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THE IMPACT OF FISCAL POLICY ON PRIVATE CONSUMPTION IN ISRAEL WITH EMPHASIS ON THE FISCAL EXPECTATIONS APPROACH

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In this paper we assess the impact of fiscal policy on private consumption. We find that there is substitution between private and public consumption but that it is of very limited magnitude (approximately 20 percent). It was also found that, in contrast to the Ricardian approach, the method of financing of public expenditure has an effect on private consumption. Thus, an increase in the direct taxation of wages has a negative effect on consumption that is equal to the full amount of the tax increase while bond financing has a positive effect as long the increase in public debt is small.

Evidence was found of the importance of the expectations mechanism with regard to future fiscal developments (the fiscal expectations approach) as manifested in the existence of a public deficit or the channel of its financing:

a. The most appropriate variable for testing the degree of substitution between private and public consumption in the long run is public consumption less unilateral transfers from abroad which reduce the public's burden of financing public expenditure.

b. Evidence was found of the negative relation between public and private consumption which was partly the result of the existence of a public deficit. It was found that if an increase in the public debt is accompanied by an increase in the ratio of the public deficit to GDP, then its effect becomes negative.

c. Also, in the short run, only partial substitution was found between public and private consumption. This primarily reflects large and persistent changes in fiscal variables that contain significant real time information on the possibility of future changes in taxation.

d. A specific test of the change in the relationship between the trends in private and public consumption following the stabilization program in 1985 showed that the degree of substitution had declined significantly as a result of the program's success.

Finally, the testing of alternative transmission mechanisms, which may influence the degree of substitution between public and private consumption, such as inflation, the real exchange rate and the real rate of interest, showed that in general they did not have a significant influence in the short or the long run.

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1. INTRODUCTION

During the last few decades, there has been extensive debate regarding the reaction to fiscal expansion. Since fiscal expansion is generally associated with an increase in the deficit and the public debt, it creates expectations of future taxation. This mechanism is at the core of the fiscal expectations approach according to which fiscal expansion can even lead to a contraction in economic activity under certain conditions (to be described below).[1] This question is particularly relevant in Israel in view of the fiscal expansion implemented in the past and the cutbacks which began in 2003. Despite the centrality of this issue, there is no theoretical or empirical consensus between the various approaches as to the direction of the effect. In other words, does fiscal expansion stimulate the economy or is it neutral or perhaps even contractionary?

The Keynesian approach emphasizes the expansionary impact of the public deficit while the Ricardian approach emphasizes the reaction to the public deficit, primarily through private consumption, as a result of the increase in future taxation. According to the pure Ricardian approach, the two opposing effects offset each other and therefore the effect of fiscal policy on consumption and on the national rate of savings will be neutral. The Ricardian approach is based on the neutrality of the manner in which public consumption is financed—whether through taxation or government bonds. As a result of the individual's infinite planning horizon, he will not view government bonds as part of his wealth but rather as savings which will be used to finance future taxation.[2] In between these two theories, we find the permanent income approach and the fiscal expectations approach which is derived from it. One of the disadvantages of the permanent income models is the fact that they do not take into account the multi-period budget constraint of the government and its effect on individuals in the future.[3] The fiscal expectations approach tries to solve this problem by explicitly taking into account the public's expectation of future taxation. In this approach, the public realizes that an increase in the government's budget deficit cannot be maintained forever, as manifested in the increased pubic debt to GDP ratio.[4]

In order to determine which of the theories—the Keynesian, the Ricardian or the expectations approach—provides the best explanation of the behavior of economic agents, empirical testing is required. The goal of this study is to carry out such empirical testing in order to produce an updated evaluation of the impact of fiscal policy in Israel and its channels of transmission. In particular, we focus on testing the importance of fiscal expectations as they are manifested in the variables which represent them, i.e., the public deficit and the public debt. The study will also examine additional aspects of the fiscal expectations approach. According

[1] Examples which have been discussed extensively in the literature include Denmark during the period 1983-86 which enjoyed a significant economic boom following a cut of 7 percent in the deficit; Ireland during the period 1987-89 which enjoyed rapid growth following a cut of 5 percent in the deficit; and Sweden which experienced a recession following an expansion of the deficit during the early 1990s.

[2] There also exists the possibility that the debt will be recycled in perpetuity. In this case the present value of debt servicing will amount to the debt itself (consul bonds).

[3] It is possible that the explanation for this is that the multi-period budget constraint is only partially relevant to egoistic individuals with a finite planning horizon (even if it is long) and depends on whether the future taxation will be imposed in their lifetime.

[4] See Sutherland (1997).

to this approach, a reduction in taxes which is accompanied by a permanent reduction in the deficit will likely be viewed in the dynamic process as more credible than a tax reduction accompanied by a permanent increase in the deficit. These issues were tested empirically by Jappelli, Giavazzi and Pagano (2000), who studied the non-linear effects of fiscal variables. However, in contrast to their work, we make a distinction between a change in the deficit accompanied by a change in taxation in the opposite direction, in which case expectations created by the deficit will weaken its effect, and a change in the deficit accompanied by a change in taxation in the same direction, in which case the effect of the change in taxation will be reinforced. In the latter case, the fact that the change in taxation and the change in the deficit are in the same direction will strengthen its credibility and will affect expectations in the same direction.

Our work explicitly distinguishes between the short run and the long run. In the short run, the extent of the offset is affected by the uncertainty regarding the permanency of the change in public spending. In other words, individuals are unsure as to whether a change is temporary or permanent, and even if they are convinced that it is permanent, they do not know what the timing of the taxation will be.[5] In our approach, a large and permanent increase (decrease) in public expenditure has a greater chance of influencing the expectations of the private sector and is more likely to convince individuals that taxes will be increased (decreased) in the future, which may lead to an offset in private consumption. In the context of the fiscal expectations approach, we will examine the correlation between public consumption and the other components of fiscal policy. Thus, for example, a decrease in the proportion of public consumption in GDP or of taxes in GDP accompanied by a decrease in the deficit will provide more reliable information concerning the intention to reduce expenditure or taxes than a decrease which is not coordinated with the deficit.

The Israeli economy is characterized by a national rate of savings which is stationary but subject to large variations in the short run[6] along with a negative correlation between private and public consumption (in terms of percentage of GDP).[7] At first glance, these findings are consistent with the reactions of individuals' consumption over time (which will be manifested in short term variations in the rate of savings around its average). This implies that there exist short run dynamics which may be the result of factors such as uncertainty or liquidity constraint which will manifest themselves in the components of fiscal policy in the short run.

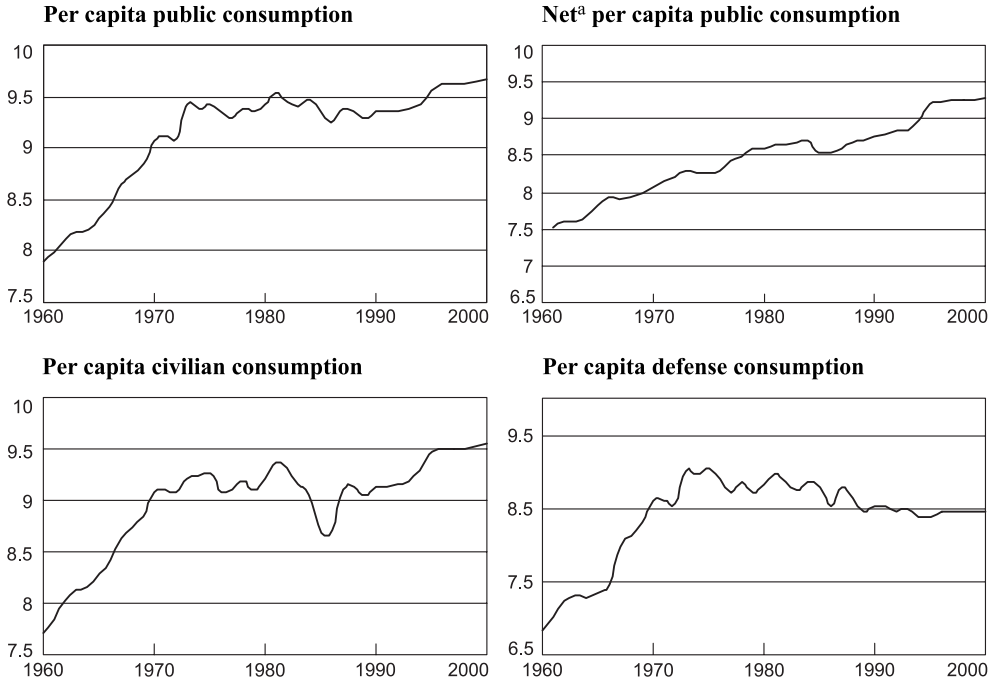
Distinguishing between the short and the long run is important in order to understand the nature of substitution between private and public expenditure. With regard to the Israeli economy, and from the point of view of the Ricardian and expectations approaches, not all the

[5] The research carried out by Bertola and Drazen (1993) concluded that the coefficient of reaction to a change in public consumption is less than one for low levels of public consumption due to the uncertainty regarding the permanency of the change. We adopt this same idea but distinguish between the short run and the long run. Thus, in the long run, there should be a full offset among Ricardian individuals and only a partial one among non-Ricardian individuals while in the short run, given that individuals cannot know what the intention of the government is, it will be smaller than one for all individuals.

[6] The ADF test shows a value of more than 5.

[7] In fact, in a regression to test Granger causality, the hypothesis that public consumption causes private consumption could not be rejected at a 7 percent level of confidence (see appendix).

