman 1991), we pointed to two main differences between our work and that of Hotchkiss which may account for the differing results. First we use a more detailed matching procedure than Hotchkiss; his data set allows him to distinguish only two areas of VocEd study, while we have eight. Second, the independent variable used by Hotchkiss is wage in first job within

17. Our findings are in conformity with the earlier results for the United States by Daymont and Rumberger, which they reported in a number of papers. Daymont and Rumberger also controlled for the match between high school vocational education and occupation. They found that vocational education related to present occupation does enhance earnings; unrelated vocational education does not. See, for example, Rumberger and Daymont (1984).

two years after high school completion, whereas our analysis relates to workers at different points in the life cycle, up to age 50. In the next section we probe these issues in more detail.

IV. Two Criticisms of Hotchkiss

A. Need for Finer Matchings?

The data set used by Hotchkiss—the second follow-up of the younger cohort of the High School and Beyond (HS&B) survey—identified only two broad types of secondary vocational training: a business support curriculum and industry-and-trade programs. Whereas the Israeli population census identified eight VocEd courses of study through which the ROCC variable was identified, the HS&B data did not permit this level of detail. Thus, for example, in the Hotchkiss analysis a worker who studied electricity at high school but worked as a plumber would be considered matched (in the industry-and-trade ROCC); in our analysis he would not be considered as matched. Hotchkiss concedes that it is desirable to use more finely graded VocEd categories to measure the match between VocEd and occupation. The question is how far did the limited two VocEd categories and the resultant broad matchings temper his results? We examined this issue in two ways.

Our first approach was to rerun Model 4 using the broader matching regime employed by Hotchkiss. To do this, we collapsed our eight VocEd categories into two, corresponding to the two broad VocEd categories used in the Hotchkiss study; we then identified those matched VocEd completers working in the two new broad ROCC categories. The effect of the alternative matching system is a redistribution of VocEd workers employed in ROCC, shifting them from the nonmatched to the matched category. As a result, the number of matched VocEd completers rose from 3,710 to 5,246 (or, from 37.5 to 53.0 percent of all VocEd workers).[18] Summary regression results for Model 4 using the Hotchkiss matchings are shown in the top panel of Table 5. The results remain highly supportive, and even strengthen, those reported in Table 4 using the Neuman-Ziderman (N-Z) matchings. The VOCM.-ROCC coefficient of 0.092 is highly significant, VOC remains insignificant though the ROCC term loses its significance.

Our second approach is to estimate the actual model employed by Hotchkiss, using the two alternative matching schemes. Though based on Model 4, the OLS model used by Hotchkiss employed two separate VocEd variables, representing industry-and-trade and business support studies. The model took the following form:

$$(5)\quad y = a'x + bI + cB + dIROCC + eBROCC + fIM.IROCC + gBM.BROCC + u.$$

The terms I and B represent VocEd workers who had studied industry-and-trade and business support studies, respectively. *IROCC* and *BROCC* are occupation groupings related to I or B courses of VocEd study; the *IM.IROCC* and *BM.BROCC* categories

18. See Appendix Table 2 for details on how the alternative matching systems affect the number of *ROCC* workers in the three categories: VocEd matched workers, VocEd unmatched workers, and academic educated workers.

Table 5
OLS Estimates of Effects of Vocational Education and VocEd Related Occupation on Monthly Earnings: Alternative Matching Regimes

Independent Variables	Coefficient	*t*-statistic
Model 4 (Hotchkiss Matchings)		
VOC	−0.015	1.18
ROC	−0.018	1.02
VOCM.ROCC	0.092	4.96
Model 5 (N-Z Matchings)		
I	−0.0004	0.03
B	−0.060	1.65
IROCC	0.045	2.76
BROCC	0.014	0.46
IM.IROCC	0.080	5.35
BM.BROCC	0.108	2.04
Model 5 (Hotchkiss Matchings)		
I	−0.013	0.96
B	−0.065	1.72
IROCC	0.019	0.85
BROCC	0.012	0.37
IM.IROCC	0.093	4.44
BM.BROCC	0.106	1.99

consist of workers who had studied *I* and *B* and work, respectively, in *IROCC* and *BROCC* occupations related to their courses of VocEd study.

