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The Public Sector Budget and Economic Growth in Israel*

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In this study we perform a time series analysis of economic growth in Israel, a country that in its short history has been characterized by sharp changes in the public sector budget deficit and its composition. We found that the endogenous growth model is more suitable for Israeli data than the classical exogenous growth model. The paper also provides a framework for dealing with unbalanced budgets in the context of the endogenous growth model. According to our theoretical model and empirical findings for Israel, the permanent taxes are a better measure than actual taxes of their influence on growth.

I. Introduction

According to endogenous growth models, the public sector budget affects the growth rate of the economy. This theoretical finding contradicts exogenous growth models which give policy instruments a role in the transition to the steady state (i.e., they affect the level of GDP instead of its growth rate). Table 1 shows the stylized facts of a young country, Israel, characterized by three periods of growth with sharp changes in the budget composition. The first period of rapid growth (1961-72) was characterized by a high rate of profit on capital, a high rate of capital accumulation, and a relatively low level of public expenditure and taxes. In the early 1970s the sharp increase in most expenditure - led by defense - substantially raised the public sector

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expenditure/GNP ratio. This increase derived from an increase in the level of taxes as well as in the public sector deficit, which meant that the public debt rose. The increase in the debt in that period (i.e., under adaptive expectations) can be seen as an increase in future taxes, or in other words, an increase in the permanent level of taxes[1]. The permanent increase in all kinds of expenditure had a crowding-out effect on the private sector, characterized by a rise in the share of employment in the public services. The third (current) period is characterized by a reduction of the government expenditure/GNP[2], mainly explained by the reduction of defense expenditure[3] and interest payments, the latter as a consequence of the reduction of the deficit and the debt. The budget deficit was reduced from an average 10 percent of GNP to a 3 percent level, which is similar to the one of the early growth period. Two points of general interest are associated with our approach concerning the Israeli case study:

— Endogenous growth has been examined mainly through cross-section samples for large numbers of countries,[4] while very few studies are based on individual cases. Incross-section samples researchers are compelled to neutralize all the variables that explain growth other than the policy variables they are interested in testing — mainly institutional country-specific variables, which are very difficult to measure. This problem does not arise in the time-series context (where institutional changes are less drastic[5]),

1. See the formal model in Section Ⅳ.
2. The public expenditure/GNP ratio has been declining since 1979, accompanied since 1985 by a reduction in the share of the public debt. In this sense it is not clear whether our choice of 1990 as the beginning of the new period is appropriate. Our criteria was related to the lagged response of growth to a reduction in public sector expenditure, because 1989 was the last year of negative per-capita growth. This choice can be backed up by massive immigration from the former Soviet Union, which marked the beginning of a new period of growth.
3. The appendix provides an international comparison of expenditure composition, which shows that in spite of the sharp reduction in defense expenditures in Israel (20 percent of GNP since 1979), it is still substantially higher than the highest figure among the OECD countries, U.S.A.
4. Most of the studies use mixed samples of developed economies and LDCs ; only a few differentiate between the two groups (see f.e. Lin (1994)).
5. See Easterly, Kremer, Pritchett and Summers (1993).

but of course, the main problem here is that a steady state analysis leaves us with a low number of observations. As far as we know, the only time-series study of endogenous growth was carried out by Young (1991) for the rapidly-growing economies of Asia (Singapore and Hong Kong). Young rejects this kind of model in favor of the neo-classical framework, according to which the accumulation of factors affects the level of the GNP rather than its growth rate.[6]

— Given the high budget deficit in Israel, it is necessary to extend the traditional endogenous growth model to a framework that deals with unbalanced budgets.

The paper is organized as follows: Section II presents a brief survey of the empirical literature on the government budget and growth. Section III reviews existing explanations of growth in Israel. In Section IV we present the basic model of endogenous growth, which is based on Barro (1990). This model is modified in order to take into account budget deficits. In Section V we present the empirical results of the endogenous growth model. Section VI gives an empirical test of the exogenous growth model for Israel, and Section VII contains our summary and conclusions.

II. A Brief Review of the Empirical Literature

A great many papers have been written in the last few years on the theoretical and empirical aspects of the different models of growth. Our aim here is simply to review some of the studies analyzing the relationship between growth and different public sector variables.

Early studies by Landau (1983 and 1986), Kormendi and Meguire

6. Note that most critiques to endogenous growth models do not reject explicitly the relationship between budget and growth, by focusing on other characteristics. Young's critique emphasizes the AK characteristic of endogenous growth (i.e., linearity in accumulable factors), while Easterly, Kremer, Pritchett and Summers (1993) emphasize that the instability of growth is inconsistent with the persistence of some of the variables used in empirical aspects of endogenous growth models, such as education and political stability. While the persistence of government policy variables is also high, as these authors note, policy variables are affected by temporary shocks, and are consequently less stable.

(1985), and Grier and Tullok (1989) support a negative correlation between the size of government-measured by government expenses- and growth. Laudau (1983) and Grier and Tullok found a negative correlation, while according to Kormendi and Meguire the correlation is statistically insignificant. These studies did not explicitly examine the composition of expenditures, by separating education and infrastructure from other categories of expenditure. Ram (1986) found a positive correlation in a model that separates public from private product and considers different types of government expenditure. Ram's work is based on a mixed sample of developed economies and LDCs. Devarajan, Swaroop and Zov (1993) also found a positive correlation in a sample of LDCs, where the composition of government expenditure produces correlations which are the opposite of what could be expected from the standard endogenous growth model: infrastructure expenditure is negatively correlated with growth, while consumption expenditure shows a positive correlation. These findings - together with others such as Landau's (1986) findings which reveal a fragile correlation between infrastructure expenditures and growth in LDCs - raise the question whether effect of government policy differs in LDCs and developed economies[7]. Lin (1994) explains that a distinction should be made between the short-run -where government has a positive impact - and the long-run, where government has a negative impact on growth.