Figure 1
Per Capita Public Consumption—Total and Net, Civilian and Defense
(in logarithmic terms)



[a] Public consumption minus unilateral transfers from abroad.

burden of financing public expenditure falls on the citizens of Israel since the public sector receives significant unilateral transfers from aboard, especially from the US government. Therefore, the substitution between public and private consumption will relate only to that part of public consumption which is not financed from abroad—herein referred to as "net public consumption." This variable is particularly relevant in the long run when information has become available to the public. In contrast, in the short run, when this information is unknown to the public, the full amount of public consumption will serve as a measure of the future burden. Furthermore, we show later on that the logarithmic transformation of per capita public consumption is a stationary variable[8] which raises the question of whether the substitution between private and public consumption reflects a long-run relation. Although per capita public consumption has an upward trend in absolute terms (unitary root), the finding that the logarithmic transformation converges to a stationary situation may be evidence that at some stage public consumption in absolute terms must also stabilize. In contrast, when

[8] It is worth mentioning that the leveling off of the per capita rate of increase is due to the decrease in public defense consumption while the growth in per capita non-defense expenditure has continued. Therefore, it is possible that the convergence was temporary and reflects the move from a situation of active conflict to one of passive conflict.

we used the alternative variable—"net per capita public consumption"[9] (which, as discussed above, better represents the financing burden of the consumers)—we found that this variable, both before and after a logarithmic transformation, has a unitary root and therefore there exists a cointegrative relation between it and private consumption.

The question of whether the rate of savings behaves in a Ricardian manner has been discussed in a number of studies. However, none of them distinguished between permanent fiscal policy and the reaction of private consumption in the short run. A study by Meridor (1985) showed that the Ricardian model provides a good description of the reaction of economic behavior to fiscal policy in Israel. Elkayam, Tal and Yariv (1987) arrived at the opposite conclusion, namely that the Keynesian approach better explains the behavior patterns in Israel. Finally, Leiderman and Razin (1988) and Lavi (1998) found mixed evidence resulting from liquidity constraints.[10]

We would emphasize that the present study focuses on the influence of fiscal variables on private consumption. In principle, it is also possible to treat local investment as a component of aggregate demand which may also be part of the offset of public consumption. However, investment is determined primarily by supply considerations which are not necessarily the same as those which influence demand. (This issue was examined in our previous paper Lavi and Strawczynski, 2001.) For example, there is a difference in planning horizons since consumers have a long run planning horizon within the context of their family[11] while firms have a much shorter planning horizon as evident from their investment behavior.

Numerous articles in the economic literature have analyzed the complementarity of private and public consumption.[12] If these two goods are complimentary, then an increase in public consumption increases the marginal utility of private consumption and therefore makes it possible to reduce its quantity. Thus, a negative correlation is created between these two variables. According to this approach, a negative correlation between the two variables is not evidence of macroeconomic effects as described in this study but rather of complementarity. However, the testing of the reduced form, which appears in studies that follow this approach, found it not to be preferable over the expectations approach and other alternatives based on macroeconomic relationships.

Survey of the literature on fiscal expectations

In recent years a number of theoretical and empirical studies have focused on the various approaches to testing the fiscal expectations approach. Among the empirical studies, Alesina and Perotti (1995) and Alesina and Ardagna (1998) found that contractionary fiscal policy leads to economic expansion when the composition of the policy favors growth-inducing activity,

[9] An ADF test showed that this variable has a unitary root.

[10] Leiderman and Razin included parameters in their model which they claimed represent the liquidity constraints on the finite planning horizon. Thus, if they differ from one this represents a deviation from the Ricardian model. Their empirical tests could not reject the hypothesis that the value of the parameters was different from one. In contrast, Lavi (1998) found that about one half of consumers do not behave according to the permanent income approach and it is possible that this reflects liquidity constraints. Lavi's findings were similar to those of Campbell and Mankiw (1989) for the US.

[11] If the assumption of altruism is adopted, then the horizon is infinite.

[12] See Graham (1993).

such as a reduction in current expenditure and an increase in investment in infrastructure. Giavazzi, Jappelli and Pagano (2000) focused on the non-linear effect of fiscal policy on private consumption and found that a significant reduction in the deficit is the correct policy to achieve an expansionary effect.

Blanchard (1990) presented a model in which raising the rate of taxation can lead to an increase in GDP, permanent income and private consumption. He assumes that there exists a rate of taxation above which a decrease in GDP can be expected as a result of the accumulated distortion in the allocation of resources. A government with a level of deficit that results in an ongoing increase in the public debt is faced with the question of whether to increase the rate of taxation in order to reduce the deficit to a level which will no longer raise the public debt or to delay fiscal stabilization policy, which will require more drastic measures in the future as a result of the increase in the debt/GDP ratio to an unsustainable level. Blanchard shows that a situation exists in which raising taxes will lead to increased private consumption because individuals expect that the increase in tax rates will prevent the expected drop in permanent income which is expected to result from the cumulative distortion in the allocation of resources. Raising taxes today will make it possible to stabilize the debt/GDP ratio and therefore to eliminate the need to raise tax rates beyond the critical level, thus raising expected permanent income. A critical assumption in obtaining this result is that individuals are egoistic and have a finite, though long, planning horizon.

A non-linear effect is also possible in Bertola and Drazen's (1993) model. They test the effect of the proportion of public consumption on individuals' expectations of future taxation and their influence on private consumption. As the proportion of public consumption in GDP increases and approaches a level which cannot be maintained over time, the probability of taxation decreases while the probability of a cutback in public expenditure increases. As a result, the rate of substitution between private and public consumption becomes increasingly smaller. At the threshold level, when individuals are convinced that a stabilization policy consisting of only a reduction in public expenditure will be implemented, there even exists the possibility of an increase in private consumption and GDP. This can occur because the expected reduction in expenditure lowers the expectations of future taxation and therefore prevents the decline in GDP which was expected as a result of distortive taxation. In contrast, when individuals come to believe that the stabilization policy (involving a reduction in public expenditure) is not to be implemented and that there will be a need for increased taxation, both private consumption and GDP will decline.

According to Sutherland (1997) the most important variable is not necessarily the level of public expenditure but the size of the public debt. According to this model, in a situation of deterioration in fiscal accounts, an increase in the debt will be internalized by consumers and lead to greater substitution between public and private consumption. This results from the increased probability of an increase in taxation which will in part be paid by consumers who are alive today, even if they are Ricardian.

The conclusion to be drawn from the theoretical models is that fiscal stabilization policies can sometimes have an expansionary effect on economic activity where each model treats fiscal variables in a different way. In all the models, stabilization through a reduction in public expenditure is preferred to an increase in taxation since a high rate of taxation leads to cumulative distortion in the allocation of resources which is manifested in a reduction of GDP.

2. DEFINITION OF VARIABLES AND ECONOMETRIC METHODOLOGY

a. The conceptual framework

According to the permanent income/life cycle approach (herein PI-LC) real per capita private consumption (c) is determined by per capita permanent income (y^P) minus the net tax rate on income (taxes minus transfer payments – *tyn*). Private per capita consumption in real terms can thus be written in the following form:

$$(1) \quad c = \alpha y^P (1-\tau)$$

where α is the marginal propensity to consume which is equal to 1 and τ is the tax rate on permanent income.[13]

According to the permanent income theory, changes in the composition of the population have an effect primarily on current income and therefore their influence will be felt on private savings and the dynamic short run process.

Permanent income is identically equal to the return on permanent human capital and the return on private wealth as expressed in the following identity:

$$(2) \quad y^P \equiv yl^P + \rho v = yl^P + \rho(vp + b),$$

where:

yl^p - the permanent return on per capita human capital.
v - total per capita wealth of households (including physical and financial capital)
vp - the wealth of households excluding government bonds.
b - government bonds.
ρ - real rate of return in the long run.

By substituting identity (2) into equation (1) we obtain the following Modigliani-type consumption equation:

$$(3) \quad c = \alpha(1-\tau)(yl^P + \rho v)$$

In our empirical tests we will distinguish between gross taxation (which determines the extent of distortion in the allocation of resources) and net taxation. It can be seen from Equation (3) that the PI-LC approach takes no account of the multi-period budget constraint and its fiscal implications on individuals in the future despite the fact that the approach does relate to future income through a long run planning horizon. The fiscal expectations approach attempts to correct this by explicitly taking into account expectations of future taxation to finance the government debt which cannot be maintained in the long run. In other words,

[13] If we define the price to the consumer as $= P_C = P_{cp}(1+ tind)$ where P_{CP} is the price to the consumer before tax and tind is the indirect tax rate, then P_Y is the price of output and if we assume in addition that $P_{cp}=P_Y$, then we can write the tax rate as follows:

$\tau = \dfrac{tyn + tind}{1 + tind}$ where *tyn* represents the direct tax rate.

it internalizes the public multi-period budget constraint as part of the budget constraint of individuals. Barro's (1979) model of tax smoothing can provide a basis for analyzing this possibility.[14] Thus, a rational individual with a long run planning horizon can treat permanent public expenditure as a variable which will determine his expectations of future taxation due to the deficit financing of government expenditure which cannot be maintained over time (as reflected in the rise in the debt/GDP ratio). It is important to emphasize that public expenditure is only an indicator of future taxation. Thus, for example, for egoistic individuals with finite planning horizons who do not take into consideration future generations, the multi-period budget constraint is only partially relevant since they are not certain that the taxes will be imposed during their lifetime (in contrast to altruistic individuals who fulfill Ricardian equivalence—see below for discussion). As a result, current taxation is not equivalent to future taxation and therefore part of the public debt is perceived as wealth since not all of it will be devoted to the payment of taxes.

The results of the fiscal expectations approach are highly dependent on its various assumptions, especially with respect to the following variables: the planning horizon of individuals; whether the taxation is distortionary; the efficiency of the capital market; and the fiscal situation of the economy and the ability to maintain it.

