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WORKING PAPER

Government debt, imperfect information and fiscal policy effects on private consumption.

- Evidence for 2 high debt countries -

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Abstract.

We investigate the effects of fiscal policy on private consumption in an economy with three types of utility maximizing permanent income consumers. Two consumer types are imperfectly informed about aggregate variables. While the first type knows nothing about the structure of the aggregate economy, the second only knows that the government has to respect a budget constraint. The third type is a perfectly informed consumer whose response to fiscal policy depends on the government debt level (as in Perotti, QJE, 1999). The model predicts that the effects of fiscal policy persist for several periods and become non-Keynesian at high levels of government debt. Estimation of the model for Canada and Italy, two high-debt countries, broadly confirms these predictions. The regressors used in the consumption function are generated through an estimated vector error correction model with a cointegrating vector derived from the theoretical model.

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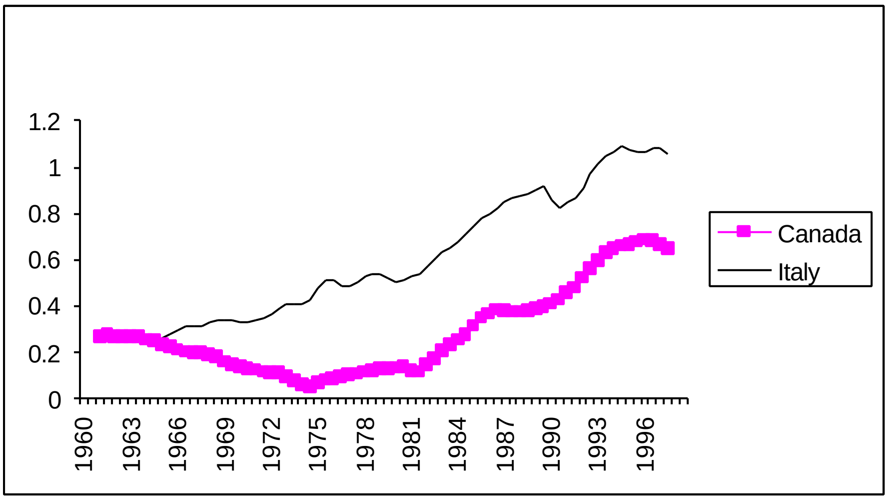
1. Introduction.

Recent literature shows renewed interest in the influence of fiscal policy on private consumption. An important fraction of this literature has demonstrated that fiscal policy effects may depend crucially on the size of government debt. At low levels of government debt the effects of fiscal policy changes may be Keynesian, whereas at high levels of government debt they may be non-Keynesian (see e.g. Blanchard, 1990; Sutherland, 1997; Perotti, 1999). Empirical support for this hypothesis has been provided by Perotti (1999), Bhattacharya (1999) and Zaghini (1999). Heylen and Everaert (2000), however, tend to reject it.

We consider a theoretical model with different types of utility maximizing permanent income consumers. One consumer type is a perfectly informed consumer whose response to fiscal policy depends on the level of government debt, as in Perotti (1999). However, unlike Perotti we do not add liquidity constrained consumers of the type discussed in Campbell and Mankiw (1990). A theoretical innovation in this paper is the introduction of utility maximizing 'imperfectly informed consumers' to the context of fiscal policy. This leads to a consumption function that is considerably different from Perotti's. Consumers with imperfect information about aggregate variables are considered in papers by Pischke (1995) and Demery and Duck (2000). Imperfect information can explain why, in contradiction with the permanent income hypothesis, private consumption is observed to be 'excessively smooth' and 'excessively sensitive' (the so-called 'Deaton paradox'). The failure of the random walk hypothesis of private consumption at the aggregate level can arise if individual income has an aggregate and an individual-specific component. The consumer cannot differentiate between both components because he or she does not know the aggregate component. If there is an innovation in aggregate income, this innovation will be partly misinterpreted as an innovation in the individual-specific component. Given that the aggregate component is more persistent than the individual-specific component, permanent income will not be adjusted appropriately and consumption will be observed to be too smooth. In the next period(s), consumers will note that the effect of income persists and will adjust consumption again so that it will appear excessively sensitive to (lagged) changes in income.