Engen and Skinner (1992) estimated a long-run version of a structural model by averaging over a long period in a sample of 32 countries. After correcting for simultaneity using instrumental variables, they found that an increase of government size through a balanced budget policy harms growth. Barro (1991) and Easterly and Rebelo (1994) also test the standard specification of the endogenous growth model in cross-section studies. Their findings support the view that investment expenditures enhance growth, and Barro's (1991) findings also show that consumption expenditure harms growth. Both studies use samples which contain developed economies and LDCs. Easterly and Rebelo (1992) tried to test

7. Empirical findings seem to support a different sign in the correlation between government expenditure and growth in LDCs and developed economics. We have not yet come across a study which provides a theoretical explanation for this.

whether the composition of taxes affects growth as predicted by endogenous growth models with an inelastic labor supply : direct taxes should harm growth while indirect taxes should be neutral. They found that the empirical correlations were not significant (in contrast to the empirical results for Israel, see Section V). Easterly, Kremer, Pritchett and Summers (1993) criticize the endogenous growth model, showing that growth rates are highly unstable across decades, while such country characteristics as education and political stability are steady. They found that debt crises and wars are among the main explanations of growth. Crises of this kind are transferred to the economy through the public sector budget, with higher deficits, higher debt, and higher taxes. This mechanism, which is tested here, constitutes a separate channel in endogenous growth models.

To the best of our knowledge, Young's studies on Singapore and Hong Kong (1991) and the four rapidly-growing economies of Asia (1994) are the only attempt to test the endogenous growth model in a time-series context. He found that linearity on accumulable factors (capital) — usually taken for granted in endogenous growth models — is rejected in favor of the neo-classical framework, with diminishing returns to capital.

III. Growth in Israel: Alternative Explanations

Ben Porath (1986) and Metzer (1986) consider different explanations for the slowdown in growth in Israel in the 1970s and 1980s. Although capital stock continued to grow faster than both labor and output, there was a sharp decline in its rate of growth, and underutilization of capital (Table 2).

The energy crisis caused changes in relative prices of inputs which led to the reallocation of interindustry resources (Bruno, 1982) and rendered a significant proportion of pre-1973 stock obsolete. Increased government subsidization of the private sector (which rose from 1 percent figure in the early 1970s 15 percent in the late 1970s, see the appendix table) caused additional misallocations of investment.

Labor input growth decreased sharply in the second period, in part because of the slowdown of immigration. This decrease in labor input was accompanied by a change in labor composition: the proportion of men

in the labor force decreased from 76 percent in 1965 to 63 percent in 1982, while that of women increased from 24 to 36 percent. The share of the public in employment rose from 22 percent in the early 1960s to 28 percent in 1981. These changes, together with others (e.g., the large number of manual laborers from the administered areas employed since 1967 declined during 1973-1981, as well as the increase in part-time employment from 17 percent in 1961-1972 to 21.8 percent in 1973-1981), helped to explain the reduction in total productivity.

Ben-Porath (1986) provides an alternative explanation of the decline in productivity, based on the characteristics of the waves of mass immigration. The high level of education that characterized Israel in 1948 (one of the highest in the world) enabled it to absorb the mass immigration from the LDCs of Asia and Africa, as well as from war-ravaged Europe. While the entry of the immigration wave initially reduced the average level of schooling and skills, this gradually rose, leading to a steep increase in productivity in the 1960s and early 1970s. The completion of this process, together with the slowdown in immigration, caused a reduction in growth rates of productivity. These features, which are difficult to quantify, are not reflected in enrollment tables (see appendix), which rise with time.

Anther explanation based on influxes of immigration is given by Metzer (1986). The slowdown in population increase affected prospects for long-term economic growth by reducing the growth rate of labor input and slowing the rate of economic development. The former affects the supply side of the economy, while the latter causes a slowdown in demand, especially of the construction industry - traditionally Israel's growth leader. This slowdown prevented entrepreneurs from expanding investment, causing a self-induced process of lower growth.

Both Ben-Porath (1986) and Metzer (1986) cite government budget variables as possible explanations of the slowdown. In the following sections we provide a formal framework for dealing with the budget and its effect on the growth process. It is of special interest to test whether the budget affects the level of output, as predicted by exogenous growth models.

Finally, we cannot end this brief survey without mentioning

inflation (Bruno, 1993). It is not clear whether the explanation works both ways however. Inflation rose from 14 percent in 1970-72 to an annual average of 36 percent in 1973-77. A further increase, brought the average to 123 percent in 1979-83, and to a peak of 400 percent in 1984. After 1985 a stabilization program succeeded on bringing down inflation substantially, to a level similar to the one in the beginning of the 70's.

Ⅳ. The Model

One of the problems of Barro's (1990) model of endogenous growth is that it assumes a perpetually balanced budget. This is an unreal assumption in an international context, particularly for the case of Israel (see diagram in the appendix). In order to deal with this problem we adopt the tax smoothing theory[8], which - adding the assumption of a zero mean for temporary expenses - enables us to show that balanced budgets should apply to permanent government expenditure instead of actual expenditure. In order to show this point in a closed form assume the following specification of expenditure:

$$G_t = \overline{G_t} + \varepsilon_t, \quad \int_0^{\infty} \varepsilon_t e^{-rt}\, dt = 0 \qquad (1)$$

where G represents total government expenditures, $\overline{G}$ is permanent expenditure and ε represents temporary defense expenditure which is assumed to be positive in war time and negative in peace time, with a zero mean. The government minimizes the excess burden of taxation, Z_t:

$$Z_t = \int_0^{\infty} T_t\, f\left(\frac{T_t}{Y_t}\right) e^{-rt} dt, \qquad f' > 0,\ f'' > 0. \qquad (2)$$

Assume that taxes are a function of income ($T = \tau Y$). The government budget constraint is:

8. See Barro (1979).

$$\int_{o}^{\infty} T_t e^{-rt} dt = \int_{0}^{\infty} G_t e^{-rt} dt. \tag{3}$$

It can be shown that the optimal policy for minimizing the excess burden under the budget constraint is:

$$\tau = \frac{\overline{G}}{Y}, \tag{4}$$

which means that taxes finance permanent expenses, or in other words, the balanced budget constraint holds for the permanent level of government expenditure.[9] Temporary defense expenditure in war time is financed by debt, which is repaid in times of peace. The model is completed by assuming two kinds of permanent expenditure: productive expenditure that enhances production (I), and unproductive expenditure which constitutes and argument in the utility function (H).