The extreme case of the fiscal expectations approach is pure Ricardian equivalence which is based on an infinite planning horizon of the individual, an efficient capital market and non-distortionary taxation. In this situation, the trend of public consumption will reflect permanent taxation, in the sense of resources that are not available to individuals, and will determine private consumption and savings. In this case, the actual rate of taxation will have no relevance. In other words, in Equation (3) the proportion of public consumption in income will replace taxes and wealth excluding government bonds will appear (see the discussion below). Thus:

$$(4) \qquad c=\alpha\left(1-\frac{g}{y}\right)\left(yl^{P}+\rho vp\right).$$

This reflects full substitutability between private and public consumption[15] and therefore the neutrality of fiscal policy with respect to total consumption (private and public) and the national rate of saving.[16] In contrast, in the case of egoistic individuals with a long, but finite, planning horizon, the relevant variable is taxation since it is the only variable which influences the permanent disposable income of these individuals with certainty.[17] The inability to resolve these issues on a theoretical level requires that empirical testing relate to both expenditure and taxation.

The mirror image of the discussion of individuals' perception of future taxation is the perception of government bonds as wealth. According to the pure Ricardian approach as

[14] A test of the validity of this model for Israel can be found in Hercowitz and Strawczynski (1996).

[15] In the permanent income approach, permanent taxation replaces public consumption and also has unitary elasticity.

[16] Under the assumption of an inefficient capital market or distortionary taxation, altruism will lead to substitutability but it will only be partial. An example of an inefficient capital market with consumers who have liquidity constraints can be found in Lavi (2003).

[17] One can think of an extreme case in which the planning horizon is short. In this case, net income is the relevant variable and therefore a change in financing between debt and taxation will immediately have an influence on private consumption.

discussed above, the representative individual knows that government bonds represent future taxation and therefore do not constitute net wealth. Thus, according to the Ricardian approach, only other types of wealth have an influence on private consumption. This provides an additional test of the theory. If individuals are egoistical and if the planning horizon is long, then both public and private debt will constitute net wealth. Nonetheless, not all public debt is net wealth if there is uncertainty as to how the government will act. In fiscal expectations models, individuals will perceive debt as net wealth only if it is sustainable and can be redeemed over time.

Finally, Equation (1) can also be written using the private propensity to consume from permanent income:

$$(5) \qquad \frac{c}{y^p} = 1 - \tau ,$$

or according to the Ricardian approach:

$$(5') \qquad \frac{c}{y^p} = 1 - \frac{g}{y} .$$

In other words, the private propensity to consume is determined by the net rate of taxation – both direct and indirect. Indirect taxation influences real income (in terms of consumption) through its effect on the price of private consumption which is used to deflate nominal income.

It is also important to relate to the implementation of the above conceptual framework in the *short run*. We will define $\tilde{G}$ as the permanent expenditure of the government, that is, the fixed stream whose discounted value is equal to the discounted value of future public expenditure:

$$(6) \qquad \tilde{G} + \frac{\tilde{G}}{1+r} + \frac{\tilde{G}}{(1+r)^2} + \ldots + \frac{\tilde{G}}{(1+r)^n} = G_1 + \frac{G_2}{1+r} + \frac{G_3}{(1+r)^2} + \ldots + \frac{G_n}{(1+r)^{n-1}}$$

where G_t represents public expenditure and t represents the year in which the expenditure is made, i.e. 1, 2, … up to the planning horizon n. The public's expectations of future taxation are determined according to information currently available on public expenditure. When current information on $\tilde{G}$ is updated, changes in future tax rates will be expected. In the present, there are measures which will have an immediate effect on $\tilde{G}$: 1) a permanent change in public expenditure which will influence the discounted value of public expenditure and therefore also $\tilde{G}$; 2) a significant one-time change which, because it takes place in the present, has a larger influence on the discounted value than a one-time measure planned for the distant future (which has less relevance due to discounting). Both types of measure will significantly influence $\tilde{G}$.

In the short run, individuals are forced to use recent changes in public expenditure as indicators of possible changes in $\tilde{G}$ and according to these indicators decide whether to expect an increase in the tax burden which will require them to react by reducing/increasing private consumption. According to the conceptual framework presented above, they will tend to believe that a change of this type will occur in one of the following two situations: 1) a

permanent increase (decrease) in public expenditure or 2) a large one-time change which is likely to reflect a permanent change in public expenditure.

Translation of the conceptual framework into fiscal variables

In what follows, we will summarize the channels of influence of the various fiscal variables according to the conceptual framework and the various approaches:

- *Public consumption*: A permanent increase in public consumption, net of unilateral transfers, is fully compatible with the concept of permanent expenditure requiring financing by taxation (see the discussion in the introduction). According to the fiscal expectations approach, under certain conditions this situation creates expectations of a future increase in the tax rate. According to the Ricardian approach, a permanent increase in public expenditure is equivalent to an increase in taxation.
- *Transfer payments to the public*: Although this is a component of public expenditure which is financed by taxes, the character of transfer payments is different from that of public consumption since it is a monetary transfer from the government. Thus, transfer payments which are financed by taxation constitute a transfer of resources between individuals without creating a need to raise net taxes and also constitute part of disposable income.
- *Public investment*: If productive, it creates income in the future and therefore there is no need to impose higher taxes.
- *Taxation*: Taxation has a direct effect on private consumption through disposable private income.[18] According to Barro's (1979) model and the pure Ricardian approach, public consumption fully represents taxation and therefore there is no need to directly take it into account. However, since the goal of this study is to test the empirical validity of the various theories, taxation will be included. In principle, we should relate to net taxation in view of the considerations mentioned in the previous section. However, in the empirical testing, the two variables—gross taxation and transfer payments—will be dealt with separately in order take into account the full weight of taxation in the distortion of the allocation of resources.[19] Since it is generally assumed that the marginal distortion increases with income, an increase in gross taxation leads to an accelerating decline in permanent income (both in the resources of the economy and the disposable income of individuals). We should also mention the models, such as Blanchard (1990), in which the influence of the distortion is not continuous and in such a case, increasing taxation to stabilize the economy can even result in an expansion of GDP and consumption.

  It is important to keep in mind that both taxation and transfer payments may also lead to liquidity effects and since they create a change in the distribution of income, their effects may differ.
- *The public deficit*: According to the pure Ricardian approach, it should not have any effect whatsoever while according to the expectations approach with finite planning horizon, it will be an indication of the need for a stabilization program which may lead to increased taxation. In addition, according to the fiscal expectations approach, the deficit constitutes a

[18] It should be made clear that a corporate tax also has an influence on consumption by way of its effect on the value of individuals' wealth (Blinder and Solow 1974).

[19] On the theoretical level, the existence of distortionary taxation eliminates the possibility of full Ricardian equivalence. However, empirically it is possible that the existence of distortionary taxation reflects only a weak deviation from Ricardian equivalence and therefore there is a need to empirically resolve the issue.

measure of the consistency of fiscal policy and therefore will either strengthen or weaken the expectations resulting from the changes in the fiscal variables (taxation or public expenditure). Thus, a reduction in taxation accompanied by a reduction in the deficit will create stronger expectations of continuity than a reduction in taxes accompanied by an increase in the deficit.

- *The public debt*: The public debt is also not meant to have any influence according to the pure Ricardian approach. Among egoistic individuals with a finite long run planning horizon, a part of the debt will be perceived as net wealth and therefore will have a positive effect on consumption. According to the fiscal expectations approach, to the extent that the debt is perceived as net wealth, the evaluation of the sustainability of the debt by individuals will also have a role.

b. Econometric methodology

The main objective of this study is to analyze the influence of fiscal variables on private consumption over time. If the relevant variables, which include private consumption and income as well as the fiscal variables, have non-deterministic trends over time (in other words, changes are not transitory but are persistent and convey past information about the series), then the best way to test the hypothesis presented above is by means of cointegration. Thus, tests will be performed on equations of the following form:

$$(6) \quad c=\lambda_0+\sum \lambda'_i X_t+\varepsilon_t,$$

where in our case X is the vector of variables which determine per capita consumption in the long run (i.e., permanent income and fiscal variables). Below we will further discuss the estimation of fiscal variables over time.

The method of estimation is based on the approach of Engel and Granger, according to which the basic test for determining the specification of a long run relation is the stationarity of the residual. Stationarity is tested using the ADF statistic. The higher the absolute value of the ADF statistic, the lower is the probability of rejecting the null hypothesis of the existence of a cointegrative relationship. Therefore, this statistic will be used to test the significance of the various specifications to be considered in this study.

In the context of causality, we rely on the theory that in the long run, in a situation of full employment, private consumption is a function of income and not vice versa and therefore private consumption is a function of exogenous policy variables and not vice versa. Nonetheless, it should be made clear that from a statistical point of view, the existence of a cointegrative relationship is not evidence of causality between fiscal variables and private consumption.[20] Furthermore, the method of cointegration tests the long run relation and therefore does not take into consideration the degree of endogeneity of the explanatory variables. This characteristic of cointegration theoretically creates the possibility of the existence of alternative transmission mechanisms which operate according to the relationship between the explanatory variables. Therefore, it is important to examine alternative macroeconomic transmission mechanisms that will allow us to determine whether the long term relation between fiscal variables and private consumption is influenced by them.

[20] Granger tests of causality are presented in the appendix.

Empirical studies have shown that consumers are affected by liquidity constraints; that there are many sources of uncertainty, such as the degree of permanence of changes in income and fiscal policies; and that there are behavioral rigidities in consumption such as habit formation. Therefore, we need to consider error correction equations of the following form which describe the short run dynamic process:

$$(7) \quad \Delta c = \omega_0 + \sum \omega_i' Y_{it} - \phi \varepsilon_{t-1} + u_t ,$$

where the vector Y can include the changes in the variables included in X (ΔX) as well as additional variables which explain the dynamic process that by definition is stationary. Inclusion of an "error correction" variable in the short run regression ensures the convergence of the short run solution to that of the long run. According to the Engel and Granger theorem, if a cointegrative relation exists then an error correction process must also exist and therefore testing the significance of the error correction coefficient can provide additional support for the existence of a cointegrative relation.