Empirically, we estimate our model for two OECD countries, Canada and Italy, where the debt to GDP ratio has increased rapidly since the mid-seventies. This can be seen in figure 1. In Italy the debt to GDP ratio has reached very high levels, even exceeding one.

Figure 1. Net debt to GDP ratio in Canada and Italy (1960:1-1997:2, semi-annual)



Source: OECD (2000).

An empirical innovation in this paper is that, unlike most other research on fiscal policy and private consumption, we take into account the long-run aspects of the data through cointegration analysis. Papers in which Euler equations are estimated often neglect the low frequency properties of the data since current variables and instruments are expressed as first differences or ratios. Other research imposes a cointegrating relationship between the variables of interest without explicitly testing whether cointegration is indeed present or whether there is more than one cointegrating relationship between the variables of interest. We also try to economically interpret the cointegrating vector(s) that we find, i.e we try to identify cointegrating vectors that are consistent with the theoretical model. One long-run implication of our model is that the government satisfies its intertemporal budget constraint. It is this long-run implication that we will test in this paper (see e.g. Hakkio and Rush 1991; Bohn 1991; Becker 1997).

Our empirical results support the existence of several types of consumers. Like Perotti we find that the effects of fiscal policy tend to become non-Keynesian at high levels of government debt, which is evidence in favour of the presence of perfectly informed permanent income consumers. Moreover we find that aggregate private consumption is excessively sensitive to (lagged) income and government expenditure changes, which suggests that some consumers may be imperfectly informed about aggregate variables (but know that the government must obey a budget constraint).

The remainder of this paper is as follows. In section 2 we discuss two imperfectly informed consumer types and briefly describe Perotti's perfectly informed permanent income consumers. In section 3 we derive an empirically testable consumption function and discuss data issues, cointegration and other methodological issues. In section 4 we present our empirical results for the consumption function for two-high debt countries, Canada and Italy. Section 5 concludes.

2. The model.

Suppose there are n consumers in the economy, each belonging to one of three consumer types. Each consumer i (i=1,…,n) lives for 3 periods t-1, t, and t+1 and maximizes a quadratic utility function subject to some budget constraint. Assuming that the real interest rate and the subjective rate of time preference are zero, we can write the change in consumption from period t-1 to t for consumer i as (see appendix A1),

(1) $\Delta c_{it} = (1/2)(E_t - E_{t-1})\left[y_{it} - t_{it} + y_{it+1} - t_{it+1}\right]$

where E_t is the expectations operator conditional on information available at time t, y_{it} is the pre-tax income of consumer i at time t and t_{it} are net taxes of consumer i at time t. Pre-tax income of consumer i can be written as the sum of aggregate per capita pre-tax income y_t and an individual-specific component. The same assumption is made for consumer i's net taxes t_{it}

(2) $y_{it} = y_t + e_{it}^y$

(3) $t_{it} = t_t + e_{it}^t$

where e_{it}^y and e_{it}^t are the individual-specific white noise. Assuming there is independence across i and a sufficiently large number of agents, these components disappear on aggregation. The following three equations describe the processes for aggregate per capita pre-tax income and government expenditures and the intertemporal government budget constraint (see Perotti 1999),

(4) $y_t = y + bg_t - l\,t_t^2 + e_t^y$

(5) $g_t = g + pg_{t-1} + e_t^g$

(6) $t_t + t_{t+1} = g_t + g_{t+1} + b_{t-1}$

Equation (4) is a simplified version of Perotti's equation (3), where g are per capita government expenditures and where $\lambda > 0$ and $\beta > 0$. The parameter λ reflects distortions on pre-tax income caused by taxes: the higher the taxes, the more pre-tax income will fall if taxes are raised. The parameter β reflects the fact that government expenditures can have a positive impact on output (as in standard Keynesian models or in classical models with endogenous labour supply). e_t^y is a stochastic disturbance with zero mean and zero autocovariances, but with a variance that need not be constant (see below). Government expenditures are assumed to be exogenous. The parameter π $(0<\pi\leq 1)$ reflects the persistence of government expenditures and e_t^g is white noise. In (6) b_{t-1} is per capita government debt at the end of t-1 (or at the beginning of t) with $b_{t-1} = g_{t-1} - t_{t-1}$ and $b_{t+1} = 0$. The latter condition is the three-period equivalent of the no-Ponzi game condition.

