WHAT DETERMINES EDUCATION EXPENDITURE IN ISRAEL?

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There were marked shifts in both the share of national expenditure on education in GDP, as well as in its composition, in 1962-98. At the beginning of the period the share of education in GDP soared, remained relatively constant in the 1970s, declined in the 1980s, and began to rise again in the 1990s. This paper analyzes the relations between these shifts and various demographic, economic, and political explanatory variables. We find that demographic variables, such as age group and the proportion of Arab students, as well as economic variables—chief among them the level and distribution of national income—explained a significant part of expenditure on education. We further find that to fully explain the development of public spending on education in Israel, we need to consider some political variables as well, such as the second Rabin government. We also compare the development of public and private expenditure on education, current expenditure and investment, and the composition of expenditure on the various stages of the education system—pre-school, primary, secondary, and higher education.

1. INTRODUCTION

In this study we examine the factors influencing the extent and composition of expenditure on education in Israel in 1962–98, for which period there are continuous and detailed data from the Central Bureau of Statistics (CBS). In those years the share of education spending in GDP underwent significant changes—with a steep rise at the beginning of the period, stability in the 1970s, a decline in the 1980s, and an increase in the 1990s. We attempt to ascertain which variables affected these changes. This study thus belongs to the field of political economy, which focuses primarily on the factors determining a government's economic policy. It nonetheless does not seek to validate any specific theory of political economics, and focuses rather on the relevant stylized facts.

Knowledge of the factors that affect education expenditure in the short and long run is necessary for understanding this issue, as well as for identifying the government's priorities. Our working hypothesis was that education expenditure is influenced by many factors, which fall into three categories: demographic, economic, and political. The demographic variables we examine are population size, age-distribution, the distribution of the student population

into ethnic groups (Jews and non-Jews), and the distribution of the Jewish student population by religious affiliation (secular, orthodox, and ultra-orthodox). Israel has separate educational sub-systems for Arabs, and for the different Jewish religious affiliations: secular (*Mamlakhti*), orthodox (*Mamlakhti-Dati*), and ultra-orthodox (*Atzma'i*). While we do not have data on the separate expenditures on these systems, we do have data on the numbers of students in each system, and these are used in this paper.

The main economic variables examined are per capita GDP (average income), the relative price of education, the distribution of income across the population, and the return on education. In analyzing the effect of economic variables, we note that some variables may not be completely exogenous to education expenditure. Thus, for example the relative price of education reflects mainly teachers' wages; increased education expenditure is sometimes expressed as a rise in teachers' pay, creating a correlation between education expenditure and price. Also, education expenditure is affected by income distribution but it also influences it in the long run, because education reduces poverty. Similarly, the return on education affects the incentive to acquire education but is also affected by education expenditure. In order to overcome the endogeneity of this variable, we use the return on education in the US.

The main political variable we examined is a measure of overall budgetary pressure, assuming that its effect on education spending is negative. This is generally measured by the public deficit/GDP ratio, and sometimes by the defense expenditure/GDP ratio, since this is completely exogenous to education expenditure and is primarily responsible for increasing the deficit in Israel.[1] An additional political variable we examined is dummy variables for the years of each government between 1963 and 1998.

The relation between education spending and the various explanatory factors is examined by estimating a cointegration regression. This examines the long-term relations between the variables, particularly those that rise over time and are not stationary. Thus, this method is appropriate especially for the above economic variables in Israel, which had relatively high growth rates throughout most of the relevant period. We run three separate tests. We first examine the long-term relation between education expenditure (i.e., log of expenditure) and the other variables. We then examine the relation between the change in expenditure over time and the change in the other variables. This examination reinforces the first test, and also enables us to expose the short-term relations between the variables. Finally, we test for the effect of the various variables on education expenditures relative to GDP. Since this is a relatively stable variable, this is not a cointegration regression.

In this paper we examine not only which variables affect total education expenditure but also which ones affect the various components of this expenditure, such as public financing versus private financing, relative expenditure on pre-school, primary, secondary, and higher education, and current expenditure on education versus physical investment in buildings and equipment. These tests, which are interesting in and of themselves, also enable us to answer some of the questions arising from the aggregate data.

The various tests we run enabled us to map out in a fairly detailed way which are the main variables affecting education expenditure in Israel. Some of the results were expected, while others came as a surprise. We find that population size explains a substantial part of the rise in education spending, as Israel has a high population growth rate. For part of the period reviewed

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[1] See Zeira and Strawczynski (2002).

the increase in education expenditure is explained by the effort to build the education system after the establishment of Israel (in 1948). We find that this effort continued for over a decade and was completed only in the mid-1960s. Another finding is that the composition of the population of students also affects the share of education spending in GDP. An increase in the proportion of Arab students reduces it. A possible interpretation of this result, which recurs in all the tests, whether regarding overall or partial expenditure, is that there is budgetary discrimination against education spending in the Arab sector.

The tests we run show that economic variables affect education expenditure as expected. Namely, a rise in income increases both public and private spending on education. A rise in the return on education (measured in the US to ensure that the variable is exogenous) is found in most cases to be non-significant and to affect only private expenditure on education. We also find that income inequality has a significant and negative effect on private spending on education, i.e., if the income of low-wage groups declines relative to the average, private spending on education falls. This result is consistent with the recent hypothesis that due to capital market imperfections it is more difficult for low-income groups to finance their children's education than it is for other groups.[2] An interesting and unexpected result is that the influence of inequality on public expenditure on education is not significant. From this we infer that, despite assertions to the contrary, the policy of Israeli governments does not act to reduce socio-economic differences by investing in education.

With regard to the political variables, we have identified three main results. First, the budget deficit is positively related to education spending. This is surprising, and we could not find a plausible explanation for it. One possibility is that education expenditure is an important component of total expenditure, and hence corresponds with the budget deficit. Another is that education expenditure is related to defense expenditure, through the training of an echelon of technical workers for the defense sector. Since the budget deficit is connected with defense expenditure, it is related to education expenditure as well. The second political variable that had an effect was the provision of free secondary education, which began in the 1970s. The third political variable we have identified is the increase in spending on education in the 1990s by the second Rabin government. The changes in education expenditure cannot be explained without a variable representing the period of that government, which increased education spending consistently throughout its term of office, 1993–96.

As noted above, this study can be linked to the empirical research within the relatively new area called political economy, which has been developing rapidly since the 1980s. This literature endeavors to analyze political decisions on various economic topics on the basis of the economic interests of the parties concerned and decision-making processes. These studies, whose preliminary results are presented in Persson and Tabellini (1990, 1999) and Drazen (2000), have focused mainly on aggregate economic policy, whether monetary or fiscal, rather than on public policy in specific spheres. Our study is innovative in focusing on a specific aspect of fiscal policy and not solely on aggregates (see also a previous study of ours, Strawczynski and Zeira [2002], in which we use a similar approach to investigate changes in defense expenditure and transfer payments in Israel). Another part of the literature which is connected with our paper is that dealing with the economic importance of education expenditure as investment in human capital, especially in relation to economic growth. A recent assessment of growth

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[2] See Galor and Zeira (1993).

studies focusing on this subject is provided by Sala-i-Martin (1997). Note that recent studies in this field have found that not only the extent of education expenditure, but also the way it is distributed and the possibility of attaining qualitative results is important. The latter are measured by comparative international tests, as shown by Hanushek and Kimko (2000). The subject has recently gained attention in Israel in Lavi (2001), particularly in view of the low level of achievements by Israel in international tests.