The empirical specification will be implemented in the framework of a general equation which will include all the main approaches to consumer behavior, i.e., the permanent income approach, the fiscal expectations approach and the Ricardian equivalence approach, while assuming that there exist different groups of consumers each behaving according to one of these approaches. Thus, empirical testing will determine the validity of each of the approaches and their relevance to the Israeli economy. The preferred approach will be the one with the strongest cointegrative relation as measured by the size of the ADF statistic.[21] The basic equation for the long run will therefore be as follows:

$$(8) \quad c = \alpha (yl^P + \nu) + \beta\tau + \lambda g + \theta (\text{"expectation" variables}) + \varepsilon ,$$

where c is private per capita consumption in logarithmic terms, yl^P is permanent wage income in logarithmic terms (see Equation (2) in the conceptual framework), τ is the tax rate, g is public consumption, "expectations variables" are the public deficit and public debt as indicators of the fiscal expectations approach and ε is the residual of the long run regression. Following are the results predicted by the various approaches:

- According to all the approaches $\alpha=1$.
- According to the pure permanent income approach $\beta=1$, $\theta=\lambda=0$.
- According to pure Ricardian equivalence $\lambda=-1$, $\theta=\beta=0$.
- With regard to the expectations approach, the effect of the fiscal variables is not unambiguous.

In general, when the size of the variables (relative to GDP) does not approach the range of budget imbalance that will require a stabilization program, we would expect, according to the fiscal expectations approach, that λ, θ and β, or at least one or two of the three, will be negative. In contrast, when the economy is in the region which requires a stabilization program and a delay will worsen the situation and require more drastic steps in the future, we would expect a reduction in public expenditure or an increase in taxes to have an expansionary effect on economic activity. (See below for separate tests of shorter sample periods for the Israeli economy.)

As discussed above, one might have thought the fiscal expectations approach to be relevant only in the short run since it relates to a situation of fiscal imbalance that cannot continue

[21] The critical value of the ADF statistic for the existence of cointegration is a function of the numbe r of variables. In most of the regressions presented below, it varies from 4.5 to 5.

over time. In reality, we find that this type of imbalance, at least in the Israeli economy, can last for extended periods of even up to a decade. Thus, we find that the main fiscal variables, such as public expenditure, taxation, the deficit and the public debt, as a proportion of total income are not stationary, i.e., have a unitary root, during the sample period. In other words, the fiscal variables contain information concerning the impact of fiscal instability on the economy over time. As a result, we tested them using a cointegration equation that embodies a long term relation.

Since the cointegration equation estimates the long run relation between the variables, the relation between the trends of disposable income and private per capita consumption can be treated as the permanent income effect on private consumption. This relation is well grounded in economic theory when the two variables have a unitary root and therefore provides a starting point for estimation. Furthermore, research in the US has shown that if income is omitted, an upward bias is created in the estimate of the substitution between public and private consumption (see Graham, 1993). We have chosen to use Modigliani's approach (Equation (2) in the conceptual framework), which distinguishes between labor income and income from non-human capital, for three reasons: a) This is a more accepted equation in empirical studies worldwide (see Nicoletti, 1988); b) Measurement of total income in the Israeli economy is derived from a national accounts identity and therefore is liable to create an element of identity in the relationship between the two variables; c) The explicit inclusion of wealth makes it possible to test whether government bonds have a wealth effect or not (as predicted by the Ricardian approach).

The explicit inclusion of wealth allows us to write Equation (8) in the following manner:

$$(8') \quad c = \alpha\,(yl^{P} + \rho_1 vp + \rho_2 b) + \beta\tau + \lambda g + \theta(\text{"expectation" variables}) + \varepsilon\,,$$

where *b* represents government bonds and *vp* is other wealth. In this way, we are able to test the size of the effect of public wealth as an additional method of testing the various approaches.

One of the primary fiscal variables is total taxation (as it appears in Equation (3) in the conceptual framework) and therefore we are interested in testing its impact. In the long run, its effect was not significant and only direct taxation was found to be significant in the regressions. In contrast, the effect of total taxation was found to be significant in the short run. It is possible that total taxation's lack of effect in the long run is a result of the fact that the consumption/GDP price ratio is affected immediately on the imposition of the tax and therefore the impact of the tax rate on the proportion of taxes is strongest in the short run. In the long run, there occurs a process in which indirect taxes are passed on to the consumption/GDP price ratio (according to the elasticities of demand and supply) and therefore there is no way to isolate the effect using a regression based on the proportion of taxes (which is influenced by the consumption/GDP price ratio). This may be the reason why only direct taxation is found to have an impact in the long run equations.

Following the transition to proportions of income, income itself does not appear as an explanatory variable (see Equation (5) in the conceptual framework). In other words, the equation focuses on fiscal variables only and therefore there is no fear of multicolinearity between taxation and income.[22]

[22] For the sake of brevity, we do not present the results of these tests whose results lead to similar conclusions.

In order to define λ as the rate of substitution, it is important to first confirm that causality runs from public consumption to private consumption and not vice versa. In the appendix, Granger causality tests are presented which show that in fact this is the direction of causality.

The short run relation will be tested using the error correction factor of the long run regression in order to test the effect of fiscal expansion/contraction on economic activity. The error correction factor ensures that the solution of the dynamic process in the short run will converge to the long run equilibrium. Following is the short run equation:

$$(9) \quad \Delta c = k_0 + k_1 \Delta(yl^P + \nu) + k_2 \Delta \frac{G}{I} + k_3 \Delta(\frac{fiscal\ variables}{I}) + \varepsilon_{t-1} .$$

Labor income is an endogenous variable and therefore the equations will be estimated using two stage least squares (TSLS).

According to the conceptual framework presented above, we are interested in testing the impact of the following policies: a) changes of a large magnitude in public consumption and taxation and b) permanent changes in fiscal policy variables. The definitions of these specifications are presented below and deal with each component of fiscal policy separately.[23] According to the model presented in this study, we would expect large and/or permanent changes to lead to changes in the opposite direction in private consumption in the short run.

There is also the possibility of a non-linear influence as explained above, in which case the impact of fiscal variables would take the following form:

$$(9') \quad \Delta \frac{C}{I} = k_0 + k_1 \Delta y^P + k_2 \beta_2 \Delta \frac{G}{I} + k_3 DUM \Delta(\frac{fiscal\ variables}{I}) + \varepsilon_{t-1} ,$$

where DUM represents a dummy variable for the degree of consistency in fiscal policy as manifested in the public deficit. For example, DUM will receive a value of one when a change in taxation is accompanied by a change in the deficit in the same direction and zero otherwise.

The tests are carried out on the following components of fiscal policy: public consumption, current transfer payments, total taxation and the public deficit.

Choice of the variable to represent per capita public consumption

Figure 1 presents the trends in public consumption in its various forms: total public consumption, public consumption less unilateral transfers and the two components of public consumption – defense consumption and civilian consumption.

In one of the more interesting results, per capita public consumption was found to be stationary. This means that it cannot be used as a variable in the analysis of the long run. In contrast, public consumption less unilateral transfers was found to have a unitary root and therefore will be used as one of the main variables in the short run regression. This result makes sense for tax financing since it is this component of public consumption which requires financing by taxes imposed on local taxpayers.

[23] Dahan and Strawczynski (1999) defined criterion for the identification of permanent fiscal changes on the basis of the size of the cyclically adjusted deficit of the public sector in order to test the relation between fiscal policy and inflation.

The business cycle, serial correlation and "error correction"

Care must be taken in dealing with the influence of the business cycle. For example, the change in the proportion of public consumption can result from changes in income. Therefore, we decided to remove the influence of the business cycle by running a regression of each variable on the business cycle which is defined as deviations from the trend (as calculated using the Hodrick-Prescott (HP) method). The residuals of this regression constitute the cyclically adjusted variable.

When working with proportions of income, the following steps were taken: a) the variables (private consumption, public consumption, taxation, etc.) were divided by potential income which was obtained according to the HP trend in order to achieve a common denominator; b) following this, we ran regressions of these variables on the business cycle. The residual of this equation is the cyclically adjusted variable.

In addition to these adjustments, we added the business cycle as an additional variable in the regression. If there are transitory factors incorporated in the fiscal variables, they would be offset by this variable.

In order to ensure that the relation between the change in private consumption (in logarithms or proportions) and the fiscal variables expresses a behavioral relation in the dynamic equations, two additional steps were taken:

- Serial correlation was removed by an autoregressive (AR) factor.
- The "error correction" factor was tested in all the regressions. If it was found not to be significant in a particular regression, then this meant that there was no significant relation with the long run equation. This implies that the dynamic process is problematic and that these equations should be treated with skepticism.

3. RESULTS

All the tests were performed for the sample period 1960 to 2000.

The long run

In what follows we present the principal results for the relation between fiscal variables and private consumption in the long run according to the various approaches. The results are presented in Tables 1 through 6 where each table relates to a specific issue. The basic specification includes revenues from direct taxation and public consumption. This relationship was found to be cointegrative in all versions of the equation as can be seen from Tables 1 and 2 where taxation appears as a proportion of total income and public consumption appears in real and per capita terms or as a proportion of total income. Following is a summary of the results:

a. A negative relationship was found between private and public consumption in all the specifications. About 20 percent of the total increase in public consumption is offset by a decline in private consumption (Table 1). An increase in direct taxation reduces private consumption by the full amount of the increase.[24]

[24] The detailed calculations can be found in the sub-section "Summary of the impact of public consumption and the method of financing on private consumption in the long run."