Suppose that a fraction of the n consumers have imperfect information in the sense that they lack information on aggregate (per capita) variables: per capita pre-tax income (y_t), per capita net taxes (t_t) and per capita government expenditures (g_t). They observe their own pre-tax income and net taxes, but they cannot differentiate between the individual-specific component of these variables and innovations in the aggregate component. In this paper we extend the idea featuring in the models by Pischke (1995) and Demery and Duck (2000) to fiscal policy. We focus on two plausible types[1] of imperfectly informed consumers: m1 consumers of type 1 have no idea at all about the structure of the economy as represented in equations (4), (5) and (6), while m2 consumers of type 2 only know that the government must obey its intertemporal budget constraint. The latter consumers thus know that equation (6) must hold even though they observe the variables in (6) with noise. Another fraction of consumers (n-

[1] Other types are possible, though less plausible.

m1-m2)/n have perfect information (type 3). We assume that per capita pre-tax income, per capita net taxes and per capita government expenditures are the same in each group, thus

$$x_t = (1/n)\sum_{i=1}^{n} x_{it} = (1/m1)\sum_{i=1}^{m1} x_{it} = (1/m2)\sum_{i=m1+1}^{m2+m1} x_{it} = (1/(n-m1-m2))\sum_{i=m1+m2+1}^{n} x_{it}$$

(where x_t can be y_t, t_t or g_t and consumers are ordered: first m1 of type 1, then m2 of type 2, then n-m1-m2 of type 3).

Consumers with incomplete information.

These consumers experience shocks without knowing the nature of these shocks. Obviously, this is problematic when they calculate their permanent income. Since individual-specific shocks are white noise (see equations (2) and (3)), they call for a small adjustment of permanent income. Aggregate shocks, on the other hand, are more persistent (see equations (4), (5) – with $\pi>0$ - and (6)) and therefore demand a larger adjustment of permanent income. Consumers who do not acquire the aggregate information will know that there is a possible aggregate persistent shock in their own innovation, though they will fail to know exactly what it is. The response of their consumption will be larger than if the shock were known to be purely transitory, but smaller than if the shock were known to be purely aggregate.

We can write (2) and (3) in first differences as

(7) $\Delta y_{it} = \Delta y_t + e^{y}_{it} - e^{y}_{it-1}$

(8) $\Delta t_{it} = \Delta t_t + e^{t}_{it} - e^{t}_{it-1}$

We assume that uninformed consumers do not know aggregate government expenditures exactly, so that we define $g_{it} = g_t + e^{g}_{it}$. Aggregate government expenditures are not observed as such, but are interpreted with noise. Call g_{it} the individual consumer's perception of g_t. The error term is white noise and disappears on aggregation over many consumers. In first differences we obtain,

(9) $\Delta g_{it} = \Delta g_t + e^{g}_{it} - e^{g}_{it-1}$

Note that the variances of e_{it}^{y}, e_{it}^{t} and e_{it}^{g} are assumed to be constant over time and across consumers. Uninformed consumers do observe Δy_{it}, Δt_{it} and Δg_{it} but not the forcing variables Δy_t, Δt_t and Δg_t. This lack of information can be incorporated in the model by solving for the Wold decomposition of Δy_{it}, Δt_{it} and Δg_{it} [2]. The Wold decomposition can be applied if Δy_{it}, Δt_{it} and Δg_{it} are covariance stationary or I(0) [3]. This gives the following equations,