The paper is organized as follows: Section 2, presents the main data on education spending in Israel in 1962–98 and identifies the main fluctuations in this variable, as well as the principal characteristics of the variables discussed here. In section 3 we examine the variables affecting expenditure on education in general, and in section 4 we examine those affecting public and private expenditure separately. In section 5 we look at spending on the various stages of education—pre-school, primary, secondary, and higher. In section 6 we look at current expenditure and investment in education. In section 7 we review the development of education spending in the short term, and section 8 contains our conclusions.

2. THE STYLIZED FACTS

We begin the discussion of education expenditure by observing total spending over time. Our sample is from 1962–98, using data from the CBS.[3] National expenditure on education increased by a factor of 11.6 during this period, expanding due to population growth and the rise in the standard of living. In order to neutralize these effects on changes in education spending, we examine this spending relative to GDP (Figure 1).

Figure 1
National Education Expenditure, 1962–1998 (percent of GDP)

SOURCE: Central Bureau of Statistics.
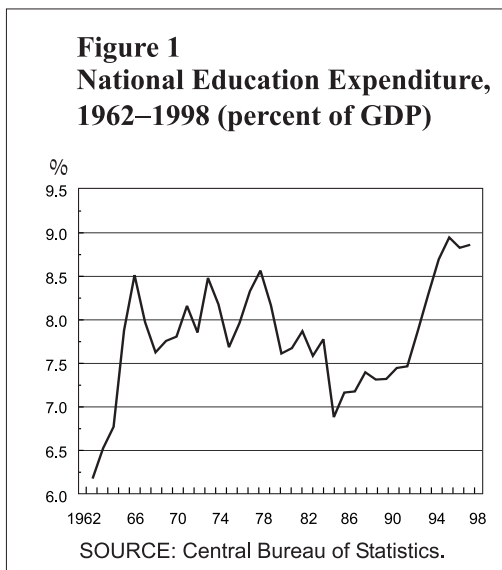
Several features are immediately apparent, chief among them the fact that education expenditure rose steeply at the beginning of the period. There were two reasons for this. The first was the significant increase in Israel's birth rate in the early years of the state, after the Holocaust and the War of Independence. This phenomenon, which the economist Yoram Ben-Porath identified as Israel's baby boom, had an effect on the demographics of the following years, and hence also on education spending. The second reason, and the main explanation for the sharp rise in education expenditure in the 1960s, was the completion of the build-up of the education system in the first years of the State. The

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[3] Most of the data on education expenditure are from the CBS (2000). Note that data from this source are not uniform, as after 1985 pension and depreciation costs are deducted from expenditure. For consistency, we have added these components for the subsequent years, using data we received directly from the CBS.

Figure 2
Ratio of Expenditure Per Student to Per Capita GDP, 1963–1998

SOURCE: Central Bureau of Statistics.
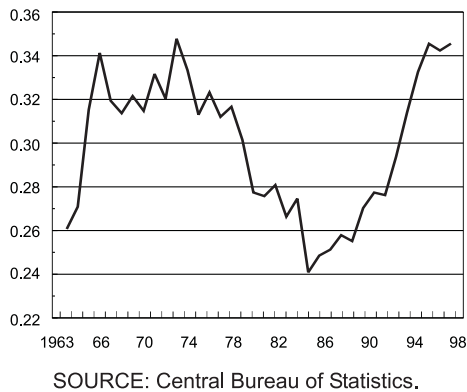
massive influx of immigration, which increased the population by over 100 percent in the first few years of the state, and the immediate introduction of compulsory education in 1949 required an enormous effort in order to expand the education system relative to what had existed under the British Mandate. This effort was gradual, and took time to complete, coming to a conclusion only in the mid-1960s.

From 1967 until the Economic Stabilization Program (ESP) of 1985 national expenditure on education fluctuated around 8 percent of GDP. During the period of rapid inflation it declined to 6 percent of GDP, explained below by various political and economic variables. After the ESP education spending began to rise slowly, to a level of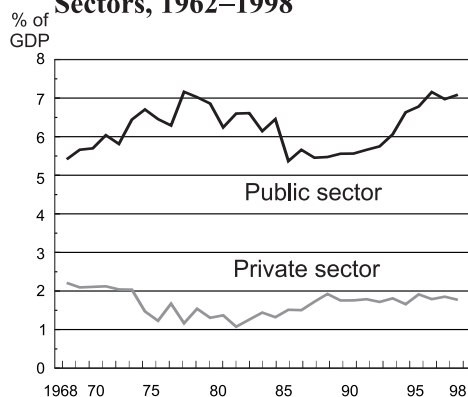 7.5 percent of GDP in 1991. The last surge, at the end of the sample period, occurred during the Rabin government in 1993–96, which declared a higher priority for education, and increased national expenditure on education to 9 percent of GDP.
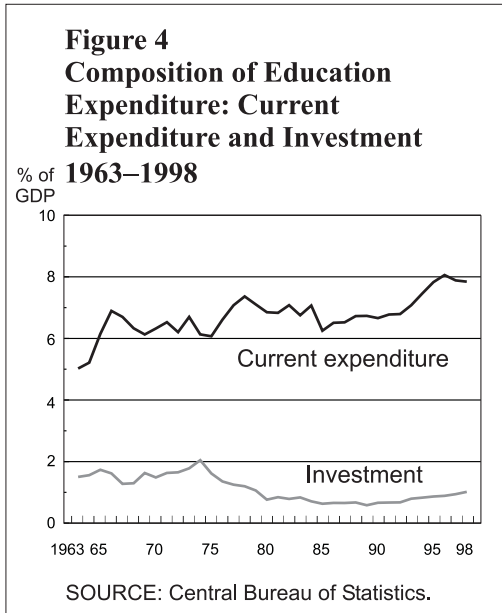
The shifts in national education spending can be better understood by examining expenditure per student relative to per capita GDP. Whereas the previous index examines solely the share of income directed to education, this one weights it by the share of students in the population (Figure 2). The principal trends identified in Figure 1 are evident here, too, with a steep rise in expenditure per student in the early 1960s, stability until the 1980s, a decline at the beginning of the 1980s, an increase after 1985, and an accelerated increase during the term of the Rabin government.

Spending per student is an important variable for the purposes of international comparisons. Education expenditure as a share of GDP is high in Israel relatively to other countries, but this is largely due to demography, as Israel has a large proportion of students. Education expenditure per student is similar to other industrialized countries.