$$\overline{G} = \overline{I} + \overline{H}. \tag{5}$$

The per-capita production function is:

$$y_t = A \ \bar{i}_t^{\alpha} k_t^{1-\alpha} \tag{6}$$

where i is permanent productive expenditures and k is private capital. This specification (except for permanent instead of actual expenditure) is the same as in Barro (1990) and it is known as the "AK model" (Rebelo, 1991): constant returns to scale are obtained for a broad concept of capital which includes both private and public capital. The problem for the representative agent is to maximize the following C.R.R.A. utility function:

$$\text{Max } U = \int_{0}^{\infty} \frac{(c^{1-\beta} \bar{h}^{\beta})^{1-\sigma} - 1}{1-\sigma} e^{-\rho t} dt \tag{7}$$

$$\text{s.t. } \dot{k} = AK^{1-\alpha} \bar{i}^{\alpha} (1-\tau) - c - \delta k,$$

9. For the empirical validity of this theory in the cases of U.S.A. and Great Britain, see Barro (1986). For the case of Israel, see Hercowitz and Strawczynski (1994).

where c is a private product, h is public permanent unproductive expenditures and δ is the depreciation rate. The solution of the model is:

$$\hat{y} = \frac{1}{\sigma}[(1-\alpha)A\,\bar{i}^{\frac{\alpha}{1-\alpha}}(1-\tau) - \rho - \delta], \tag{8}$$

where y is the growth rate. Growth is a positive function of capital productivity and productive government expenditure and a negative function of taxes, the depreciation rate, and consumption impatience.

V. Empirical Results: Endogenous Growth

The diagrams in the appendix show the development of the main variables for the three periods described above. The correlations with growth are basically consistent with the standard endogenous growth model: growth is positively correlated with the rate of return on profits and with public sector investment in the infrastructure, and negatively correlated with taxes and the public sector deficit.

The empirical application of the model requires a discussion of a number of issues:

1. The first issue is related to the empirical explanation of steady state growth rates as opposed to transitional growth rates. As well-known, the solution of endogenous growth models is characterized by jumping straightforward into the steady state (i.e., there are no transitional dynamics). Consequently, we must start by testing the appropriate length of the periods which will serve as a basis for the concept of steady state in our regression analysis. Table 3 provides a test for the speed of convergence.

The results support a one-year convergence to a steady state: the only significant variable is the constant term, while all other variables representing transitional terms are insignificant (above ten percent). Consequently, the regressions will be performed by using yearly data.

2. Israel receives a considerable amount of unilateral transfers, and this

must be taken into account in any historical analysis of the public sector budget. We correct the government budget constraint as follows:

$$T_t + U_t = I_t + H_t,$$

where U is unilateral transfers (as usual we assume that H includes public transfers to the private sector). If permanent unilateral transfers are known in advance, we must correct budget constraint (2) by reducing the need for taxes in order to finance total permanent government expenditure (which is equal to actual expenditure minus transitory defense expenditure). This reduction is carried out by using permanent unilateral transfers.

3. We need a technique in order to differentiate between permanent and transitory variables, both for defense expenditure and unilateral transfers. For this purpose we use an exponential smoothing technique, which gives transitory expenditure with an approximate zero mean (see diagram in appendix).

4. Equation (8) includes technological variables. We take the gross rate of profit on capital, R, as an approximation for gross capital productivity $[(1-\alpha)Ai^{\alpha/(1-\alpha)}]$. Although this figure is based on the average rate, while we need marginal estimates, we believe that the rate of profit represents a good approximation.

5. Barro's (1990) original model is based on public expenditure — a flow — instead of on the stock of capital. Although it is possible to generalize the model to public capital stock, we present the regressions based on public expenditure on the infrastructure.

6. Equation (8) can be used to assess the impact of the composition of government expenditure on growth. This exercise requires identification of the productive government expenditure component included in the rate of return on profit.

7. Demand parameters are represented by ρ, which will be assumed to be fixed (and consequently included automatically in the error term).

Given that our aim is to assess the impact of expenditure and taxes in accordance with the basic model, it is useful to divide up the presentation as the basis to these items.

5.1) *Expenditure*

The relevant logarithmic transformation of equation (8) for expenditure is:

$$\ln(\hat{y} + \frac{\rho + \delta}{\sigma}) = \ln\frac{1}{\sigma} + \ln(1-\alpha)A + \frac{\alpha}{1-\alpha}\ln\bar{i} + \ln(1-\bar{\tau}).$$

Note that the left side includes a term of the depreciation rate and the utility parameters which add up to the per-capita rate of growth. This helps us to overcome the problem of negative per-capita growth for some of the years in the sample (we assumed a value of 5 for this term). As explained before, permanent taxes are estimated by the need of financing permanent expenditure (net of permanent unilateral transfers).

The estimate of the component of the rate of return on profit associated with productive government expenditure, can be inferred from Table 3.

The only variable positively correlated with growth is investment expenditure. This variable also has the highest correlation with the rate of return on profit, and the highest level of significance. According to these findings, investment is the main candidate for productive expenditure. The high correlation between defense expenditures and R suggests that the possibility that this kind of expenditure is productive should also be checked. We will consider education as an additional candidate.

Table 5 gives the results of the regressions. Dummy variables were included for the war years, 1967 and 1973.

The first regression tests the basic specification [equation (8)], where R includes the contribution of productive public expenditure. All the

parameters show the expected sign with a high level of statistical significance.

The following regressions consider different specifications of productive expenditure. Regression (2) and (3) consider different candidates for productive expenditure: investment (regression 2) ; and the combination of investment, education and defense (regression 3). As expected, investment alone gives a better result.