(10) $\Delta y_{it} = a^{y} + q(L)h_{it}$

(11) $\Delta t_{it} = a^{t} + y(L)u_{it}$

(12) $\Delta g_{it} = a^{g} + f(L)m_{it}$

where a^y, a^t and a^g are constants. θ(L), ψ(L) and φ(L) are polynomials in the lag operator where for a variable x_t we have $Lx_t = x_{t-1}$ and where from our three-period assumption we have that these polynomials are of the first order and can be written as $q(L) = 1 + q_1 L$, $y(L) = 1 + y_1 L$ and $f(L) = 1 + f_1 L$. η_{it}, υ_{it} and μ_{it} reflect the innovations in consumer i's own pre-tax income, net taxes and perception of government expenditures. These innovations are white noise and have a variance that is constant across consumers. Thus consumers with incomplete information know equations (10), (11) and (12) and know that behind the innovations in these equations there may be aggregate shocks. However, they do not know the exact composition of these innovations (aggregate or idiosyncratic). In appendix A2 we show how to solve for the Wold decomposition for Δg_{it} (equation (12)) [4].

The parameters θ_1, ψ_1 and ϕ_1 depend on the parameters of the model (β, λ, π) and on the relative variances and thus the relative size of the aggregate and the individual-specific

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[2] The Wold decomposition applies to any covariance stationary process and states that any such process X_t can be decomposed as $X_t = m + \sum_{i=0}^{\infty} z_i u_{t-i}$ with $\sum_{i=0}^{\infty} z_i^2 < \infty$ and with $z_0 = 1$ and where u_t is white noise (see Hamilton 1994, p. 108-109)

[3] A process X_t is covariance or weakly stationary if neither the mean μ_t nor the autocovariances γ_{jt} depend on time t: $E(X_t) = m$ and $E(X_t - m)(X_{t-j} - m) = g_j$ for all t and j (see Hamilton 1994, p. 45).

[4] A formal derivation of the Wold decomposition for Δy_{it} and Δt_{it} is not feasible given the fact that the processes for t_t and t_t^2 are unknown.

shocks. The smaller the variance of the individual-specific components in equations (7), (8) and (9), the smaller (in absolute value) θ_1, ψ_1 and ϕ_1 (this can be seen simply by comparing equations (7), (8) and (9) with (10), (11) and (12)). In appendix A2 we show that $\phi_1 < 0$. Consumers are assumed to know these parameters [5].

Summarizing, we have a structural model captured by (4), (5), (6) , (7), (8) and (9), but due to lack of information on the forcing variables these equations are not used by uninformed consumers. Instead consumers of type 1 use (10) and (11) and consumers of type 2 use (10), (12) and the government constraint (6) in which variables are observed with noise.
Similarly for period t+1 we have,

(13) $\Delta y_{it+1} = \alpha^y + \theta(L)\eta_{it+1}$

(14) $\Delta t_{it+1} = \alpha^t + \psi(L)\upsilon_{it+1}$

(15) $\Delta g_{it+1} = \alpha^g + \phi(L)\mu_{it+1}$

where due to the three-period assumption all lag polynomials are of order 2.

The main requirement to apply the Wold theorem is that Δy_{it}, Δt_{it} and Δg_{it} and thus Δy_t, Δt_t and Δg_t are covariance stationary. Given (5) it will be required for Δg_t that $0 < \pi \leq 1$. Assuming that the debt level b_t is either I(0) or I(1), t_t will also be I(0) or I(1) and its first difference Δt_t will be I(0). A complication shows up if t_t is I(1). In that case t_t^2 is a non-linear function of an I(1) variable and is not necessarily strictly I(1). Similarly Δt_t^2 will not be strictly I(0). For instance, Allen (1997) shows that the first difference of the quadratic function of a variable that follows a random walk (thus an I(1) variable) is not strictly covariance stationary. Even though it has constant unconditional mean and zero autocovariances, its unconditional variance is dependent on time; it is an 'extended I(0)' variable (see Granger 1993). Given the small amount of literature on this type of variables, it seems reasonable to assume that we can interpret Δt_t^2 as such an 'extended I(0)' variable with constant mean and autocovariances that are not dependent on time, but with a time-dependent

[5] In a multi-period setting this knowledge could be the result of the observation of their own past incomes and taxes and their past perceptions of government expenditures. In our three-period setting, where there is no history to learn from, we assume this knowledge to be given.

variance. From (4) we have $\Delta y_t = b\Delta g_t - l\Delta t_t^2 + e_t^y - e_{t-1}^y$, where given that Δy_t and Δg_t are I(0) variables (thus with constant variance) and Δt_t^2 is possibly extended I(0) (with time-dependent variance), the error term e_t^y could be heteroskedastic. Let us now turn to consumption.