The classification of national education expenditure into public and private spending (Figure 3) shows that the main fluctuations described above were due to public spending, which accounts for the lion's

Figure 3
Composition of Education Expenditure: Public and Private Sectors, 1962–1998

SOURCE: Central Bureau of Statistics.

**Figure 4
Composition of Education
Expenditure: Current
Expenditure and Investment
1963–1998**

SOURCE: Central Bureau of Statistics.

share of education expenditure in Israel. Private spending accounted for 2 percent of GDP in the early 1960s declined to 1 percent of GDP in the 1970s, with the introduction of public high-school education, and rose again in the 1990s. This increase is associated with several significant social developments that took place in Israel: the growing importance of education in the period of high tech, the widening of social differences and with them the expansion of private education, and the reduction of government participation in public education in the 1980s.

When national education expenditure is divided into current expenditure and investment (buildings and equipment as a share of GDP) in Figure 4, the fluctuations in current expenditure are, as expected, smaller than those in investment. Current expenditure was characterized by a continuous rising trend throughout the period of the sample, compared with a marked rise in investment expenditure during the beginning of the period until the mid-1970s, when it reached 2 percent of GDP, after which it fell. In the 1990s there was a trend shift, and the share of investment in education spending rose slightly. One of the hypotheses we examine below is that investment responded primarily to the large population changes due to the influxes of immigrants in the 1950s and 1990s, albeit with a lag. Figure 5 presents the classification of education by stage: pre-school, primary, secondary, and higher education. It shows that the changes in spending on primary and secondary education over time resemble those in national expenditure on education. The fluctuations in expenditure on higher education are quite different. In the 1960s this category rose more than the others, a trend which persisted until 1970, after which it fell continuously until the end of the 1990s. Expenditure on pre-school education is characterized by a continuous rise throughout the years, apparently related to the fact that a growing proportion of women entered the labor force, so that demand for pre-school services increased.
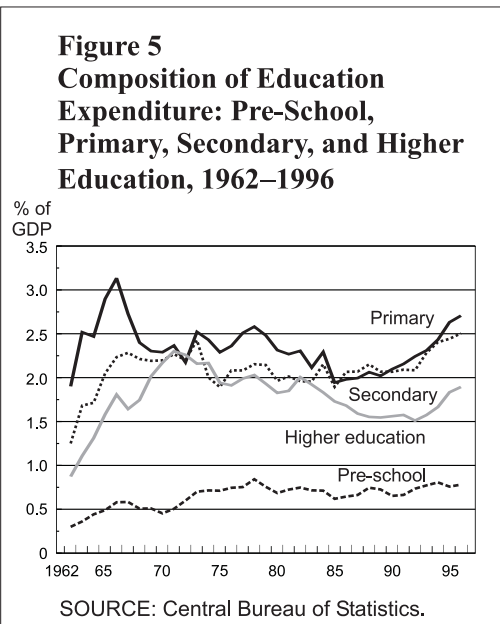
**Figure 5
Composition of Education
Expenditure: Pre-School,
Primary, Secondary, and Higher
Education, 1962–1996**

SOURCE: Central Bureau of Statistics.

**Figure 6
Proportion of 0–4 Age Group in
Population, 1950–1998**

%

SOURCE: Central Bureau of Statistics.
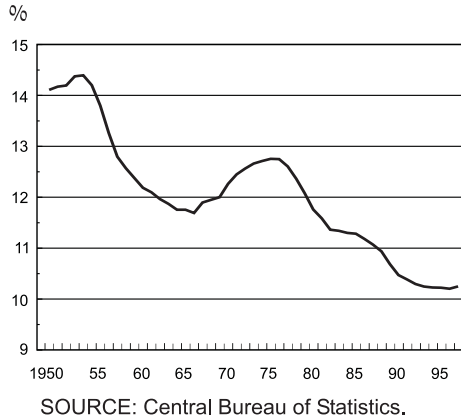
**Figure 7
Ratio of Arab Students to Total
Number of Students, 1962–1999**

%

SOURCE: Central Bureau of Statistics.
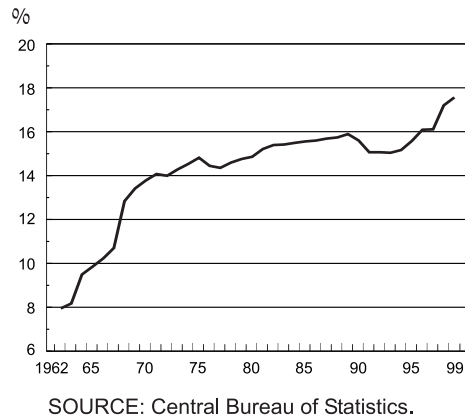
While education expenditure constitutes the dependent variable in this study, the demographic, economic, and political variables are the explanatory variables. We next present the dynamics of the two main demographic variables, Figure 6 shows the share in the population of the 0–4 age group. Note that this pre-school age group reached a peak of over 14 percent of the population in the early 1950s, after the Second World War and the War of Independence, It declined sharply between 1954 and the end of the 1960s. It can therefore be described as a Baby Boom,[4] and this explains the expansion of the education system in the following years, until the entry of the baby boom cohort into higher education in the late 1960s. Another baby boom began in the wake of the Six Day War (1967), and continued until the mid-1970s. Since then the proportion of children in the 0–4 age group has been declining to about 10 percent in the last few years.

The other salient demographic variable for our purposes is the proportion of Arab students in the education system (Figure 7). This proportion rose steeply in the 1970s, as Arab children entered the education system, and continued to grow in the 1970s and 1980s, albeit far more slowly, apparently reflecting the (high) Arab birth rate. In the early 1990s, due to the influx of immigrants from the former USSR, the proportion of Arab students declined, but rose more rapidly once more in the later 1990s.

3. ANALYSIS OF NATIONAL EDUCATION EXPENDITURE

In this section we discuss national, i.e., total, expenditure on education. This item comprises public and private spending, as well as current expenditure and investment. Below we examine the various components of national education expenditure more closely, first analyzing the changes in it, then viewing those changes in relation to GDP.

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[4] See Baron (1984, 1987) and Ben-Porath (1980, 1988).