Summary results for the two regressions are shown in Panels 2 and 3 of Table 5; the size and sign of the coefficients in the two regressions are very similar. In both cases the *IM.IROCC* and *BM.BROCC* terms are positive and significant, in conformity with our earlier results; the VocEd variables are not significant though *ROCC* variables are insignificant in three out of the four cases.

These two tests indicate that the broader Hotchkiss and finer N-Z matching schemes, used on a common Israeli data set, yield similar results. Our general conclusion is that the strong differences in the results for the United States and Israel do not stem from differences in the nature of the matching schemes used.

B. Relevance of First Job Earnings

Differences in definition of the independent wage variable, stemming from the nature of the data sets used in the two studies, may account for the differing results. Using the Israel Census of Population as a data base, our sample consisted of a cross-section of individuals of ages up to 50; our independent variable was the log of current wage. On the other hand, the data base used by Hotchkiss was derived from

Table 6
OLS Estimates of Effects of Vocational Education and VocEd Related Occupation on Monthly Earnings: Different Age Groups (t-statistics in parentheses)

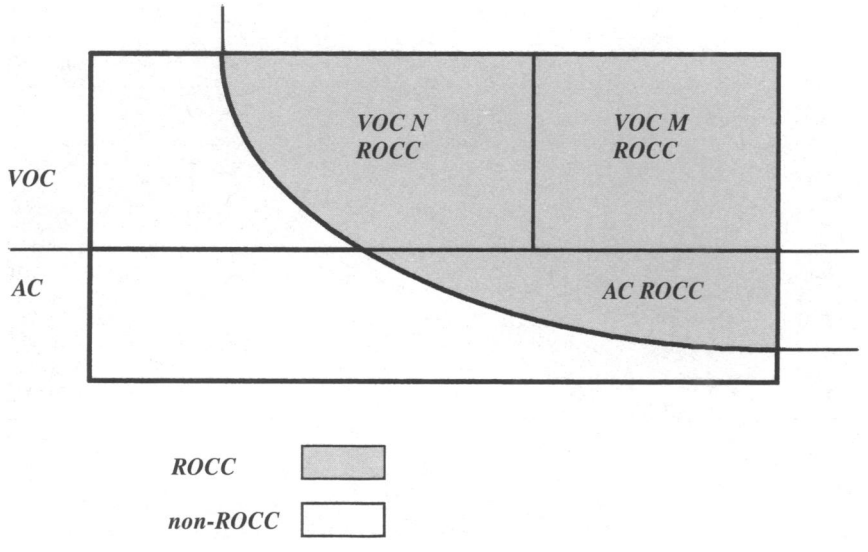
	Age Group				
Independent Variables	25–29	30–34	35–39	40–44	45–49
Model 4					
VOC	−0.014	−0.049	0.023	−0.022	0.052
	(0.71)	(2.12)	(0.90)	(0.65)	(1.46)
ROCC	0.042	0.037	0.0003	0.086	0.052
	(1.74)	(1.28)	(0.01)	(1.77)	(1.05)
VOCM.ROCC	0.032	0.143	0.065	0.138	0.081
	(1.440)	(5.52)	(1.99)	(2.84)	(1.55)
Sample size	4567	3819	2816	1506	1341
% employed in VocEd-related occupation (*VOCM.ROCC/VOC*)	38.0	39.9	36.6	32.8	33.0

a follow-up of 1980 high school sophomores. The sample was thus standardized on age and the independent variable used was the log of wage in the first job taken within the first two years after leaving high school. The arguments used by Hotchkiss to justify the restricted focus of his study to recently graduated young workers is less than convincing; he claims that VocEd effects on earnings are likely to be strongest for younger groups, and weaken over time.