Equation (4) considers the possibility of a quadratic relationship between defense expenditure and growth (Dahan, 1993) : for low levels of expenditure the correlation is positive, and for high levels growth is impaired. This hypothesis is not rejected by the data.

5.2) *Taxes*

We ran two sets of regressions for taxes (table 6). The first one (equations 1, 2 and 3) analyzes the composition of taxes, while the second (from 4 to 8) considers different specifications of taxes.

A known result tested in empirical ground (Easterly and Rebelo (1992)) is that direct taxes harm growth while indirect taxes are neutra l[10] Although this hypothesis should be tested using average marginal rates, the lack of data before 1975[11] forced us to use average taxation figures. Regressions 1 to 3 show that this indeed is the case: while direct taxes have a negative coefficient, indirect taxes and import taxes are insignificant. This result differs from that of Easterly and Rebelo, who found a non-significant relationship for a cross-section sample. In order to avoid simultaneity we also ran a two-stage least squares regression (TSLS) of specification 2 (not reported), and received the same qualitative results.

Regressions 4 to 8 consider different specifications of total taxes.[12] Regressions 4 considers unilateral transfers as lump-sum by taking permanent expenditures as an estimate of permanent taxes. Regression

10. This result assumes inclastic labor supply. If labor is elastic then we shall expect that direct taxes are more harmful, while both taxes harm growth.

11. In 1975 an income tax reform was implemented. One of the purposes of the reform was to equalize effective and statutory marginal rates.

12. Note that in regressions based on the estimate of permanent expenses the simultaneity problem is less relevant since the series were smoothed.

5 considers net taxes, i.e., taxes net of public transfers to the private sector. Regression 6 considers taxes plus unilateral transfers as an estimate of permanent expenditure (instead of permanent expenditures minus unilateral transfers, as shown in Table 4). Regression 7 considers the share of taxes, and finally, in order to avoid simultaneity, Regression 8 is a two-stage least squares (TSLS) regression with lagged taxes as an instrumental variable. It is interesting to note that estimates of permanent taxes give a better result than actual taxes themselves.

VI. Exogenous Growth

According to exogenous growth models (Solow (1956)), steady state growth is exogenously given, possibly, because of technological changes. In this section we test this hypothesis with data for Israel, using a model that includes public sector budget variables. The problem is:

$$\text{Max } U = \sum_{0}^{\infty}(1+\rho)^{-t}u(c_t ; h_t) \tag{9}$$

$$\text{s.t.} \quad c_t = k_t^{\alpha} i_t^{\phi}(1-\tau_h-\tau_g) - k_{t+1} + k_t(1-n-\delta); \quad \alpha+\phi<1,$$

where δ represents the depreciation rate and n is population growth. A linearization of the solution in the steady state, assuming a C.R.R.A. utility function, allows us to estimate the following equation :

$$\ln(y) = \frac{\alpha}{\alpha-1}\ln(\rho+\delta+n-\alpha) + \frac{\alpha}{1-\alpha}\ln(1-\tau_h-\tau_g) + \phi\frac{1}{1-\alpha}\ln(i) + \frac{1}{1-\alpha}\gamma t \tag{10}$$

where γ is the exogenous improvement in labor efficiency and n is population growth.[13] The fact that the sum of exponents in the

13. Note that this equation is equivalent to the one exposed in Mankiw, Romer and Weil (1990) with additional terms related to public sector budget.

production function is less than one indicates to diminishing returns to a broad concept of capital. Thus, in the steady state the only source of growth is obtained by assuming (f.e) an exogenous improvement of labor efficiency.

In order to perform the regression, we must consider the rate of population change separately, given the sharp changes of this rate in the Israeli context. One important difference between this model and that of endogenous growth model is that taxes affect the level of output and not its rate of change. Because of decreasing marginal productivity, in the steady state there is no capital growth while taxes affect the steady state level of capital.

According to the main equation, we expect output level to be negatively correlated with population growth, positively correlated with public investment (or public capital), and negatively correlated with taxes. Given the simultaneity problem, we ran TSLS regressions with lagged terms as instrumental variables. The results are given in Table 6.

The results show that the specification of the exogenous growth model is not consistent with Israeli data. While in OLS regressions the long run exogenous growth rate is significant, this is not the case for the TSLS equations. Moreover, taxes are positively correlated with output level, and have a high significance level in most of the OLS regressions (3 and 5), a finding that contradicts the basic model. Similarly, there is a negative correlation between the level of output and the share of public capital in output, a finding that again contradicts the intuition of the basic model. It is interesting to note that the contribution of population growth is insignificant, probably as a consequence of the fact that it is not clear whether causality goes from population to growth or vice versa, as noted by Ben-Porath (1986).

VI. Summary and Conclusions

Explanations of the slowdown of growth in Israel include the reduction of accumulable factors, the reduction of productivity as a consequence of the misallocation of capital and labor, external shocks, wars, and reasons related to the composition and size of mass immigration. There is no doubt that some part of these factors are reflected in the public sector budget, which has suffered from sharp changes during Israel's short history. This enables us to

test the endogenous growth model, which predicts that the government budget affects the rate of growth of the economy, instead of its level — as predicted by the exogenous growth model. This can shed some light on the empirical literature, since most tests addressed cross-section samples for a large number of countries, characterized by different intrinsic institutional frames.

Our findings do not reject the view that budget variables affected the economy's growth rate. We can summarize our findings as follows:

— The rate of profit on capital was significant in explaining the growth rate. This result does not reject some linearity in accumulable factors or, a high rate of innovation that prevents the economy from reaching a steady state around zero marginal productivity of capital, as suggested by the exogenous growth model.

— Taxes in Israel affect the rate of growth rather than the level of output. An estimate of permanent taxes gives better results than actual taxes for assessing their effect on growth.

— The hypothesis that the composition of taxes affects the rate of growth cannot be rejected. A significant negative correlation was found for direct taxes, while indirect taxes showed an insignificant one.

— While investment is positively correlated with growth, its coefficient in the regression was not significant. Education expenditure is not significant either, suggesting that other variables representing human capital may be more relevant.