Table 1
Real Values of National Education Expenditure, 1962–98

(standard deviation in smaller font)

Explanatory variables \ Period	Dependent variable: (Log (REDU))						
	1962–98					1970–98	1962–98
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
C	–2.48	–5.41	–3.92	–2.13	–2.68	–1.29	3.69
	0.53	0.65	0.61	0.32	0.53	1.78	0.23
LOG (POP)	2.28	1.13	0.44	0.66	1.40	1.04	
	0.065	0.21	0.22	0.14	0.18	0.37	
LOG (Y_POP)		1.19	1.16	0.84	0.68	0.88	
		0.21	0.17	0.11	0.18	0.41	
LOG(Y)							1.04
							0.02
LOG(RP)			1.09	0.86			
			0.23	0.11			
RDEF				0.35	0.69	0.68	0.51
				0.10	0.16	0.19	0.14
INITIAL				0.08	0.07		0.07
				0.01	0.16		0.02
RABIN				0.04	0.04	0.05	0.05
				0.005	0.008	0.01	0.008
BOT_TOP						–0.96	
						0.53	
ADJ R^2	0.97	0.98	0.99	0.998	0.995	0.99	0.99
DURBIN-WATSON	0.43	0.73	0.30	1.30	1.52	1.61	1.37
ADF*	–2.92	–3.07	–2.60	–4.62	–6.36	–6.72	–4.80

* The critical value (5%) in regression no. (5) (constant *plus* 5 variables) is 4.7 (according to Davidson and Mckinnon, 1993).

a. Estimation of the level of education expenditure

In this section we discuss national, i.e., total, expenditure on education. This expenditure comprises public and private spending, as well as current expenditure and investment. The following sections examine the various components of national education expenditure more closely. We first analyze the changes in the absolute level of education expenditure, and then view those changes relative to GDP.

a. Estimation of the level of education expenditure

We first attempt to examine which variables affect the size of national education expenditure in real terms (all the real variables are deflated by the CPI). Note that over the years education spending in Israel has risen significantly due to both population growth and the increase in per capita income. As a result, it is reasonable to assume that this expenditure is far from being stationary, as is in fact borne out by a simple test, which shows that it is a I(1) variable.

Consequently, the tests we use in order to discuss the level of education expenditure are cointegration tests. The statistic used to examine the extent of cointegration in the various equations is the Augmented Dickey-Fuller (ADF).

The results of estimating the effect of the various variables on national education expenditure in real terms, denoted by REDU, are shown in Table 1. We actually use logs of expenditure and of most explanatory variables in order to estimate elasticities. The first equation is the simplest version, with a single demographic variable, POP (population size). The equation indicates that population size has a positive effect on education spending. We also examined the possibility of adding another demographic variable, the share of the 5–19 age group in the population, but this variable gets a negative sign. The reason for this is quite clear: the relative size of this group declines over time, and hence is negatively correlated with the variables for income, which rise with time and are positively correlated with education expenditure. Hence, the basic demographic variable we use henceforth is population size.

We next start adding economic variables to the model. In the second equation we add the economic variable of income, or more precisely, per capita GDP, denoted by Y_POP. This variable reduces the effect of population in the equation, as it captures part of the trend rise over time but population remains positive and significant. The elasticity of the population and income variables is close to 1. The third equation adds another economic variable, the relative price of education, denoted by RP.[5] This variable is significant and has a positive influence, meaning that the elasticity of education to price is less than unity. Moreover, the coefficient of price is around 1, so that the elasticity of education expenditure to price is close to zero. Notwithstanding, adding the price variable is problematic, as it is not exogenous to education spending: part of the mechanism whereby the government influences education expenditure is teachers' pay, which affects both expenditure on education and its relative price, and hence these two variables move in line with one another, with no clear causality. Later in the study we try to avoid using relative price as an explanatory variable.

Note that in equation (3), to which the economic variables have been added, there is no cointegration, as is the case with the first two equations. This means that in order to understand the development of education spending over time, we need to add more variables to the model. An examination of the residuals of the regression indicates that they were large and positive in the 1970s, when the budget deficit rose markedly, and fell in the years after the ESP, when the deficit contracted. It may be concluded from this that in order to understand the changes in education expenditure it is necessary to add political variables, which represent overall budget pressure.

The first political variable we add is, therefore, the deficit/GDP ratio, RDEF. It measures the extent of fiscal pressure on education expenditure. Adding this variable to the regression improves the various measures of cointegration, but it is still not significant. An examination of the residuals of the equation raises two main issues. The first is the rise in spending on education in the first few years of the sample—the early 1960s—which is not explained by the regression. As noted in Section 2, education expenditure soared in those years, encompassing all education items. As stated earlier, this increase can be interpreted as the conclusion of the build-up of the education system after the establishment of Israel and the absorption of the mass immigration of the 1950s. Another issue unexplained by the regression is the steep

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[5] Note that the relative price variable has been calculated by the CBS only since 1970. We extend the variable back to 1962 by extrapolating from the trend rise in price.

increase in education expenditure in the 1990s. We know that at that time the Rabin government made a huge effort to expand spending on education. Consequently, we add two new political variables to the model. The first, INITIAL, represents the conclusion in 1962–65 of the initial build-up of the education system in the first years of the state. The second, RABIN, represents the duration of the Rabin government in 1993–96, when the declared policy was greater investment in education. Both these variables represent a gradual and permanent increase in education expenditure. They are defined as 0 prior to the first year, as 1 in the first year, they grow by 1 in each of the following years, and are set to be constant after the last year of the respective period. Thus, the regression coefficient of a dummy variable of this kind describes the incremental growth rate of education expenditure during those years.

Note that the addition of these two variables is not arbitrary. Prior to it we ran a test with a series of dummy variables for changes in education expenditure in each of the governments in office during the sample period, 1963–98, in addition to the political variable of the budget deficit, RDEF. The results were non-significant for all periods, except for 1963–65 and 1993–96. Hence, governments did not significantly alter education expenditure. Since we think that the change in 1963–65, during the first years of the Eshkol government, is associated more with the initial build-up of the education system than with a policy change, we conclude that the only period in which there has been a conscious and significant change in education expenditure is in the Rabin government of 1993–96.

The fourth equation describes the effect of all the variables described above, demographic, economic, or political, on national expenditure on education. We see that all the variables have a strong and significant effect. There is also a marked improvement in the ADF index of the level of cointegration, and hence there is a relation between the explanatory variables and national education expenditure in the long run. The coefficients derived from this regression reveal that the elasticity of expenditure with respect to population is 0.66, indicating that a one percent increase in the population increases education expenditure by 0.66 percent. Clearly, this does not mean that education per student declines as the number of students rises, because income tends to rise with population in Israel and according to equation (4) it also has a strong positive effect on education expenditure. The change in education expenditure resulting from the Rabin government's policy shift is positive and significant. The relation between the budget deficit and education spending is also positive, indicating that the latter is in line with the general budget trend. We find this result quite puzzling. Most of the increase in the budget deficit in Israel in those years has been caused by an increase in defense expenditure. This should have a negative effect on education expenditure, due to crowding out. But this is not what the data show. We also examined the relation between defense expenditure and education expenditure in an equation similar to (4) and found a positive relation as well. We return to this puzzle later on.

We next examine the effect of omitting the relative price variable from the regression, because the relative price of education reflects mainly teachers' wages, an item which constitutes a large part of education spending. Hence, the decision on wages is not independent of the decision on the size of education expenditure. For example, a political decision to improve education and increase expenditure could be achieved by increasing teachers' pay, thus making teaching more attractive, or requiring teachers to improve the quality of teaching in return for higher pay (e.g., by remaining longer hours in school, etc.). Thus, the price variable is significantly associated with some of the political variables which were added to the regression,

and we therefore assume that omitting it can improve the results of the estimation. In fact, equation (5), from which the relative price is omitted, yields far better results, particularly in the ADF statistic. This means that the equation achieves a higher level of cointegration. Later in the paper we regard equation (5) as the basic equation for the level of national spending on education.