The question arises whether the restriction of the sample to young workers in the Hotchkiss study can account for the differences in the results of the two studies. We examined this issue by dividing our sample into five-year age groups, estimating Model 4 for each age cohort, and then examining the results for any differences between the youngest group (a proxy for the sample used in the Hotchkiss study) and four older age groups. Because most high school completers move directly into military service for three years or more, we took age 25–29 as our youngest group. Summary results for the five regressions are given in Table 6.

The findings are both initially surprising and highly suggestive. Although the effects of VocEd in occupations related to course studied are weak for the youngest group, these effects strengthen considerably with age: this is the opposite of the situation posited by Hotchkiss. Thus the term *VOCM.ROCC* is insignificant for the 25–29 year age group (in conformity with the results for the Hotchkiss study) but becomes significantly positive for older age groups, up to age 45. *VOC* and *ROCC* are insignificant or negative for all age groupings. Because these results are based on Israeli and not U.S. data, they are in no way conclusive; however, they do suggest that the failure to include older workers in the Hotchkiss study may have led to results that are unduly pessimistic with regard to the labor market outcomes of vocational schooling in the United States.

There is, however, one caveat here. The results for the youngest age group may reflect a cohort effect that continues as they age. It would have been instructive to test for the presence of such cohort effects, using the recently available data set from the 1995 Israeli Census of Population; this would entail replicating the present research twelve years on and examining whether a nonsignificant *VOCM.ROCC* result is found for the 30–34 and 35–39 age groups. Unfortunately, the question on VocEd field of study was dropped from the 1995 Census.



Appendix Figure 1
Sample Subgroups

Note: The chart defines the various sample subgroups used in the research. It is seen that the interaction of *VOC* times *ROCC* defines a category (*VOCN.ROCC* plus *VOCM.ROCC*) that is broader than the term *VOCM.ROCC* used in Models 3 and 4. Sample numbers are provided in Appendix Table 1.

Appendix Table 1

VocEd completers		
VOCN		
VOCN (non-*ROCC*)	3,575	
VOCN.ROCC	2,615	
VOCM.ROCC	3,710	
Total *VOC*		9,900
Academic school completers		
AC (non-*ROCC*)	2,125	
AC.ROCC	2,050	
Total *AC*		4,175
Total sample		14,075

Appendix Table 2
Vocational School Completers and Workers Employed in Training Related Occupation: Alternative Matching Regimes

	Vocational School Completers		Employed in ROCC (Number)			
			Vocational School Completers			
	Number	% Working in Study-Related Occupations	Matched	Nonmatched	Academic School Completers	Total Employed in *ROCC*
Vocational Grouping	(1)	(2)	(3)	(4)	(5)	(6)
Neuman-Ziderman Matchings						
Industry and trade	9,455	37.0	3,498	1,584	980	6,062
Business	445	47.6	212	1,031	1,070	2,313
Total	9,900	37.5	3,710	2,615	2,050	8,375
Employed in *ROCC* (%)	na	na	44.3	31.2	24.5	100.0
Hotchkiss Matchings						
Industry and trade	9,455	53.1	5,021	61	980	6,062
Business	445	50.6	225	1,018	1,070	2,313
Total	9,900	53.0	5,246	1,079	2,050	8,375
Employed in *ROCC* (%)	na	na	62.6	12.9	24.5	100.0

na: not applicable

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[Footnotes]

[7] **Vocational Schooling, Occupational Matching, and Labor Market Earnings in Israel**
Shoshana Neuman; Adrian Ziderman
The Journal of Human Resources, Vol. 26, No. 2. (Spring, 1991), pp. 256-281.
Stable URL:
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[10] **Effects of Training, Occupation, and Training-Occupation Match on Wage**
Lawrence Hotchkiss
The Journal of Human Resources, Vol. 28, No. 3. (Summer, 1993), pp. 482-496.
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