— Defense expenditure and growth in Israel are correlated according to a quadratic function: with high levels of expenditure growth is impaired, while low levels growth is enhanced.

Table 1 Indicators of Economic Growth

	1961-72		1973-89		1990-93
	mean	variation coefficient	mean	variation coefficient	mean
GDP growth per capita(%)	6.5	0.82	1.4	1.76	2.6
Rate of return(%)	12.2	0.32	11.0	0.32	11.3
Total expenditure	45.5	0.24	73.5	0.10	57.4
Total taxes(% of GNP)	30.8	0.14	44.1	0.07	40.1
Direct taxes(% of GNP)	12.6	0.20	21.7	0.14	18.2
Indirect taxes(% of GNP)	11.1	0.05	12.5	0.15	15.6
Pub. sector deficit(% of GNP)	3.3		10.2		3.0
Pub. sector investment(% of GNP)	5.2	0.14	3.4	0.36	3.4
Capital growth rate(%)	8.8		4.7		3.4

Table 2 Growth Accounting in Israel

Growth rate	1961-72	1973-89	1990-93
Labor input	3.6	1.2	4.9
Capital input	8.8	4.7	3.4
Output	10.0	3.5	6.6
Total factor productivity	4.8	1.3	2.2

Table 3 - Testing for Convergence to the Steady State (Dependent Variable: lngpc5[14], Two-Tail Significance below Coefficients)

Variable	(1)	(2)	(3)	(4)
Constant	1.50 0.0003	1.87 0.0004	1.82 0.0054	2.35 0.0028
lngpc5(-1)	0.23 0.1966	0.27 0.1601	0.27 0.1889	0.26 0.2103
lngpc5(-2)		-0.22 0.2354	-0.27 0.1826	-0.35 0.1063
lngpc5(-3)			0.07 0.7368	0.12 0.5796
lngpc5(-4)			-0.24 0.2344	
D.W.	1.91	1.96	1.99	2.16

Table 4 Government Expenditure, Growth, and the Rate of Return on Profit

	Correlation with Growth	Correlation with Return on Profit (R)	Significance Level (dependent variable : R)
Investment	0.15	0.50	0.0035
Defence	-0.2	0.49	0.0042
Education	-0.07	0.14	0.4524
Gov.Services	-0.36	-0.18	0.3200
Subsidies	-0.35	0.23	0.2100
Health	-0.42	-0.24	0.1871
Transfers	-0.30	-0.14	0.4219

14. As explained later (section 5.1), the dependent variable is the logarithm of the growth rate plus an additional term (estimated as 5 percent) which is based on the depreciation rate, the subjective discount factor and the elasticity of substitution.

Table 5 Public Expenditure and Growth
(Dependent Variable: Per-Capita Growth[15],
Two Tail Significance below Coefficients)

Variable	(1)	(2)	(3)	(4)
Constant	-1.8 0.0815	-2.2 0.0542	-1.8 0.4286	-16.6 0.0012
ln R	0.6 0.0313	0.8 0.0270	0.6 0.1225	0.8 0.0456
ln 1 STOGU	0.7 0.0017	0.8 0.0019	0.7q 0.0214	0.9 0.0112
D67	-1.3 0.0075	-1.2 0.00153	-1.3 0.0176	-1.6 0.0029
D73	-1.1 0.0210	-1.1 0.0252	-1.1 0.0302	-0.8 0.0954
ln INV		-0.3 0.3756		0.0 0.9878
ln PROD			-0.0 0.9940	
ln DEF				9.5 0.0227
lnDEF2				1.6 0.0282
R^2	0.44	0.44	0.44	0.52
D.W.	1.73	1.79	1.73	2.10

15. As explained before a 5% parameter is added to the dependent variable. The notation is described after Table 5.

Table 6 Taxes and Growth (Dependent Variable: Per-Capita Growth, Two Tail Significance below Coefficients)

Variables	(1)	(2)	(3)	(4)*	(5)	(6)	(7)	(8) TSLS*
Constant	3.17 0.0122	2.63 0.2874	2.69 0.2882	1.42 0.0510	1.67 0.0708	1.66 0.0707	1.96 0.0334	2.00 0.0428
ln R	0.50 0.0973	0.56 0.0418	0.52 0.2074	0.50 0.0825	0.56 0.0791	0.58 0.0688	0.44 0.1531	0.43 0.1707
D67	−1.33 0.0139	−1.29 0.0247	−1.23 0.0451	−1.39 0.0072	−1.35 0.0193	−1.43 0.0159	−1.44 0.0304	−1.45 0.0133
D73	−1.06 0.0427	−1.04 0.0580	−1.05 0.0604	−1.18 0.0188	−1.10 0.0461	−1.47 0.0136	−1.12 0.0362	−1.11 0.0414
ln DT	−0.79 0.0194	−0.82 0.0243	−0.91 0.0688					
ln IDT		0.19 0.8018	0.19 0.9066					
ln IMT			0.16 0.7823					
ln 1STOTG				0.43 0.0036				
ln 1NTAX					2.94 0.0920			
ln 1TAXU						2.59 0.0895		
R^2 D.W.	0.34 1.54	0.32 1.53	0.29 1.51	0.41 1.72	0.27 1.46	0.27 1.43	0.32 1.57	0.29 1.58

* Instrumental variable : ln TAX(−1)

R	Gross rate of return on profits.
1STOGU	1 minus share (in GNP) of permanent expenditure net of permanent unilateral transfers (see text).
D67, D73	Dummies for war years.
INV	Share of public expenditure in investment
PROD	Share of public expenditure on investment, education and defense.
DEF	Share of public expenditure on defense.
DT	Share of direct taxes.
IDT	Share of indirect taxes.
IMT	Share of import taxes.
1STOTG	1 minus share of permanent expenditure.
1NTAX	1 minus share of taxes plus share of transfers to the private sector.
1TAXU	1 minus share of taxes plus unilateral transfers.
1TAX	1 minus share of taxes.