Our next step was to examine the addition of income inequality to the explanatory variables in the regression, as done in equation (6) in Table 1. We examined several variables, and found that the most significant one was the ratio between the average incomes of the lowest and of the highest quintiles, denoted by BOT_TOP. In effect, this variable is positively correlated with economic equality: a rise in the income of the bottom quintile relative to that of the highest quintile indicates greater equality. Note that combining the variables for income distribution in a study of education expenditure is problematic for two main reasons. First, income distribution data are available only from 1970, so this regression has fewer degrees of freedom due to the shorter sample period. Second, this variable is endogenous. While we expect income distribution to affect education spending, it is also affected by education in the long run, since education tends reduce inequality. The coefficient estimate is negative, i.e., equality is negatively correlated with expenditure on education, but the relation is not significant. In Section 4 we break education spending down into into its public and private components to try and solve some of this endogeneity problem. From this point regression (5) serves as our basic model, due to both its high cointegration and the long sample period.

In the last test, described in equation (7) in Table 1, we substituted another variable, real GDP, denoted by Y, for the variables of population size and per capita GDP. We find that the results of this equation are very similar to those of our basic equation, equation (5). These results also justify studying education expenditure relative to GDP, i.e., as a share of GDP, as the elasticity of education spending to GDP is unitary. In the following section we examine the main variables affecting education expenditure as a share of GDP.

b. The share of education expenditure in GDP

As shown above, spending on education as a share of GDP, denoted by EDU_Y, has undergone dramatic changes in the last forty years. We now address the extent to which these changes can be explained by the demographic, economic, and political variables. The results are presented in Table 2. The first regression in the table examines the relations between the variables in regression (7) in Table 1, excluding GDP. All the variables are significant. Like Table 1, Table 2 shows that the overall budget deficit is positively correlated with education expenditure, as do the political variables at the beginning of the period and the Rabin government in the 1990s. The regression does display a high serial correlation, however, and its level of cointegration is low. In order to overcome this difficulty, we examine the possibility of adding other variables to the regression.

We next add the following demographic variables: the size of the age groups of primary, secondary, and higher education, POP5_15, POP15_19, POP20_24 respectively. The effect of these variables can be interpreted as the relative marginal cost (as this is their share in the population) of each age group. In other words, it is the marginal cost of a primary school student, a secondary school student, and a university student *times* the probability that a member of the relevant age group will attend an institution of education appropriate to his or her age,

Table 2
Ratio of National Education Expenditure to GDP, 1962–98

(t-values in smaller font)

Explanotory variables \ Period	Dependent variable: EDU_Y		
	1962–98 (1)	1962–98 (2)	1962–98 (3)
C	0.059	–0.012	0.085
	14.36	–0.429	6.78
POP5_14		0.22	
		2.18	
POP15_19			–0.35
			–2.50
POP20_24		0.29	0.31
		2.41	2.90
ARAB			–0.25
			–5.15
RDEF	0.030	0.02	0.018
	2.97	1.70	1.51
INITIAL	0.004	0.004	0.008
	3.66	3.43	6.44
RABIN	0.003	0.004	0.004
	6.21	5.69	9.24
ADJ R^2	0.70	0.74	0.85
DURBIN-WATSON	1.01	1.30	1.99
ADF	–3.38	–4.06	–6.41

and *divided by* average income (GDP per capita). Equation (2) in Table 2 presents the results of the regression with the age groups. According to this equation, only the 5–14 and 20–24 age groups have a significant and positive effect, while the 15–19 age group (secondary school students) has a weaker effect on education spending. Does this mean that the cost of a primary school student is greater than that of a secondary school one? We should beware of jumping to hasty conclusions on the basis of this equation, even if it explains a large part of the variance in expenditure on education, as it is still open to improvement because of its high serial correlation and relatively low level of cointegration.

In order to improve the estimation we add another set of demographic variables, to capture the effect of ethnicity and affiliation to educational sub-systems. The first of the three additional variables, ARAB, measures the proportion of Arab students in the total student population in Israel. The second variable, MAMAD, measures the share of students in religious schools in the total Jewish student population, and the third, HARED, measures the proportion of students in ultra-orthodox schools (*Hinukh Atzma'i* and *El Hama'ayan*) in the total Jewish student population. We find that of these three variables only ARAB is both significant and negative, while the other two are not significant. The estimation of the effect of the additional demographic variables is presented in equation (3) in Table 2 where the significance level of each variable rises markedly. Furthermore, R^2 is also higher and the level of cointegration is also much better. Note that adding the variables ARAB changes the effect of the age group variables.

The effects of the secondary school (15–19) and university (20–24) age groups become significant, that of the former being negative and of the latter positive. It is possible to infer from this that the cost of a secondary school student is less than that of a primary school one, while that of a university student is far higher. An important finding is that the effect of the proportion of Arab students is negative and significant, indicating that education expenditure per Arab student is lower than per Jewish student. Is this finding an indication of discrimination against Arab students? We think that this issue deserves further research which is beyond the scope of this paper.

To conclude this section, it can be said that education expenditure as a share of GDP is affected mainly by policy variables. It rose when the baby boom cohort entered the education system and when the Rabin government was in office in the 1990s. Spending went up when the potential population of students rose, fell when the population of secondary school students increased, and contracted when the share of Arab students in the population of students rose.

4. PUBLIC AND PRIVATE EXPENDITURE ON EDUCATION

In this section we discuss national expenditure on education by its private and public components. It is not easy to distinguish between the two, as on the one hand individuals contribute to some of the education spending by public institutions, while on the other the government covers part of the education expenditure by private institutions. In general, public and private expenditure can be classified either by the implementing agent or by the financing source. The question which classification is more relevant for the purpose of this study cannot be easily answered. We chose to focus on the financing source, because the ultimate question that concerns us is how much the government is willing to pay for education. Consequently, we examine the variables affecting the public and private financing of education respectively. We also review public expenditure on education by implementing agent, nevertheless.

Equation (1) in Table 3 describes public spending on education relative to GDP.[6] Our dependent variable in this equation is publicly financed education spending relative to GDP, denoted by FIN_PUB_Y. The explanatory variables in this equation are the usual policy variables, with the exception of INITIAL; since data for financing are available only from 1968, which makes this variable irrelevant. The variable POP20_24 for the higher education age group is positive but not significant, and has hence been dropped from the regression. All the other variables have similar effects to that on total education expenditure. The 15–19 age group has a negative effect on the results, as do Arab students, while there is a positive correlation between spending on education and the public-sector deficit; the second Rabin government has a strong effect, as is the case in the aggregate regressions.

Equation (2) in Table 3 adds an income distribution variable, BOT_MED, which measures the ratio of income between the lowest and the median quintiles.[7] The effects of all the other variables remain without significant changes. The effect of equality is positive and not

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[6] In other regressions, not reported here, we examine the relation between levels of private expenditure and the explanatory variables. We find *inter alia* that the elasticity of private expenditure to income is greater than 1.