Table 1
Cointegrative Relationship between Private Consumption, Income and Fiscal Variables, 1962–2001

(standard deviations in parentheses)

	Explanatory variables[1]										Statistics		
	Wage income per capita	Wealth per capita	Net public consumption per capita[2]	Net public consumption per capita (% of income)	Taxes on wages	Taxes on wages (% of income)	Transfers per capita	Transfers (% of income)	Taxes minus transfers (% of income)	Const.			
Equations	W	V	GN	GNR	TWB	TWBR	TRD	TRDR	TWBR-TRDR		A.D.F[3]	R^2adj	D.W.
1	0.901	0.094	–0.085		–0.269		0.205			1.405	–5.46*	0.994	1.40
	(0.068)	(0.056)	(0.038)		(0.069)		(0.033)			(0.798)			
2	0.816	0.109	–0.080			–2.372		3.139		1.419	–5.41*	0.994	1.35
	(0.052)	(0.035)	(0.024)			(0.485)		(0.716)		(0.493)			
3	0.849	0.115	–0.075						–2.633	1.042	–5.68*	0.994	1.41
	(0.032)	(0.034)	(0.024)						(0.364)	(0.181)			
4	0.800	0.089		–0.334					–2.441	1.223	–5.39*	0.994	1.37
	(0.029)	(0.035)		(0.117)					(0.395)	(0.196)			

* Higher than critical value (see below); The cointegrative relationship is not rejected at five percent level.

[1] All per capita variables are calculated using logarithms, except for variables that are percent of income which are identified by the letter R.

[2] Net public consumption is defined as public consumption less unilateral transfers from abroad.

[3] Critical values for a 5 % significance levels are: 4.78 for four explanatory variables and 5.15 for five explanatory variables.

Table 2
The relevance of Taxes and Fiscal Variables in the Cointegrative Relationship, 1962–2001

(standard deviations in parentheses)

	Explanantory variables[1]						Statistics		
	Wage income per capita	Wealth per capita	Net public consumption per capita[2]	Net public consumption (% of income)	Taxes minus transfers (% of income)	Const.			
Equations	W	V	GN	GNR	TWBR-TRDR		A.D.F[3]	R^2adj	D.W.
1	0.850	0.115	–0.075		–2.633	1.042	–5.68*	0.994	1.41
	(0.032)	(0.034)	(0.024)		(0.364)	(0.181)			
2	0.793	0.105			–2.882	1.033	–3.86	0.992	1.09
	(0.030)	(0.038)			(0.399)	(0.203)			
3	0.983	–0.021	–0.112			1.573	–3.64	0.986	0.88
	(0.042)	(0.045)	(0.036)			(0.259)			
1.1	0.800	0.089		–0.334	–2.441	1.223	–5.39*	0.994	1.37
	(0.028)	(0.035)		(0.117)	(0.395)	(0.196)			
2.1	0.793	0.105			–2.882	1.033	–3.86	0.993	1.09
	(0.030)	(0.038)			(0.399)	(0.203)			
3.1	0.893	–0.041		–0.616		1.817	–4.25	0.988	1.00
	(0.034)	(0.041)		(0.154)		(0.246)			

* Higher than critical value (see below); The cointegrative relationship is not rejected at five percent level.

[1] All per capita variables are calculated using logarithms, except for variables that are percent of income which are identified by the letter R.

[2] See definition in a footnote to Table 1.

[3] Critical values for 5 % significance levels are: 4.39 for three explanatory variables, 4.78 for four explanatory variables and 5.15 for five explanatory variables.

b. The preferred fiscal variables, in a cointegrative sense, are public consumption and direct taxation (Table 2). These variables were found to be critical in the cointegrative relation with private consumption. Since omitting the taxation variable leads to a situation of no cointegrative relationship (Equation (3) and (3.1) in Table 2), the pure Ricardian approach is rejected. It is concluded therefore that the possibility that the behavior of individuals is not uniform and that there are different groups of individuals cannot be rejected. The conclusion agrees with that of Campbell and Mankiw (1989) for the US and of Lavi (1998) for Israel.

c. Rejection of the pure Ricardian approach raises the possibility that public debt constitutes net wealth for the private sector. This hypothesis was tested in Table 3. The results indicate a cointegrative relationship when we define wealth as public debt or just other wealth (*vp*). Nonetheless, the preferred result according to the ADF value is obtained when we use total wealth. These results provide significant additional evidence that reinforces the rejection of the pure Ricardian approach.

d. As explained in the conceptual framework, we are especially interested in testing the expectations approach. According to this approach, a permanent increase in the rate of public consumption without a parallel increase in taxation implies that a future tax increase will be required (see Bertola and Drazen). The best variable to represent this

Table 3
Are Government Bonds Net Wealth?

(standard deviations in parentheses)

	Explanatory variables[1]								Statistics		
	Non-public wealth per capita	Government bonds per capita	Total wealth per capita	Wage income per capita	Taxes minus transfers (% of income)	Net public consumption per capita[2]	Net public consumption (% of income)	Const.			
Equations	V-B	B	V	W	TWBR-TRDR	GN	GNR		A.D.F[3]	R^2adj	D.W.
1	–0.062	0.094		0.773	–2.005	–0.033		2.493	–4.78	0.995	1.52
	(0.060)	(0.027)		(0.040)	(0.408)	(0.027)		(0.514)			
2	0.110			0.885	–2.686	–0.086		0.884	–5.38*	0.994	1.38
	(0.040)			(0.028)	(0.412)	(0.025)		(0.260)			
3		0.070		0.800	–2.303	–0.047		1.956	–5.11*	0.996	1.50
		(0.015)		(0.035)	(0.282)	(0.021)		(0.125)			
4			0.115	0.849	–2.633	–0.075		1.042	–5.68*	0.995	1.41
			(0.034)	(0.032)	(0.364)	(0.024)		(0.181)			
1.1	–0.081	0.097		0.747	–1.888		–0.126	2.651	–4.73*	0.995	1.50
	(0.055)	(0.027)		(0.030)	(0.401)		(0.125)	(0.474)			
2.1	0.075			0.825	–2.395		–0.379	1.172	–5.16*	0.994	1.34
	(0.039)			(0.023)	(0.435		(0.119)	(0.264)			
3.1		0.065		0.759	–2.275		–0.203	1.968	–4.85*	0.996	1.45
		(0.017)		(0.028)	(0.304)		(0.110)	(0.127)			
4.1			0.089	0.800	–2.441		–0.334	1.223	–5.39*	0.994	1.37
			(0.035)	(0.028)	(0.395)		(0.116)	(0.196)			

* Higher than critical value (see below); The cointegrative relationship is not rejected at five percent level.

[1] All per capita variables are calculated using logarithms, except for variables that are percent of income which are identified by the letter R. [2] See definition in a footnote to Table 1.

[3] Critical values for 5 % significance levels are: 4.39 for three explanatory variables, 4.78 for four explanatory variables, 5.15 for five explaining variables, 5.52 for six explaining variables and 6.26 for seven explanatory variables.

Table 4
Public Sector Deficit and Consumption, 1962–2001

(standard deviations in parentheses)

	Explanatory variables[1]							Statistics		
	Wage income per capita	Wealth per capita	Net public consumption per capita [2]	Net public consumption (% of income)	Taxes minus transfers (% of income)	Public sector deficit (% of Income)	Const.			
Equations	W	V	GN	GNR	TWBR-TRDR	DEFGR		A.D.F[3]	R^2adj	D.W.
1	0.729	0.149	0.055		–2.546	–0.615	0.666	–4.64	0.995	1.20
	(0.048)	(0.032)	(1.169)		(0.325)	(0.197)	(0.201)			
1.1	0.760	0.178		0.349	–2.773	–0.679	0.437	–4.36	0.996	1.18
	(0.026)	(0.039)		(0.211)	(0.349)	(0.184)	(0.272)			
2	0.777	0.139			–2.538	–0.409	0.793	–5.18*	0.995	1.26
	(0.025)	(0.031)			(0.327)	(0.089)	(0.170)			

* Higher than critical value (see below); The cointegrative relationship is not rejected at five percent level.
[1] All per capita variables are calculated using logarithms, except for variables that are percent of income which are identified by the letter R.
[2] See definition in a footnote to Table 1.
[3] Critical values for 5 % significance levels are: 4.39 for three explanatory variables, 4.78 for four explanatory variables and 5.15 for five explanatory variables.

effect is the public debt; however, the size of the debt also has a positive wealth effect. Therefore, in Table 4 we tested the influence of the public deficit which represents the *marginal* effect of the proportion of the public debt in total income. In order to take into account the possibility of an extraordinary increase in the deficit, we used the *proportion* of the deficit in total income. We would of course expect this variable to have a negative effect. The results demonstrate that also when we omit public consumption and include the deficit, the cointegrative relationship is preserved, although the ADF statistic declines somewhat. This result is significant in view of the fact that public consumption was found to be a critical variable in all the previous specifications that were tested. When public consumption and the public deficit were both included, the substitution effect of public consumption was considerably weakened, a result which is consistent with the predictions of the fiscal expectations approach as presented above.

e. There exists an alternative hypothesis according to which the transmission mechanism that creates the substitution effect between public and private consumption does not in fact reflect the Ricardian process but rather alternative transmission mechanisms which in principle are meant to have an impact both in the short and long run. The following transmission mechanisms were tested:

• The long-run interest rate—An increase in public expenditure increases the deficit and leads to higher interest rates in the long run. This in turn has a negative effect on consumption (through the substitution effect).

• Inflation and the real exchange rate—An increase in public expenditure, under conditions of full employment, will create inflationary pressure on local prices which will in

turn lead to a real appreciation of the exchange rate. At the same time, there will be an erosion of real income (especially wages) and an increase in the import surplus which will lead to a decline in savings.

Table 3 presents the results of the following tests: Equation (1) including all the variables mentioned above; Equation (2) not including public expenditure in order to test whether the alternative transmission mechanisms have any effect; Equations (3) and (4) which tested various combinations of the transmission mechanisms described above; and finally Equation (5) which directly tested the interest rate, a widely accepted mechanism of transmission.