Table 7 Exogenous Growth

(dependent variable - per - capita GNP, two tail significance below coefficients)

Variables	OLS (1)	TSLS* (2)	OLS (3)	TSLS (4)	OLS (5)	TSLS** (6)
Constant	0.50	0.38	0.66	0.103	0.25	0.53
	0.1138	0.3291	0.0001	0.9647	1.6666	0.7551
ln Y(-1)	0.70	0.88	0.024	2.15	0.32	5.20
	0.0005	0.0014	0.8265	0.7937	0.0234	0.7138
ln(n)	0.005	0.065	- 0.016	0.070	- 0.029	0.245
	0.8806	0.2506	0.2437	0.8361	0.1712	0.7643
lnISTOTG	0.011	0.039	- 0.035	0.117	- 0.055	0.546
	0.6963	0.3368	0.0215	0.8435	0.0078	0.7546
TIME	0.020	0.019	0.044	- 0.03	0.022	- 0.14
	0.0260	0.0769	0.000	0.9163	0.000	0.7653
DD73	0.11	0.22	0.231	- 0.096		
	0.3678	0.1867	0.0003	0.9413		
D73TIME	- 0.013	- 0.022	- 0.919	- 0.005		
	0.0984	0.0530	0.000	0.9372		
ln TAY			- 1.22	2.49	- 1.178	9.07
			0.000	0.8622	0.00	0.7600
ln INV	0.02	- 0.15				
	0.6595	0.2498				
R^2	0.98	0.96	0.99	0.82	0.99	- 0.32
D.W.	1.77	2.23	1.47	2.00	0.83	1.97

* Instrumental variable: ln INV (-1).

** Instrumental variable: ln TAY (-1).

Table 8 Historical Development of Public Expenses (as Percents of GNP)

	1961-1965	1966-1970	1971-1975	1976-1980	1981-1985	1986-1990	1991	1992
Defense	10.2	18.8	28.2	24.9	20.6	14.8	12.5	10.7
Gov. Services	1.8	2.0	2.4	2.9	3.0	2.7	2.5	2.4
Investment	5.0	5.1	5.7	3.9	2.4	2.6	3.4	3.3
Education	5.6	5.5	4.8	4.8	4.4	4.1	4.3	4.2
Health	0.9	1.3	1.5	2.2	2.1	1.9	2.1	2.1
Transfers	5.2	7.8	10.5	14.1	13.8	15.6	16.2	16.4
Business Sector	1.9	3.9	1.2	14.5	12.8	6.9	6.5	7.5
Total	33.5	48.4	71.3	79.1	73.6	61.8	57.8	56.3
Coefficient of Var.	5.7	16.0	15.0	2.3	4.9	3.1		27.0*

* For the whole period, 1961-1992.

Table 9 Historical Development of Taxation (as Percents of GNP)

	1961-1965	1966-1970	1971-1975	1976-1980	1981-1985	1986-1990	1991	1992
Direct taxes	11.9	15.3	21.2	24.6	23.4	21.4	17.3	17.7
Indirect taxes	17.1	15.9	19.7	21.5	19.9	22.3	21.8	22.9
Local taxes	11.5	10.7	10.3	13.2	12.1	15.1	15.8	16.4
Import taxes	5.7	5.2	9.4	8.3	7.8	7.2	5.9	6.5
Total taxes	29.0	31.2	40.9	46.2	43.3	43.7	39.1	40.6
Coefficient of Var.	2.1	10.3	4.3	4.7	7.2	7.9		17.5*
Unil. Transfers	1.7	3.0	7.7	10.3	12.8	10.0	8.2	7.2

* For the whole period, 1961-1992.

Table 10 Public Sector Expenditures in OECD Countries: Average 1986-1990 (as Percents of GNP)

	Growth	Total Expenditure	Interest	Defense	Education	Health	Social Security	Investment
U.S.A	2.8	36.2	4.3	5.8	5.2	4.5	7.6	1.6
Britain	3.2	43.1	4.7	4.5	5.2	5.0	11.9	1.4
Austia	3.0	51.6	3.6	1.1	3.9	5.8	19.5	2.8
Belgium*	3.2	54.5	10.7	2.5	4.9	0.8	20.8	3.2
Denmark	1.5	56.5	6.8	2.1	4.7	6.9	20.8	1.3
France	3.1	48.7	2.8	2.7	4.7	6.9	20.8	1.3
Germany**	3.0	47.1	2.9	2.6	3.6	7.6	18.7	2.3
Italy*	3.0	57.3	8.4	1.6	3.7	5.0	16.6	3.3
Luxembourg	4.3	49.4	0.9	1.0	5.3	1.0	22.9	5.0
Holland	2.5	58.3	7.0	2.8	3.2	7.4	20.9	2.8
Norway	1.6	54.8	4.1	3.4	6.5	7.5	17.9	4.1
Sweden	2.2	62.5	6.3	2.8	1.6	0.5	19.5	1.0
Canada**	2.5	44.9	7.4	1.8	5.3	6.0	10.9	2.8
Finland	3.5	42.8	1.5	1.5	4.3	3.2	10.3	2.3
Ireland	4.4	51.5	9.8	1.4	5.7	6.2	12.5	2.2
Portugal*	4.7	45.0	8.3	2.4	4.3	3.6	10.5	N.A
Spain**	4.5	38.9	3.4	1.8	1.8	3.9	12.5	1.5
Australia	3.6	37.5	4.3	2.4	5.1	5.4	8.0	2.6
Average	3.2	48.9	5.4	2.5	4.5	4.7	15.8	2.5
Israel**	3.6	55.7	11.6	13.8	5.8	1.9	10.6	1.5

notes: * Based on a three-year average.
** Based on a four-year average.

Source : Government Financial Statistics.

Table 11 Taxation in OECD Countries: Average 1986-1990 (as Percent of GNP)

	Growth	Total Taxes	Direct	Indirect
U.S.A.*	2.8	29.4	21.2	8.2
Britain	3.2	36.9	21.3	15.6
Belgium	3.2	46.1	33.9	12.2
Denmark	1.5	50.5	31.7	18.8
France	3.1	42.8	28.4	14.4
Germany	3.0	41.3	28.9	12.4
Italy	3.0	36.0	26.4	9.9
Sweden	2.2	55.0	38.0	17.0
Canada	2.5	34.8	21.7	13.1
Spain*	4.5	32.5	22.1	10.4
Japan	4.8	29.8	21.8	8.1
Greece	1.7	32.6	16.3	16.3
Average	3.0	39.0	26.0	13.0
Israel	3.6	42.2	20.8	21.5

* Average for 1986-89.