Proposition 1 (type 1 consumers). A fraction m1/n of the consumers are imperfectly informed about aggregate variables and do not incorporate the intertemporal budget constraint of the government. The change in per capita consumption of these m1 consumers is given by,

(16) $\Delta c_t^1 = d_1 + (b^y / q\,(L))\Delta y_t - (b^t / y\;(L))\Delta t_t$

where d_1 is a constant, $b^y = (1 + q_1 / 2)$ and $b^t = (1 + y_1 / 2)$ and where θ(L) and ψ(L) are polynomials of the first order in the lag operator. For the derivation of equation (16) we refer to appendix A3. Assuming that the lag polynomials θ(L) and ψ(L) are invertible we can write (16) as,

(16') $\Delta c_t^1 = d_1 + b^y \Theta(L)\Delta y_t - b^t \Psi(L)\Delta t_t$

where $\theta(L)^{-1}=\Theta(L)$ and $\psi(L)^{-1}=\Psi(L)$ are infinite-order lag polynomials. The fulfilment of the invertibility conditions depends on the underlying parameter values, but cannot be shown analytically, since we cannot formally derive the Wold decomposition for Δy_{it} and Δt_{it}.

Proposition 2 (type 2 consumers). A fraction m2/n of the consumers are imperfectly informed about aggregate variables but do incorporate the intertemporal budget constraint of the government. The change in per capita consumption of these m2 consumers is given by,

(17) $\Delta c_t^2 = d_2 + (b^y / q\,(L))\Delta y_t - (b^g / f\,(L))\Delta g_t$

where d_2 is a constant, $b^y = (1 + q_1 / 2)$ and $b^g = (1 + f_1 / 2)$ and where θ(L) and φ(L) are polynomials of the first order in the lag operator. For the derivation of equation (17) we refer to appendix A3. Assuming that the lag polynomials θ(L) and ϕ(L) are invertible we can write (17) as,

(17') $\Delta c_t^2 = d_2 + b^y \Theta(L)\Delta y_t - b^g \Phi(L)\Delta g_t$

where $\theta(L)^{-1}=\Theta(L)$ and $\phi(L)^{-1}=\Phi(L)$ are infinite-order lag polynomials. In appendix A2 we show that the invertibility condition for ϕ(L) is fulfilled.

As can be seen from (16) and (17), the lack of information of consumers of type 1 and 2 causes consumption to be excessively sensitive to (lags in) income (see Pischke 1995 and Demery and Duck 2000). Consumption of type 1 consumers is also excessively sensitive to (lags in) net taxes and consumption of type 2 consumers is also excessively sensitive to (lags in) government expenditures [6]. Consumption does not respond only to 'surprises' in income, net taxes and government expenditures as is the case when consumers have complete information (see below). For type 2 consumers for instance, if in period t government expenditures increase, given that g is exogenous, this will lead to a change in g_t and g_{t+1} (if shocks in g are persistent, thus if $\pi \neq 0$). When the consumer observes this, he or she will be uncertain about how much government expenditures have augmented since expenditures are observed with noise. The consumer will therefore interpret the shock only partly as a shock in aggregate g and will thus underestimate the persistence of the shock. He / she will change his/her estimate of permanent income too little. Consumption in t will adjust, but not enough. This can be seen from equation (17') where the direct change in consumption in period t due to a change in government expenditures in t depends on b^g, which equals $1+f_1/2$ with $-1<f_1<0$ (see appendix A2). As we saw earlier, the larger the variance of idiosyncratic shocks, the more negative is f_1. The reaction of type 2 consumers to aggregate shocks within the same period will then be relatively small.