[7] The BOT_MED variable was found to be more significant than the BOT_TOP variable in the regressions of private expenditure on education.

Table 3
Public and Private Education Expenditure, 1962–98

(t-values in smaller font)

	Dependent variable: (Log (REDU))					
	FIN_PUB_Y		EXC_PUB_Y	FIN_PRIV_Y		
Explanotory variables \ Period	1968–98	1970–98	1962–98	1968–98		1970–98
	(1)	(2)	(3)	(4)	(5)	(6)
C	0.17	0.16	0.088	–0.09	–0.03	–0.12
	6.92	6.16	7.12	–5.32	–1.15	–8.26
POP15_19	–0.69	–0.76	–0.48			
	–5.50	–5.53	–3.46			
POP15_19*H				0.05	0.05	0.04
				4.48	4.49	4.01
POP20_24			0.42	0.43	0.23	0.35
			3.95	4.40	1.76	3.62
ARAB	–0.32	–0.31	–0.30			
	–3.47	–2.98	–6.34			
LOG(RP)				0.02	0.01	0.02
				7.70	1.16	10.10
BOT_MED		0.03				0.04
		1.31				3.42
RDEF	0.05	0.04	0.02			
	5.51	4.90	1.92			
INITIAL			0.008			
			6.60			
RABIN	0.003	0.003	0.003			
	8.81	8.73	7.91			
FIN_PUB_Y				–0.41	–0.21	–0.37
				–5.74	–1.71	–6.15
WS/WU_USA					0.02	
					1.98	
ADJ R²	0.85	0.85	0.86	0.81	0.83	0.88
DURBIN-WATSON	2.28	2.57	2.03	1.74	2.22	2.75
ADF*	–6.81	–5.19	–5.62	–5.26	–5.95	–7.64

significant, indicating that as poverty increases there is no significant change in public spending on education.

In equation (3) in Table 3 we examine the variables that influence public expenditure by implementing agent, namely, in public institutions of education. The results resemble those on public finance, with one difference—the effect of the 20–24 age group becomes significant and positive. Since there are data on expenditure by implementing agent since 1962, we introduced the INITIAL variable into this equation. The results indicate that this variable is highly significant.

In the subsequent equations we examine the variables that affect private spending on

education relative to GDP, denoted by FIN_PRIV_Y. Whereas public expenditure on education behaves similarly to total national expenditure on education as it accounts for most of it, the dynamics of private spending are quite different. Equation (4) examines the influence of the variables for age group, relative price, and public education expenditure on private expenditure. Note that we examine the effect of the 15-19 age group as it interacts with the period in which secondary education was private. Secondary school fees were finally abolished in 1978, during the Begin government, but they had already been substantially reduced prior to that. We find that the period in which the 15–19 age group had the most effect was 1962–73. We examine the effect of the relative price variable to obtain information about the elasticity of demand for private education in Israel. As for the effect of public spending on private spending, it is expected to be negative, due to the complementarity of the two expenditures. The results of the regression are consistent with these hypotheses on the whole. The effect of the age groups for which tuition fees are paid (higher education, and secondary education until the mid-1970s) is positive. Equation (4) also shows that the effect of relative price is positive but slight, namely, elasticity is less than—but close to—unity. The effect of public expenditure is significant: every additional shekel spent on education by the government enables households to reduce their expenditure by 40 agorot. Thus, public spending leads to a partial crowding out of private spending.

Another important variable which could explain the long-term development of education expenditure is the relative return on education. It provides an incentive to invest in human capital, namely, to increase education spending. Adding this variable to the regression might raise the usual endogeneity problem, as education feeds back and reduces the relative return on education in the long run. To avoid this problem we use the wage of graduates relative to that of non-graduates in the US as an exogenous index of this variable, assuming that it reflects general technological gains to education which obtain in Israel as well. Regression (5) shows that this variable is significant for private expenditure, and that introducing it improves cointegration. Non-reported regressions we have run show that this variable is insignificant for public expenditure. Our conclusion is that while individuals are influenced by the return on education; the public sector is not.

In equation (6) we add another income distribution variable, BOT_MED. We find that this variable has a positive effect on private spending on education. Namely, raising the income of the poor relative to the average increases private expenditure on education. Since this result obtains at a given level of aggregate income, it indicates that poor families face credit constraints that hamper their access to education, and increasing their relative income enables them to overcome these constraints. This finding supports many recent studies, which have claimed that credit constraints play a significant role in education decisions of the poor. The directions of all the other variables remain the same as in the basic equation.

5. EXPENDITURE ON THE VARIOUS STAGES OF EDUCATION

In this section we examine the main variables affecting education expenditure at each level of education: pre-school, primary, secondary, and higher. This examination is important for two main reasons. First, we want to know whether expenditure at the various stages of education has developed in line with total education expenditure or not. Second, the decomposition of

Table 4
Expenditure on Pre-School, Primary, Secondary and Higher Education

(t-values in smaller font)

Dependent variables \ Explanotory variables	GAN_Y (1)	PRIMARY_Y (2)	SECONDARY_Y (3)	HIGH_Y (4)
C	0.03	0.06	–0.003	–0.05
	7.49	3.01	–0.54	–5.25
POP0_4	0.05	0.29		
	2.18	4.08		
POP5_14	–0.097	–0.22		
	–4.18	–2.55		
POP15_19	–0.06		0.095	–0.10
	–3.13		1.37	–2.30
POP20_24	–0.11	–0.36	0.07	0.37
	–3.15	–3.18	1.67	7.08
ARAB_PRIMARY		–0.0006		
		–4.05		
RDEF	0.004	0.016	–0.003	0.002
	1.76	2.99	–0.070	0.34
INITIAL	0.001	0.004	0.002	0.002
	5.40	7.45	5.47	4.75
RABIN		0.002	0.001	0.001
		4.91	5.63	2.91
HATIVA		–0.0016	0.0003	
		–0.97	0.34	
ADJ R^2	0.87	0.80	0.81	0.88
DURBIN-WATSON	1.52	2.33	2.19	1.22
ADF*	–5.51	–7.00	–5.71	–4.97

expenditure could illuminate various aspects of total education expenditure and help us better understand its development. Because data are not available for 1997 and 1998, we examine education expenditure at each stage relative to GDP in 1962–96. In the period covered by our sample the education system underwent a substantive change, with the establishment of the junior high school: until the late 1960s the primary schools comprised the first to the eighth grades, and the secondary schools the ninth to the twelfth. At the beginning of the 1970s junior high schools, comprising the seventh to the ninth grades, were established in most towns and settlements in Israel, so that the primary schools comprised only the first to the sixth grades, and the secondary schools the tenth to the twelfth. Our expenditure data for the 1970s and subsequently treat the junior high and secondary schools as one unit. We have adjusted the data on numbers of students accordingly.