The two main results are as follows: a) The rate of substitution between public and private expenditure was not reduced as a result of the inclusion of alternative transmission mechanisms in the regression; b) The strength of the cointegrative relationship, as measured by the ADF statistic, declined significantly (see Equation (1) in comparison to Equation (3) in Table 1).

The overall conclusion is therefore that we can statistically reject the hypothesis that the rate of substitution between public and private consumption reflects alternative mechanisms of transmission.

Summary of the impact of public consumption and the method of financing on private consumption in the long run

In order to calculate the substitution effect in the long run, we analyze the impact of an exogenous shock to the fiscal variables using the coefficients obtained for the long run equations. The following table summarizes the effect of changes in public consumption and direct taxation on wages where column (1) is based on Equation (1) in Table 1 and column (2) is based on Equation (3) in Table 1:

The influence of an increase in fiscal variables on private consumption (percentage of the change in the fiscal variables)

Equation	(1)	(2)
Increase in public consumption	–0.19	–0.17
Increase in the tax on wages	–1.0	–1.4

Although the result reported in column (2) is based on a more cointegrative relationship and is stable even in the estimation of the alternatives, the coefficient of taxation in this equation is not reasonable, a result which persisted even when we attempted to distinguish between gross taxes and transfer payments.[25] Therefore we view the substitution effect which

[25] An attempt was also made to directly include per capita disposable income instead of all its components separately but the cointegrative relationship was on the threshold of significance and was dependent on the form in which public consumption appeared (level or proportion).

Table 5
Alternative Macroeconomic Explanations, 1962–2001

(standard deviations in parentheses)

	Explanatory variables[1]								Statistics		
Equ.	Net public consumption[2] (% of income) GNR	Return on long-run bonds RB	Real exchange rate PXPY	Inflation p	Wage income per capita W	Wealth per capita V	Taxes minus transfers (% of income) TWBR-TRDR	Const.	A.D.F[3]	R^2adj	D.W.
1	–0.252	–0.169	–0.001	–0.062	0.653	0.253	–1.500	0.859	–4.84	0.995	1.22
	(0.158)	(0.377)	(0.001)	(0.026)	(0.071)	(0.080)	(0.475)	(0.329)			
2		–0.167	–0.002	–0.055	0.591	0.313	–1.531	0.828	–4.67	0.995	1.22
		(0.386)	(0.001)	(0.026)	(0.060)	(0.073)	(0.486)	(0.336)			
3		–0.184		–0.031	0.766	0.141	–2.575	0.875	–3.45	0.993	0.91
		(0.453)		(0.029)	(0.043)	(0.065)	(0.463)	(0.395)			
4		–0.330			0.798	0.089	–2.782	1.176	–3.85	0.993	1.09
		(0.433)			(0.031)	(0.044)	(0.341)	(0.278)			
5	–0.346	–0.432			0.806	0.067	–2.294	1.417	–5.49*	0.994	1.38
	(0.117)	(0.392)			(0.028)	(0.040)	(0.415)	(0.263)			

* Higher than critical value (see below); The cointegrative relationship is not rejected at five percent level.

[1] All per capita variables are calculated using logarithms, except for variables that are percent of income which are identified by the letter R.

[2] See definition in a footnote to Table 1.

[3] Critical values for 5 % significance levels are: 4.39 for three explanatory variables, 4.78 for four explanatory variables, 5.15 for five explanatory variables, 5.52 for six explanatory variables and 6.26 for seven explanatory variables.

appears in column (1) to be the fundamental result in the context of taxation (while in the context of public consumption, the effect in both equations was reasonable and similar).

The above calculation only relates to an increase in public consumption, i.e., without the explicit inclusion of the effect of the deficit, while it was implicitly assumed that in the scenario of an increase in public consumption taxation would increase. The deficit has two opposite effects: a positive wealth effect and a negative effect resulting from the increased risk of instability (as captured in the regression by an increase in the proportion of the deficit) which is predicted by the fiscal expectations approach. When these components are explicitly taken into account (in Equation (2) in Table 4 and the conclusions drawn from Table 3 with respect to the separation of wealth into government bonds and other wealth), then the rate of substitution remains unchanged at approximately 20 percent. Furthermore, the positive wealth effect becomes negative as a result of the inclusion of the public deficit:

Effect of a deficit-financed increase in public consumption on private consumption (percentage of the increase in public consumption)

Wealth Effect	Effect of the proportion of the deficit	Total Effect
2.9	–22.1	–19.2

This result indicates that the public deficit is a good replacement for private consumption in the regression and indeed when the variables were both included, the rate of direct substitution, as expressed in public consumption in Table 4, was not significant (in comparison to that found in Table 3). It is important to mention that the coefficient of direct taxation was similar in both of the above regressions.

Ratio of complementarity between public and private consumption

Table 6 tests the hypothesis of complementarity between public and private consumption by separating public consumption into civilian and defense expenditures.[26] Our basic hypothesis is that public civilian consumption complements private consumption to a greater extent than defense consumption. In addition, we are interested in testing to what extent the substitution mechanism implies complementarity or other mechanisms such as fiscal expectations.

The results show that indeed the rate of complementarity for civilian consumption is more significant than for defense consumption. At the same time, we found that the hypothesis of complementarity does not indicate a cointegrative relationship at the 5 percent level.

When public consumption is expressed in proportions, it was found that the cointegrative relationship was significant at the 5 percent level. However, when we added the deficit, which represents the existence of a fiscal expectations mechanism, it was found that the substitution factor fell drastically (recall that this result was also found for total public consumption—see Table 4). This result indicates that the negative relationship is to a large extent due to the expectations mechanism.

The short run

The main results for the *short run* are based on the dynamic equations estimated for the long run. The lagged residual of the long run regression was used as an "error correction" factor in the short run regression. The residual was taken from the long run regression with the highest ADF statistic or, in other words, with the highest degree of cointegration. Most of the issues dealt with in the analysis of the long run were also included in the testing of the short run framework with the following results (Table 7):

- The basic equation (Equation (1)) indicated that the error correction variable is significant and therefore complements the long run equation in accordance with the Engle-Granger theorem. As in the long run estimation, two fiscal variables—public consumption and taxation of wages—were found to be significant. These results provide support for the results arrived at in the analysis of the long run.

[26] A thorough testing of the theory of complementarity for all its components is beyond the scope of the present study.

Table 6
Testing Complementarity between Private and Public Consumption

(standard deviations in parentheses)

	Explanatory variables[1]									Statistics		
	Wage income per capita	Wealth per capita	Defense government expenditure per capita	Civilian government expenditure per capita	Defense government expenditure (% of income)	Civilian government expenditure (% of income)	Taxes minus transfers (% of income)	Public sector deficit (% of Income)	Const.			
Equations[3]	W	V	GB	GC	GBR	GCR	TWBR-TRDR	DEFGR		A.D.F2	R^2adj	D.W.
1	0.967	0.171	–0.044	–0.170			–2.664		0.397	–5.08	0.995	1.40
	(0.089)	(0.039)	(0.013)	(0.070)			(–8.029)		(0.236)			
2	0.897	0.153	–0.019	–0.106			–2.552	–0.241	0.539	–5.01	0.995	1.27
	(0.100)	(0.040)	(0.021)	(0.082)			(0.336)	(0.167)	(0.252)			
1.1	0.808	0.117			–0.465	–1.110	–2.212		0.956	–6.15*	0.995	1.31
	(0.044)	(0.042)			(0.101)	(0.455)	(0.391)		(0.166)			
2.1	0.809	0.118			–0.251	–0.776	–2.252	–0.222	0.873	–5.67*	0.956	1.23
	(0.044)	(0.042)			(0.195)	(0.520)	(0.389)	(0.173)	(0.177)			

* Higher than critical value (see below); The cointegrative relationship is not rejected at five percent level.

[1] All per capita variables are calculated using logarithms, except for variables that are percent of income which are identified by the letter R.

[2] Critical values for 5 % significance levels are: 4.39 for three explanatory variables, 4.78 for four explanatory variables and 5.15 for five explanatory variables.

[3] See equations 2 and 3 in table 1 and equations 1 and 1.1 in table 4.

Table 7
Effects of Fiscal Variables[1] on Consumption:[2] Short-Run Dynamic Equations

(TSLS equations,[3] t statistics in parentheses)

	Explanatory variables (changes)															Statistics	
							Public sector deficit (% of income)[5]			Taxes on wages (% of income)[5]			Public consumption per capita				
Equations	Constant	Wealth per capita d(V)	Wage income per capita d(W)	Error-correction term[4] RES(–1)	Short term interest rate dR(–1)	Transfers (% of income)[5] d(TRDR)	Low d(DEFGRS)	Big d(DEFGRB)	Total d(DEFGR)	Low d(TWBRS)	Big d(TWBRB)	Total d(TWBR)	Low d(GS)	Big d(GB)	Total d(G)	R^2adj	D.W.
1. Average change in fiscal variables																	
a. Excluding public sector deficit	–0.017 (–1.815)	0.142 (2.035)	1.102 (7.582)	–0.581 (–3.266)		7.817 (4.405)						–2.621 (–4.212)			–0.235 (–3.966)	0.719	1.91
b. Including public sector deficit	–0.016 (–1.859)	0.137 (1.959)	1.100 (7.905)	–0.562 (–3.204)		7.550 (4.360)			–0.144 (–0.698)			–2.809 (–3.655)			–0.205 (–2.944)	0.735	1.81
2. Big and low changes in fiscal variables																	
a. Excluding public sector deficit	–0.017 (–1.829)	0.148 (1.381)	1.107 (6.721)	–0.579 (–2.920)		7.825 (4.392)				–2.287 (–0.690)	–2.710 (–2.190)		–0.197 (–1.471)	–0.244 (–3.441)		0.701	1.98
b. Including public sector deficit	–0.017 (–1.879)	0.124 (1.204)	1.090 (7.831)	–0.604 (–2.651)		7.080 (4.197)	–0.057 (–0.108)	–0.232 (–1.040)		–3.106 (–1.469)	–2.717 (–1.979)		–0.100 (–0.852)	–0.218 (–2.323)		0.711	1.76
3. Only big changes in fiscal variables																	
a. Excluding public sector deficit	–0.021 (–1.705)	0.146 (1.868)	1.053 (6.247)	–0.511 (–2.232)		7.971 (3.661)					–2.597 (–2.945)			–0.203 (–2.750)		0.648	2.03
b. Including public sector deficit	–0.018 (–1.906)	0.124 (1.479)	1.044 (7.702)	–0.540 (–2.541)		6.524 (4.070)		–0.262 (–1.416)			–2.533 (–2.150)			–0.107 (–1.463)		0.735	2.01
c. Including public sector deficit and long-run Interest rate	–0.019 (–1.985)	0.146 (1.625)	1.071 (7.740)	–0.638 (–1.985)	–0.041 (–1.676)	6.798 (3.933)		–0.427 (–1.917)			–3.018 (–2.479)			–0.124 (–1.624)		0.734	2.02
4. Big and persistent changes in fiscal variables																	
a. Excluding public sector deficit	–1.943 (–1.705)	0.099 (1.243)	1.074 (6.685)	–0.581 (–2.564)		7.664 (3.824)					–2.140 (–1.930)			–0.196 (–2.681)		0.641	2.09
b. Including public sector deficit	–0.018 (–1.838)	0.092 (1.123)	1.106 (6.743)	–0.551 (–2.487)		6.727 (4.063)		–0.332 (–1.440)			–2.877 (–1.748)			–0.126 (–1.777)		0.711	2.02