In period t+1, as the shock is observed to persist, consumption will adjust fully and consumption in t+1 will appear to be excessively sensitive to changes in government expenditures (note from (4) that the change in g will also affect y_t). The intuition for income and net-taxes is similar to that for government expenditures. Given that the individual-specific

[6] Note that for period t+1 we obtain the specifications (16) and (17) written for t+1 with all polynomials of order 2 and $b^y = b^t = b^g = 1$.

component is less persistent than the aggregate component (see equations (2) and (3)), a consumer who cannot distinguish both will partly interpret an innovation to aggregate income or aggregate net-taxes (if the consumer is of type 1) as an innovation in the individual-specific component and will not adjust permanent income appropriately. In the next period(s), as the effect is observed to persist, permanent income and consumption will be adjusted again and will appear excessively sensitive to (lags in) income and (lags in) net taxes.

Consumers with complete information.

While consumers with incomplete information will use a smaller information set (equations (10), (11) and (12) instead of (7), (8) and (9)), consumers with complete information can distinguish the aggregate from the individual components and know the structure of the economy (equations (4), (5) and (6)).

Proposition 3 (type 3 consumers). A fraction (n-m1-m2)/n of the consumers are perfectly informed about aggregate variables and know the structure of the economy. The change in per capita consumption of these n-m1-m2 consumers is given by,

(18) $$\Delta c_t^3 = g^g e_t^g + g^t e_t^t + g^y e_t^y$$

where $g^g = (1/2)\big((p+1)[b - (1+2lE_{t-1}t_{t+1})]\big)$, $g^t = l(E_{t-1}t_{t+1} - E_{t-1}t_t)$ and $g^y = (1/2)$. For the derivation of equation (18) we again refer to appendix A3.

Perotti assumes that the expected path of taxes is upward sloping and assumes $E_{t-1}t_t = pE_{t-1}t_{t+1}$ where 0<p<1. From (6) we can write $E_{t-1}t_t + E_{t-1}t_{t+1} = L_{t-1}$ with $L_{t-1} = b_{t-1} + E_{t-1}g_t + E_{t-1}g_{t+1}$. Combining both results, we obtain $E_{t-1}t_{t+1} = (1+p)^{-1}L_{t-1}$ and $E_{t-1}t_t = p(1+p)^{-1}L_{t-1}$. Using these results in the expressions for γ^g and γ^t above, we obtain $g^g = (1/2)\big((p+1)[b - (1+2l(1+p)^{-1}L_{t-1})]\big)$ and $g^t = l(1-p)(1+p)^{-1}L_{t-1}$.

Thus consumers with complete information only respond to 'surprises' in government expenditures, net taxes and pre-tax income. The effect of shocks in net taxes and government expenditures on the consumption of type 3 consumers is time-varying and depends on the parameters of the model (λ, π, β) and on the expectations of future taxes. Taxes are expected to be high in the future when ‘times are bad’. That will be the case when (for a given p) the initial government debt is high or when future expected government expenditures are high. In those cases γ^g tends to become (more) negative and γ^t is more positive. Thus the effects of fiscal policy shocks become more non-Keynesian when ‘times are bad’ (captured through L_{t-1}). For more on the intuition we refer to Perotti (1999) and to appendix A3.

Aggregate per capita consumption.

We can now write the per capita macroeconomic change in private consumption as the weighted average of (16), (17) and (18),

(19) $\Delta c_t = j_1 \Delta c_t^1 + j_2 \Delta c_t^2 + (1 - j_1 - j_2)\Delta c_t^3$

where the weights $j_1 = m1/n$ and $j_2 = m2/n$ denote the fractions of the consumer types in the economy.

There are two analytical *limitations* in the theory leading to equation (19). First, given the small amount of literature on the issue, we base our analysis of the quadratic function of I(1) variables on the example of Allen (1997) who only considered the quadratic function of a *random walk* process. Second, it is assumed that all lag polynomials can be inverted. Violation of these assumptions can invalidate the model. The empirical specification we estimate in the next section is nevertheless firmly based on the intuition of the Perotti (1999) model and on the models of imperfect information (Pischke 1995, Demery and Duck 2000). It is from that point of view a useful empirical specification, regardless of possible analytical problems encountered in this section.