The analysis of education expenditure at the various stages of education is given in Table 4, which presents four tests for the period 1962-96—one for each dependent variable: spending on pre-school (denoted by GAN), primary, secondary, and higher education, all relative to GDP. We test the relation to the following explanatory variables: the various age groups (0–4 5–14 15–19 20–24), the various education systems (Arab, Jewish religious, ultra-orthodox),

and the usual variables: budget deficit relative to GDP (RDEF), the period of initial build-up (INITIAL), and the period of the second Rabin government (RABIN). In other unreported regressions, we added education expenditure (EDU_Y) to these explanatory variables, and the results are in line with those given in Table 4. In each of the tests displayed in Table 4 we have omitted the variables that were very non-significant, except for those whose insignificance is interesting. Since the results are generally consistent with our hypotheses and with the aggregate tests in Section 3, we focus solely on the new results.

It is interesting to test the effects of the relative size of various age groups on their education expenditure, and especially on cross-influences. We find that spending on pre-school education is positively related to the size of the pre-school age-group (0–4), but significantly negatively related to the size of all the other age groups. This result could reflect the crowding-out of pre-school education spending. Expenditure on primary education is negatively correlated with the size of the appropriate age group, 5–14. We have no explanation for this result. Spending on primary education is not correlated with the size of the secondary-education age group (15–19), but is negatively correlated with the higher-education age group (20–24), and is positively correlated with the size of the pre-school age group (0–4). This last result may reflect forward looking by the education system, which begins to increase investment in primary education when the number of pre-school students starts to rise. Expenditure on secondary education is not significantly correlated with any age group, though it is positively correlated with the size of the 15–19 and 20–24 age groups. Note that there is a negative correlation between spending on higher education and the size of the 15–19 age group. We also found that the size of the primary-school age group is positively correlated with expenditure on higher education. This may be due to the need to increase teacher-training programs in order to expand primary education. These results are preliminary, and lead us to conclude that this topic requires further research, which we leave for the future.

An interesting point emerges from analyzing the effects of the size of the secondary-school age group (15–19) on education expenditure at the various stages. As noted earlier, the size of this group is negatively correlated with spending on both higher and pre-school education. It is positively but not significantly correlated with secondary education expenditure, but the negative correlation with pre-school and university education expenditure is larger than the positive correlation with secondary education expenditure. This might provide an explanation for the puzzling results in Section 3, i.e., that the size of this age group (15–19) is negatively correlated with total education expenditure. This may be due to crowding out by pre-school and higher education expenditures. Of course, a full resolution of this puzzle requires further study.

Next, we use the results of Table 4 to try to better understand the positive correlation between the budget deficit and education expenditure, which is reported in Section 3. This contradicts the hypothesis that when the deficit is too large, fiscal pressure serves to reduce expenditure. Table 4 presents the correlation between the budget deficit, expenditure, and various stages in education. The budget deficit is found to be insignificant with regard to secondary and higher education, but positive and significant for primary and pre-school education. We may conclude from this that the positive relation between education spending and the overall public-sector deficit stems largely from expenditure on primary and pre-school education.

To conclude this section, note some additional results presented in Table 4. The variable for the junior-high-school period (HATIVA), which is a dummy for the years after 1970 when junior high schools began operating, takes the expected signs, but the correlation is insignificant with regard to either primary or secondary education. The correlation between the initial build-up of the education system in the early 1960s (INITIAL) and primary education is twice as large as that with secondary and higher education. The same applies to the Rabin government: the increase in expenditure per student in primary education was double that per student in secondary or higher education. These results indicate the preferences of the education system at times of expansion.

6. CURRENT EXPENDITURE VS. INVESTMENT

This section looks at another break-up of education expenditure, this time into current expenditure versus investment, i.e., in buildings and equipment. The explanatory variables we test for are similar to those used in previous tests, although we expect them to have different effects on current expenditure and on investment. Thus, we expect the relative price to have no effect on investment, while it should have a strong effect on current expenditure, as it is strongly affected by current wage payments. Another hypothesis is that investment expenditure is influenced strongly by the backlog in schools and equipment infrastructure—in the wake of the needs created by a rapidly growing population. Hence we test for the effect of the size of the 5–19 age group on investment, as this explanatory variable represents the share students in the total population. We also add to the analysis a variable that represents influxes of immigrants into the country, which is the share of those who immigrated recently (in the last five years) in the population. This variable is denoted by OLIM5_POP.

The results of our tests are presented in Table 5. We first test (in equation 1) a specification similar to that used for examining public expenditure on education in Section 4. The results show that the effects of most of the variables are in the expected directions, though the substitutability of expenditure between the various age groups is not significant when it comes to current expenditure. Consequently, regression (2) excludes the insignificant variables, thereby reinforcing the cointegrative relation (the ADF rises from 4.22 to 4.45). The variables affecting current expenditure are those that influence total expenditure, albeit with differing intensities: the effect of relative price (wages) is greater, while that of the deficit is smaller.

Regression (3), which is based on a similar specification, is applied to investment expenditure. Since some of the variables are insignificant here too, only the significant variables are presented in regression (4), reinforcing the cointegrative relation. Note that the variables omitted from the regression (e.g., INITIAL) are insignificant. Three results should be stressed with respect to the investment regressions. First, while the budget deficit is insignificant, defense expenditure as a share of GDP has a very significant effect on investment in education. This result indicates that the positive effect of defense and education expenditure works mainly via investment. Second, the proportion of students in the population (5–19 age group) is highly significant for investment in education, as expected. Third, the immigrant variable, OLIM5_POP, is positive and significant as well, in addition to the effect of increased population. This may be because immigration was connected with population dispersal, requiring greater investment in school buildings.

Table 5
Current Education Expenditure VS. Investment

(t-values in smaller font)

Dependent variables \ Explanotory variables	CURRENT_Y (1)	CURRENT_Y (2)	INV_Y (3)	INV_Y (4)
C	–0.04	–0.068	–0.09	–0.10
	–3.10	–3.32	–6.56	–8.86
POP15_19	–0.21		0.14	
	–1.37		1.08	
POP15_19*H	0.00		0.04	
	0.00		3.38	
POP20_24	0.33		0.03	
	1.85		0.03	
ARAB	–0.29	–0.17		
	–3.91	–3.24		
LOG(RP)	0.039	0.029		
	5.29	5.27		
DEFENSE_Y			0.0003	0.0005
			3.41	9.66
RDEF	–0.02	0.02		
	–0.17	2.45		
INITIAL	0.006	0.006		
	5.16	5.76		
RABIN	0.001	0.002	0.002	0.002
	1.76	4.01	4.97	4.94
POP_5_19				0.32
				9.43
OLIM5_POP			0.051	0.077
			3.78	6.05
ADJ R^2	0.89	0.88	0.87	0.81
DURBIN-WATSON	1.34	1.33	2.08	1.89
ADF*	–4.22	–4.45	–5.45	–5.75

7. THE SHORT-TERM (ERROR CORRECTION) EQUATIONS

In this section we return to aggregate education expenditure, but examine how it is related to the explanatory variables in the short rather than the long run. In more technical terms, in this section we run error-correction tests for the cointegration analysis in Section 3. We use regression (5) in Table 1 as the basic equation for calculating the short-term dynamics. We do this by adding to that equation its residual (with a lag) as the error-correction variable. This term represents the reversion to the long-term relation between education expenditure and the explanatory variables. In accordance with the cointegration methodology we expect the coefficient for this variable to be negative, ranging between zero and minus one.