Table 12 Education Enrollment (Number of Years, Percent of Civilian Force)

Year	0	1-12	13+
1961	16.1	74.8	9.1
1970	12.2	76.0	11.8
1980	8.0	72.8	19.2
1990	5.6	69.1	25.3
1992	5.2	66.9	27.9

Figure 1 Per-Capita Rate of Growth

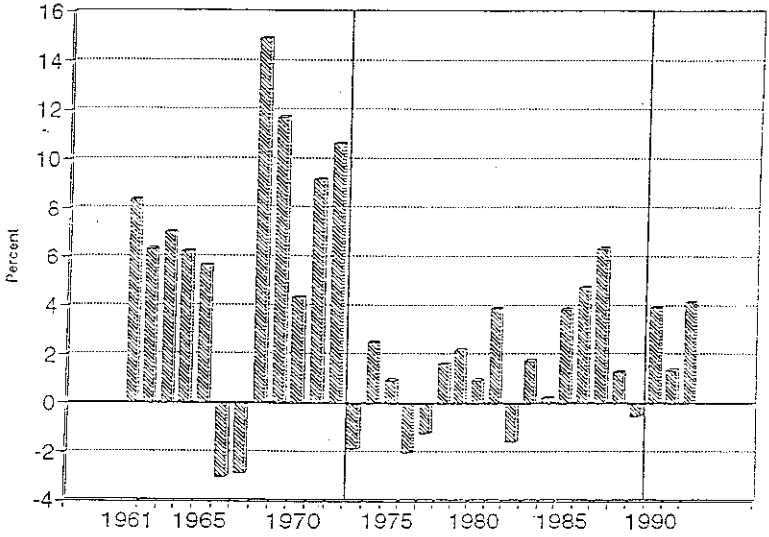


Figure 2 Profit Rate

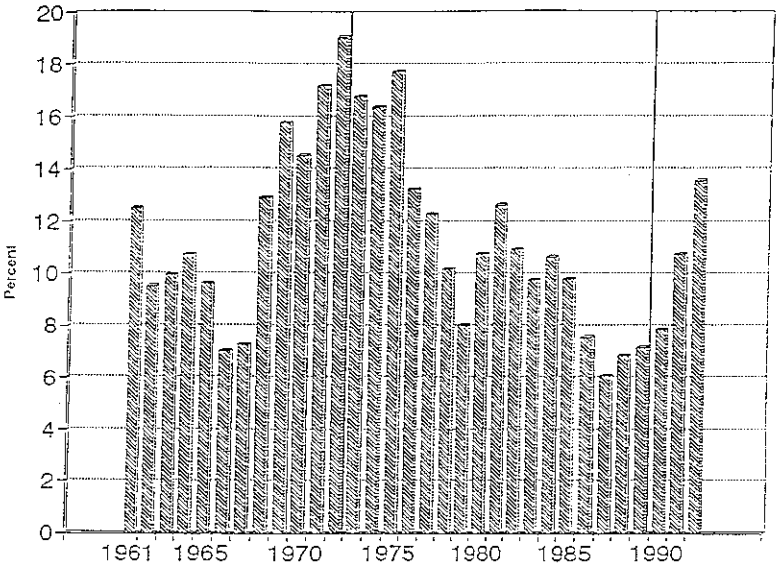


Figure 3 Smoothed Public Expenditures
(Excluding Smoothed Unilat. Transfers)