[1] The fiscal variables are cyclically adjusted.

[2] Changes in per capita consumption (in log terms).

[3] Endogenous variables: wage, income and fiscal variables. Instrumental variables: the endogenous variables with a two-year lag and some with a three-year lag, public-sector consumption, transfers and public-sector deficit, the public debt with a one- and two-year lag, private consumption with a two-year lag, wealth, short-term interest rate and the error-correction term. The short-term interest rate also appears as an instrumental variable in equations 3b and 3c in this table.

[4] Based on the residuals of equation 2 in table 1.

[5] Income is defined as total national income *plus* transfers from abroad.

- The effect of the change in the proportion of the public deficit (lagged by two years) on the change in the proportion of private consumption was negative although not significant at a level of 5 percent. The negative effect represents the expectations of future taxation among individuals with a long run, though finite, planning horizon (in accordance with the permanent income approach). When the deficit was added to the regression, it was found to be significant and in all the regressions it was found that the coefficient of substitution between private and public consumption declined somewhat.
- The beginning of the table presents the impact of the fiscal variables when the change was large and/or persistent and therefore had a higher likelihood of being permanent. The terms "large" and "persistent" are defined as follows:

  A "large" change was defined as over 2.5 percent in a given year. Sensitivity analysis was done for changes of over 1.5 percent and over 2 percent.

  A "persistent" change was defined as one in which a fiscal variable (public consumption or gross taxation) moves in the same direction (either upward or downward) for at least two years where the beginning of the move is defined such that the cumulative effect is at least five percent. In addition, a version was tested without the minimum requirement.

  An examination of the sample data (see Table 1 in the appendix which presents the data) shows that large and persistent changes in public consumption, taxation and the deficit occurred primarily in the 1970s while there were no such events in the 1990s.

  The results show that the substitution between private and public consumption in the short run is mainly the result of large changes while small changes in pubic consumption do not have a significant effect.
- The possibility of a negative relationship between private and public consumption was also tested in the short run. This would reflect the existence of alternative transmission mechanisms such as an inflationary shock, a change in the exchange rate or an increase in the rate of interest. An inflationary shock, manifested in a change in the rate of inflation, had a significant impact but did not affect the rate of substitution between public and private consumption. The influence of a change in the interest rate, whether lagged or unlagged, was not significant.

  Since this method does not ensure that there are no additional relationships, we also treated public consumption as an endogenous variable and estimated them using TSLS. Equation 2 presents the main results which show that the coefficient of public consumption, or in other words the estimate of the rate of substitution, remained unchanged.
- The wealth effect (without government bonds) was found to be significant and the effect of government bonds was found to be of a large magnitude.
- The fiscal expectations approach is based on the degree of credibility of changes in fiscal policy. Thus, for example, when taxation is reduced and the deficit increases, the expansionary impact of the tax cut on consumption is weakened or even offset completely since in addition to its direct effect, expectations are created that the tax cut cannot be maintained over time and that in the future there will be a need for an even larger tax increase in order to compensate.[27] In the opposite case, when taxes are increased and the deficit reduced, the negative effect is weakened since the stability of the economy has been

[27] Increasing the deficit increases both the internal and external debt. These developments have two negative effects: a) The continuing accumulation of debt which increases interest payments (and at high levels of debt the addition to interest payments becomes increasingly larger); b) The accumulation of debt leads to uncertainty regarding future developments in the economy.

increased and there is no fear of a higher tax increase in the future. The results of the test of this hypothesis (which are not reported here) were generally not significant; however, the number of observations was very small.
- The hypothesis was tested as to whether total taxation has an effect in the short run (beyond the influence of direct taxation). The results of this test appear in Appendix 3 and show that total taxation contains additional information beyond that conveyed by direct taxation in the short run.

4. SUMMARY AND CONCLUSIONS

This study has examined the impact of fiscal policy and its components on private consumption. Following is a summary of the results:
- Fiscal expansion through the increase of public consumption, which results in an increase in the deficit, is offset only partially in the short run by a reduction in private consumption of about 20 percent. The method of financing of the public expenditure was found to have an effect on private consumption: an increase in the direct taxation of wages has a large negative effect on private consumption equal to the amount of the tax increase. Financing with government bonds has a positive effect on the condition that the ratio of bonds to GDP does not increase. If the ratio of bonds to GDP increases, as manifested in an increase in the size of the deficit, then the influence of the debt becomes negative. In summary, fiscal expansion financed by debt increases demand in the intermediate run but in the long run, when the only method of financing is taxation, fiscal policy works to reduce demand. This last result is evidence of the existence of heterogeneity among consumers[28] and/or complementarity between public and private consumption.
- The result relating to substitution is an indication of the existence of fiscal expectations among consumers who have a finite planning horizon and are influenced by the ratio of the deficit to GDP as a possible signal of future taxation. The results, which show that government bonds have a positive wealth effect on private consumption and a negative effect on the size of the deficit, are compatible with the existence of partial substitution between public and private consumption and therefore provide support for the expectations approach.
- Fiscal policy's short run effect on economic activity is similar to its long run effect. The existence of substitution between private and public consumption primarily reflects large and persistent changes in fiscal variables.
- Tests of alternative channels which may influence the extent of the substitution between public and private consumption, such as the interest rate, inflation and the real exchange rate, showed in general that they do not have a significant impact. In none of the cases did they reduce the substitution between public and private consumption.
- Evidence was found that the extent of substitution between public and private consumption reached a peak during the period of the stabilization program and weakened thereafter (1986–2000).

[28] The fact that the sum of the reactions is greater than one may indicate that certain groups also save for crisis situations which are characterized by non-linear costs, as in Blanchard's model mentioned in the survey of the literature.

APPENDIX 1: GRANGER CAUSALITY

The causality tests are presented in the table below. The results indicate that public consumption explains private consumption and not vice versa. Thus, it cannot be claimed that the relationship is the result of the government reaction to changes in private consumption. (For example, when the proportion of private consumption is increasing, the government may reduce the rate of public consumption in order to prevent a decline in the national savings rate and in the opposite case when the rate of private consumption is declining, the government may adopt a more expansionary fiscal policy.) Another important test is that of causality between direct taxation and private consumption which indicated that there is no clear causality in either direction.

Granger Causality

Null Hypothesis	F	Probability
Private consumption does not cause public consumption	0.263	0.611
Public consumption does not cause private consumption	3.423	0.072
Private consumption does not cause the deficit	1.981	0.168
The deficit does not cause private consumption	5.983	0.019
Private consumption does not cause taxation of wages	0.409	0.527
Taxation of wages does not cause private consumption	0.116	0.736
Private consumption does not cause transfer payments	0.139	0.712
Transfer payments do not cause private consumption	0.343	0.562
Private consumption does not cause the rate of taxation	3.754	0.060
The rate of taxation does not cause private consumption	0.261	0.612

Appendix Table 1
Big[1] and Persistent[2] Changes[3]