Table 6
Short-Term Equations[a]

(standard deviation in smaller font)

Explanatory variables	Period	Dependent variable: dLog (REDU)									
		1970–98									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C		0.01	0.02	0.04	0.04	0.03	0.03	0.04	0.04	0.03	0.04
		0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dLOG (Pop)		0.74									
		0.88									
dLOG(Y_POP)		0.64	1.43	0.50	0.63	0.73	0.76	0.71	9.72	0.68	0.07
		0.28	0.44	0.33	0.28	0.28	0.28	0.27	0.28	0.26	0.08
(RDEF)		0.76	0.75	0.76	0.08	0.77	0.77	0.75	0.78	0.78	0.77
		0.16	0.18	0.16	0.16	0.17	0.17	0.16	0.17	0.16	0.17
d(INITIAL)		0.08		0.09	0.07	0.07	0.08	0.07	0.08	0.08	0.07
		0.03		0.03	0.02	0.03	0.02	0.03	0.03	0.02	0.03
d(RABIN)		0.05									
		0.02									
Resid(-1)		–0.77	–0.83	–0.72	–0.08	–0.73	–0.74	–0.73	–0.73	–0.74	–0.73
		0.18	0.21	0.18	0.19	0.19	0.19	0.18	0.19	0.18	0.19
d(BOT_TOP)			–1.27								
			–1.99								
Dum_k7				0.03							
				0.02							
Dum_k8					–0.03						
					0.02						
Dum_k9						0.00					
						0.02					
Dum_k10							0.01				
							0.02				
Dum_k11								–0.03			
								0.02			
Dum_k12									–0.00		
									0.02		
Dum_k13										0.04	
										0.02	
Dum_k14											–0.01
											0.03
ADJ R^2											0.60

[a] The period is 1962–78, unless stated otherwise.

Table 6 presents the results of the error correction tests. The first equation includes the first difference for all the variables in the basic equation. We find that they are all significant and have the same signs as in the long-run equation (in Table 1), with one exception—population, which is insignificant. This means that this variable affects expenditure in the long run, but not in the short run. Hence, education spending does not adjust rapidly to changes in the population of students.

The second equation incorporates an income distribution variable, the relation between the lower and upper quintiles. Its effect is significant in the short run as well, and works in the expected direction. Equations (3)–(10) add a systematic examination of all the terms of office of the various governments, or the periods of the various Knessets, to the analysis. This is done in order to examine whether there have been significant changes in education spending by other governments than the Rabin government. even in the short run. The result is clear-cut: all the dummy variables for the various periods are insignificant, except for the 13th Knesset, which coincides with the second Rabin government.

Finally, we used the short-run equations to run a (non-reported) dynamic simulation of the effect of a one-off shock to the size of the population and to a one-off increase in the public-sector deficit. This dynamic simulation shows that most of the effect (about 60 percent) of these changes occurs in the first year after the shock, while the full adjustment to the shocks continues for several years (approximately 10), albeit less intensively.

8. CONCLUSIONS

In this study we analyze the shifts in national education expenditure and its various components in Israel between 1962 and 1998. During this lengthy period education expenditure underwent many changes. The share of education expenditure in GDP rose steeply at first, remained relatively stable during the 1970s, declined in the 1980s, and rose once again in the 1990s. Our aim in this study has been to analyze the relations between these shifts and various demographic, political, and economic variables. Our main findings are as follows:

a. The demographic variables

(i) Population size plays an important part in explaining the development of national expenditure on education. The significance of the variable for the baby boom cohort confirms the view that part of this effect occurs with a lag. The influxes of immigrants affect mainly expenditure on investment in buildings and equipment.

(ii) The share of the 15–19 age group (secondary school) in the population is negatively correlated with education expenditure in Israel. Since this relation operates via spending on primary and higher education, this finding may be interpreted as indicating that these expenditures crowd out expenditure on secondary education.

(iii) The share of Arab students in the total student population is negatively correlated with education expenditure in Israel. This obtains mainly with regard to primary education, as the share of Arab students in secondary education is small, making their effect insignificant. These findings indicate discrimination against the Arab educational system in Israel.

b. The economic variables

(i) The main economic variable which affects education expenditure is income, or per capita GDP. As expected, its effect is positive.

(ii) The distribution of income does not affect public spending on education, indicating that the government does not respond to shifts in inequality by actively changing education expenditure.

(iii) The distribution of income does affect private expenditure on education. An increase in the income of the lower quintile relative to the upper quintiles, which keeps income intact, increases total private spending on education. This finding supports recent theories on the effect of capital market imperfections on investment in human capital.

c. The political variables

(i) The public deficit is not significantly correlated with education expenditure, i.e., there is no crowding-out of spending on education, as could be expected. An examination of defense expenditure yields a positive correlation between spending on defense and on higher education—a finding which could attest to a link between defense and higher and technological education.

(ii) The building-up of the education system in the first years of the state went on until the mid-1960s. This build-up was necessary both because during the Mandate the education system did not encompass the entire population, and also because of the huge population increase in the early 1950s. As a result, education expenditure rose gradually until the mid-1960s (higher education expenditure increased until the late 1960s).

(iii) Spending on education was not correlated with the party in government or with the composition of the Knesset, with one exception—the expansion of education budgets during the Rabin government in 1993–96. This increase was significant and no other variable can account for it.

Some of the findings described above are expected while others are quite surprising. The findings about the effect of the distribution of income on public expenditure, on the effect of the 15–19 age group, and the effect of the budget deficit are surprising. At first glance it is also surprising to find that the composition of the government and the Knesset, with the exception of the Rabin government, have no effect on education policy. Interestingly, however, this is also characteristic of other components of socio-economic policy, such as transfer payments (see Strawczynski and Zeira, 2002). Actually it has often been claimed recently that there are no significant economic differences between the two main political parties. This study bears out that contention.

It is generally difficult to draw policy conclusions from a study which focuses mainly on understanding the actual policy implemented rather than investigating its effect on the economy. Nevertheless, a study of this kind does point to the large discrepancies between declared policy and actual policy. If this gap becomes too large it is advisable to reduce it.

Three such discrepancies emerge from this study. The first is related to education expenditure in the Arab sector. Despite the official policy of equality, expenditure on Arab education is discriminated against, and this effect is significant. In this area, at least, there is certainly room for change, to bring implementation into line with declared goals. The second discrepancy

is associated with the policy response to income inequality: despite repeated proclamations by governments to the effect that education constitutes the long-term solution to inequality, we find that in effect public spending on education, which is determined by the government, has not responded to the large shifts in inequality which have occurred in the last twenty years. Here, too, implementation should be consistent with pronouncements. The third case involves public spending priorities. Despite repeated affirmations by various governments that they intend to make education their first priority, in the sample period we found only one government that actually made a clear policy shift in that direction.

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