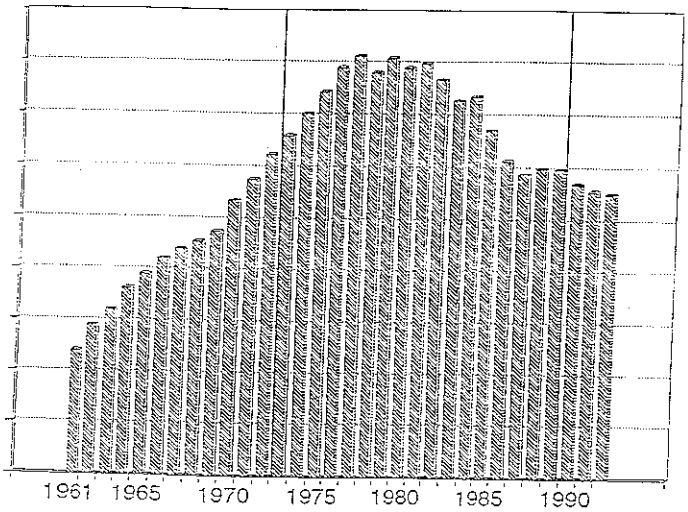


Figure 4 Public Sector Investment
in Infrastructure

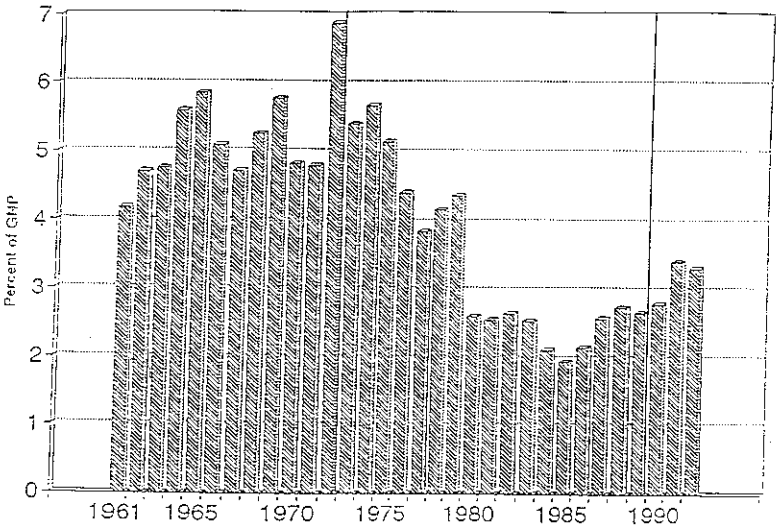


Figure 5 Public Sector Deficit

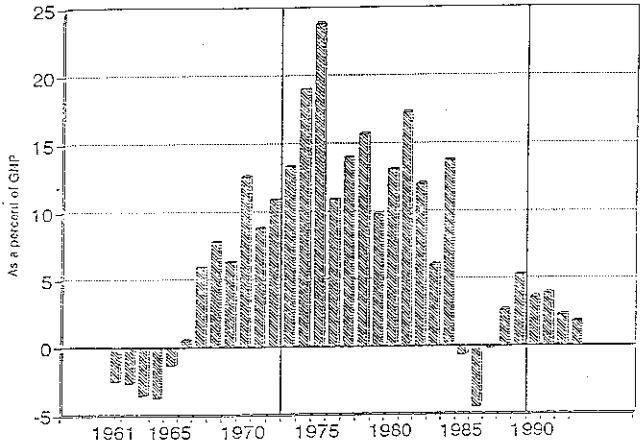


Figure 6 Total Public Debt

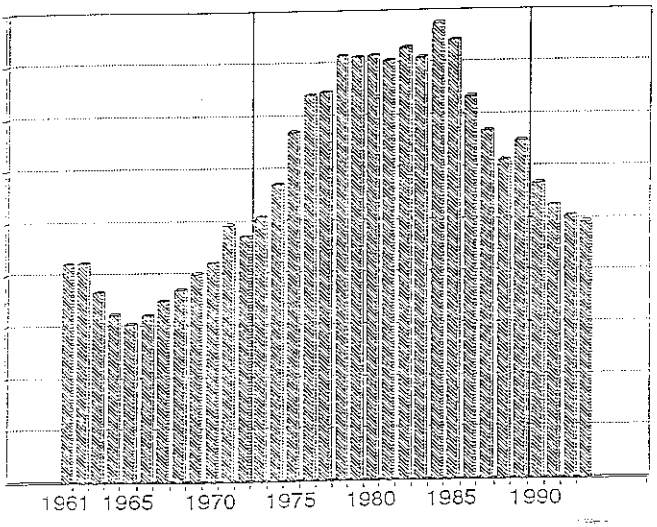


Figure 7 Transitory Defence Expenditures

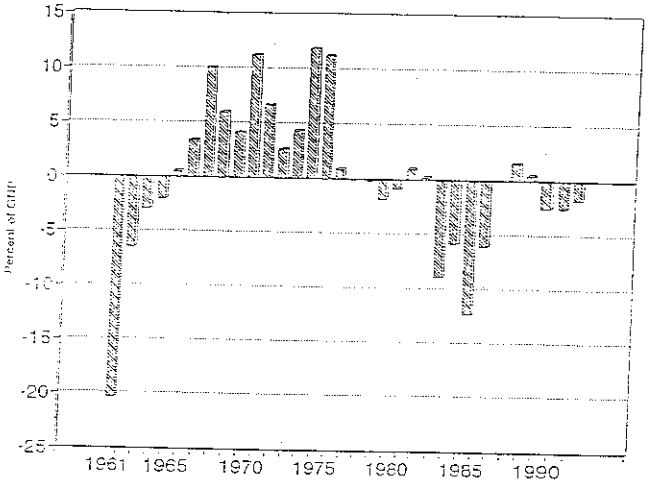


Figure 8 Government Expenditure Composition

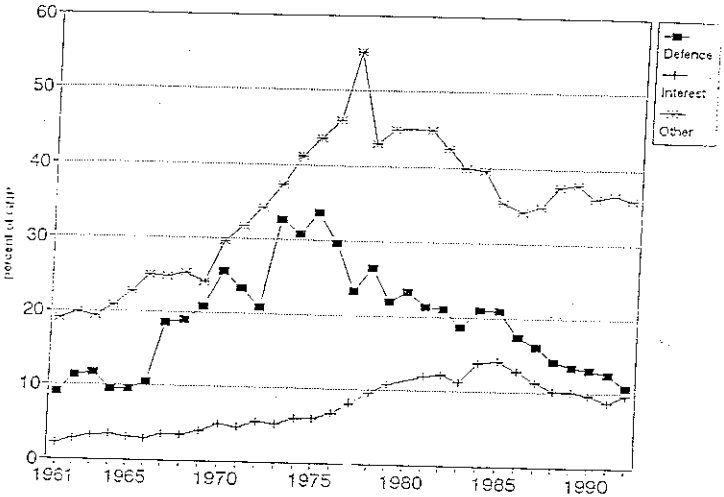
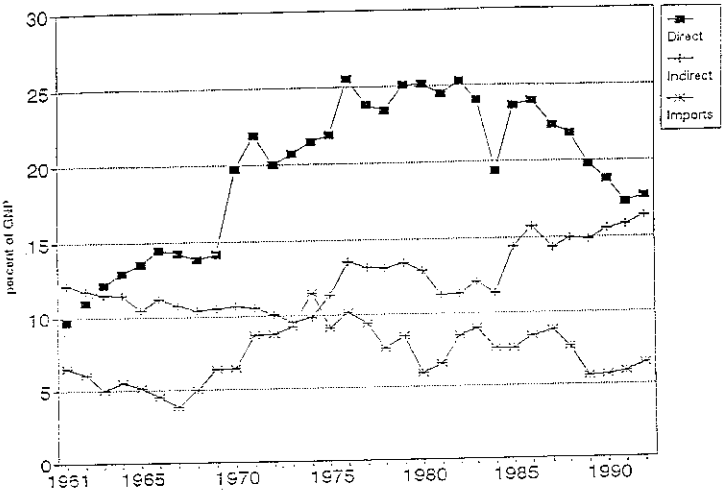


Figure 9 Taxation Composition



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