	Public sector deficit			Tax revenues			Public sector consumption		
Year	Persistent	Big	Change	Persistent	Big	Change	Persistent	Big	Change
1961			–0.013			0.003	0.007		0.007
1962	0.012		0.012			–0.004	0.016		0.016
1963	0.013		0.013			0.000			–0.003
1964	0.004		0.004			0.010			–0.006
1965	0.017		0.017			–0.002	0.013		0.013
1966	–0.011		–0.011			0.016	0.027	0.027	0.027
1967	–0.014		–0.014			–0.009	0.044	0.044	0.044
1968	0.038	0.038	0.038	0.020		0.020			–0.004
1969	0.003		0.003	0.022		0.022	0.007		0.007
1970	0.033	0.033	0.033	0.030	0.030	0.030	0.047	0.047	0.047
1971			–0.010	0.006		0.006	–0.020		–0.020
1972	0.036	0.036	0.036	–0.013		–0.013	–0.027	–0.027	–0.027
1973	0.045	0.045	0.045	–0.042	–0.042	–0.042		0.088	0.088
1974	0.029	0.029	0.029	0.027	0.027	0.027			–0.003
1975	0.011		0.011	0.001		0.001			0.024
1976		–0.078	–0.078	0.066	0.066	0.066	–0.039	–0.039	–0.039
1977	0.013		0.013			–0.020	–0.032	–0.032	–0.032
1978	0.028	0.028	0.028	0.007		0.007			0.014
1979		–0.044	–0.044	0.025	0.025	0.025			–0.022
1980	0.026	0.026	0.026	0.009		0.009	0.026	0.026	0.026
1981	0.047	0.047	0.047			–0.016	0.016		0.016
1982	–0.052	–0.052	–0.052		0.027	0.027	–0.030	–0.030	–0.030
1983	–0.055	–0.055	–0.055	–0.018		–0.018	–0.032	–0.032	–0.032
1984		0.068	0.068	–0.070	–0.070	–0.070			0.019
1985	–0.115	–0.115	–0.115	0.053	0.053	0.053	–0.025	–0.025	–0.025
1986	–0.029	–0.029	–0.029	0.030	0.030	0.030	–0.041	–0.041	–0.041
1987	0.031	0.031	0.031	–0.004		–0.004		0.035	0.035
1988	0.014		0.014	–0.010		–0.010	–0.016		–0.016
1989	0.010		0.010	–0.029	–0.029	–0.029	–0.019		–0.019
1990			0.000			0.003			0.002
1991			–0.007			0.000			–0.008
1992			0.020			0.011			–0.010
1993			–0.005			–0.001	0.001		0.001
1994			–0.007	0.013		0.013	0.001		0.001
1995	0.016		0.016	0.012		0.012	0.017		0.017
1996	0.015		0.015			–0.011	0.007		0.007
1997	–0.017		–0.017			0.003			–0.004
1998	–0.007		–0.007			–0.004			–0.002
1999			0.003			–0.006			0.001
2000			–0.019			0.025			–0.003

[1] Higher than 2.5 percent.
[2] More than two years and more than 2 percent change.
[3] As a percent of income.

APPENDIX 2: THE EFFECT OF THE STABILIZATION PROGRAM ON THE DEGREE OF SUBSTITUTION

The Israeli economy entered a period of critical fiscal instability in the mid-1980s which was manifested in uncontrolled inflation and a balance of payments crisis. The situation necessitated a stabilization program which was initiated in July 1985. The fiscal expectations approach would predict a different pattern of behavior during this period as compared to previous periods and, in particular, that the success of the stabilization program would result in a change in the expectations of the public towards fiscal policy. Substitution between public and private consumption will occur to the extent that the changes in public consumption create expectations of future taxation. Therefore, we tested whether a change in the rate of substitution occurred during various periods before and after the stabilization program. As mentioned in the discussion of Figure 1, its behavior in the intermediate run is well described by variables that are expressed as proportions of income.[30] Therefore, in this section, we focus on regressions based on proportions of income that we claim have validity for the intermediate run. These results are presented in the tables in Appendix 3 and 3.1 (for total expenditure and net expenditure respectively).

Equation 1 presents the basic specification. The results of Equation 2, which included sub-periods before and after the stabilization program (1973-1980, 1981-1985 and 1986-2000) provide evidence of a change in the cointegrative relationship which was reflected in a higher ADF during the periods of high inflation when the relationship strengthened and a lower ADF subsequently when the relationship weakened. The inclusion of inflation (Equation 3) showed that only during the period 1986-2000 was there a significant effect which reduced the degree of substitution between public and private consumption while previous periods were characterized by an increase in uncertainty resulting from inflation. In this regression we obtained the most significant cointegrative relationship with an ADF of –6.08. The results of this regression were as follows: a) There was a decline in the basic coefficient from 0.49 to 0.36; b) Subsequent to the stabilization program, the rate of substitution between private and public consumption fell even further to 0.28 (0.36-0.08). This coefficient demonstrates that there was a significant degree of substitution following the stabilization program as well. This result likely reflects the continuing uncertainty regarding a future stabilization program or alternatively the extent of the offset resulting from the existence of altruistic individuals. It is also worth mentioning that the results in this section are compatible with one of the characteristics emphasized in the models of Bertola and Drazen and Sutherland, namely a decline in substitution between private and public substitution following a successful stabilization program which signals both a decline in the proportion of public expenditure in GDP and in the ratio of public debt to GDP.

[30] It is generally thought that variables expressed as a proportion of income are stationary in the long run. However, for the Israeli economy, all the fiscal variables expressed as a proportion of income during the sample period had a unitary root according to the ADF test.

Appendix Table 2
Middle Range Regressions for Different Inflationary Periods

(standard deviations in parentheses)

	Explaining variables (per capita, logarithmic terms, except for variables expressed in rates)													
	Wage (% of income)	Wealth (% of income)	Other Wealth (% of income)	Government bonds (% of income)	Taxes (% of income)	Public consumption (% of income)	Public consumption in 1973–80 (% of income)	Public consumption in 1981–85 (% of income)	Public consumption in 1986–2000 (% of income)	Inflation in 1981–85	Const.	Statistics		
Equations	WR	VR	VR-BR	BR	TBR	GR	GR 73–80	GR 81–85	GR 86–00	p 81–85		A.D.F[1]	AdjR[2]	D.W
1	0.622	0.015			–0.278	–0.486					0.430	–5.69*	0.782	0.96
	(0.127)	(0.008)			(0.080)	(0.089)					(0.075)			
2	0.645	0.037			–0.293	–0.321	–0.038	–0.113	0.053		0.303	–5.93	0.812	1.13
	(0.137)	(0.011)			(0.124)	(0.111)	(0.043)	(0.049)	(0.059)		(0.084)			
3	0.695	0.041			–0.357	–0.361			0.080	–0.032	0.295	–6.08*	0.841	1.17
	(0.111)	(0.010)			(0.099)	(0.092)			(0.050)	(0.010)	(0.073)			

[1] The value is higher (in absolute value) than critical value (see below), i.e, the cointegrative relationship is not rejected The 5 percent sigificance critical values for cointegration are 4.78 for four explaining variables, 5.15 for five explaining variables, 5.52 for six explaining variables, and 6.26 for seven explaining variables.

Appendix Table 2.1
The relationship between Consumption and Fiscal Variables in the Middle range

(standard errors in parentheses)

	Explaining variables (per capita, logaritmic terms, except for variables expressed in rates)													
	Wage (% of income)	Wealth (% of income)	Other Wealth (% of income)	Government bonds (% of income)	Taxes (% of income)	Net public consumption (% of income)	Net public consumption in 1973–80 % of income	Net public consumption in 1981–85 % of income	Net public consumption in 1986–2000 % of income	Inflation in 1981–85	Const.	Statistics		
Equations	WR	VR	VR-BR	BR	TBR	GNR	GNR 73–80	GNR 81–85	GNR 86–00	p 81–85		A.D.F[1]	AdjR[2]	D.W
1	0.904	0.009			–0.432	–0.323					0.310	–4.72	0.688	1.10
	(0.130)	(0.009)			(0.087)	(0.099)					(0.082)			
2	0.757	0.040			–0.375	–0.119	–0.090	–0.175	0.091		0.204	–5.10	0.750	1.14
	(0.153)	(0.015)			(0.145)	(0.117)	(0.055)	(0.067)	(0.097)		(0.090)			
3	0.886	0.046			–0.481	–0.237			0.124	–0.042	0.184	–5.37	0.797	1.33
	(0.115)	(0.013)			(0.105)	(0.105)			(0.081)	(0.011)	(0.072)			

[1] The value is higher (in absolute value) than critical value (see below), i.e., the cointegrative relationship is not rejected. The 5 percent sigificance critical values for cointegration are 4.78 for four explaining variables, 5.15 for five explaining variables, 5.52 for six explaining variables, and 6.26 for seven explaining variables.

APPENDIX 3: THE EFFECT OF TOTAL TAXATION IN THE SHORT RUN

According to the results obtained for the long run, the relevant tax variable for the specification of the long run relationship is direct taxation. As explained in the section on methodology, it is possible that this is a result of the fact that the consumption/GDP price ratio is influenced by the proportion of indirect taxation. In the long run, this taxation is passed on to the price ratio while in the short run it is possible that the consumption/GDP price ratio is affected to a greater extent. Therefore we would expect that in the short run, the proportion of total taxation in GDP (which also includes indirect taxation) is what influences private consumption while in the long run, the effect will be felt only through direct taxation.

In this appendix, we show that taking into account total taxation adds information on the behavior of private consumption in the short run. The results are presented in the Appendix table 3:

- In the basic specification of the short run regression, it was found that the coefficient of total taxation is significant and equal to about –0.75. All the rest of the coefficients in the regression remained significant.
- When large changes were distinguished from small ones, it was found that most of the effect of total taxation is related to large changes while the effect of small changes was not significant.

Appendix Table 3
Short Run Regression[1]

(TSLS equations, t statistics in parentheses)

	Explanatory variables											Statistics	
		Wage income per capita	Error correction term	Transfers (% of income)	Taxes on wages (% of income)	Taxes (% of income)			Per capita public consumption				
						Low	Big	Total	Low	Big	Total		
Equations	Constant	d(W)	RES(–1)	d(TRDR)	d(TWBR)	d(TBRS)	d(TBRB)	d(TBR)	d(GS)	d(GB)	d(G)	D.W.	R^2adj
Basic Equation	–0.013	1.256	–0.501	7.040	–2.970			–0.742			–0.236		
	(–0.947)	(4.456)	(–2.296)	(2.754)	(–3.417)			(–2.045)			(–2.296)	1.77	0.607
Big and low changes	–0.013	1.266	–0.525	6.793	–3.009	–0.630	–0.772		–0.204	–0.241			
including for taxes	(–0.953)	(4.468)	(–2.271)	(2.803)	(–3.642)	(–0.719)	(–2.245)		(–1.233)	(–2.855)		1.79	0.591
Only big changes	–0.020	1.269	–0.629	7.387	–2.803		–0.589			–0.232			
including for taxes	(–1.561)	(5.204)	(–2.586)	(3.338)	(–3.882)		(–2.141)			(–3.114)		1.97	0.632

[1]See footnotes to table 7.

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