Other potential objections against the model are that the consumer fractions are assumed to be time-invariant and that the model does not explain why consumers can belong to different types. It would seem logical to assume that consumers with a high income can acquire more information than low-income consumers. This possibility is ruled out a priori however since it is assumed that aggregate per capita income in each of the three consumer groups is the same.

3. Methodology.

3.1 A testable consumption function.

Since it is not feasible to derive a testable consumption function from the model given the three-period assumption, we use a specification which captures the intuition of the model.

We know that type 3 consumers react only to *current shocks* in government expenditures, net taxes and pre-tax income. Moreover their reaction to shocks depends on 'initial conditions' as captured by L_{t-1}. From proposition 3 we know that the presence of type 3 consumers implies that the effects of government expenditure shocks and tax shocks tend to become less Keynesian as L_{t-1} increases. L_{t-1} is the government debt b_{t-1} augmented with the discounted sum of future expected government expenditures. To test the model an empirical equivalent of L_{t-1} , say l_{t-1}, should be constructed. A problem is that 1) the calculation of this sum of discounted streams is not evident (given large standard errors on forecasts of government expenditures far into the future) and 2) this quickly makes the value of government debt irrelevant in l_{t-1}. Since in this paper we want to highlight the role of government debt as an initial condition and since we work with two high-debt countries, we test the model by using government debt b_{t-1} instead of l_{t-1}.

We know that at the aggregate level type 1 consumers react to current and lagged changes in pre-tax income and net taxes, type 2 consumers react to current and lagged changes in pre-tax income and government expenditures [7]. Thus type 1 and type 2 consumers respond to *current shocks*, to *forecastable current changes* and to *lagged changes* in income, taxes and government expenditures. Since the reaction to *current shocks* is what type 1 and 2 consumers have in common with type 3 consumers, we should be able to identify the presence of types 1 and 2 by looking at *forecastable current changes* and *lagged changes in income*, taxes and government expenditures. We use a specification where *current changes* in income, net taxes and government expenditures are decomposed into *forecastable current changes* and *current shocks* (see Perotti 1999). To identify the presence of type 3 consumers, we can use the fact that these consumers' reaction to current shocks depends on the level of government debt and

[7] From the model, strictly speaking, an infinite distributed lag function of Δy_t , Δt_t and Δg_t should be included in the consumption function (20), which is not feasible. We thus test the model by looking at q significant lags.

becomes less Keynesian as the debt level rises [8]. We then estimate the following consumption function,

$$
\begin{aligned}
(20)\quad \Delta c_t = {} & r_0 + r_1 E_{t-1}\Delta t_t + r_2 E_{t-1}\Delta g_t + r_3 E_{t-1}\Delta y_t + r_4 e_t^t + r_5 b_{t-1} e_t^t \\
& + r_6 e_t^g + r_7 b_{t-1} e_t^g + r_8 e_t^y + \sum_{j=1}^{q} d_j^t \Delta t_{t-j} + \sum_{j=1}^{q} d_j^g \Delta g_{t-j} + \sum_{j=1}^{q} d_j^y \Delta y_{t-j} + e_t^c
\end{aligned}
$$

where we have added an error e_t^c which represents transitory consumption or a preference shock. If the fraction of type 3 consumers is sufficiently large, the initial debt ratio should play a role in the effects of fiscal policy and we should find $\rho_5>0$ and/or $\rho_7<0$. If type 1 and/or type 2 consumers are present, the coefficients on $E_{t-1}\Delta t_t$, $E_{t-1}\Delta g_t$, $E_{t-1}\Delta y_t$ and on the q lags of Δy_t, Δg_t and Δt_t should be jointly significant. If type 1 consumers are present, the coefficients on $E_{t-1}\Delta t_t$ and on the q lags of Δt_t should be jointly significant. If type 2 consumers are present, the coefficients on $E_{t-1}\Delta g_t$ and on the q lags of Δg_t should be jointly significant. First we need to determine the number of lags q in (20).

In section 3.2 we discuss data issues. In section 3.3 we go into the construction of the variables to be used in (20) and in 3.4 we discuss the estimation problems we encounter with (20). Section 4 contains our estimation results.

3.2 Data issues.

We use semi-annual data, taken from OECD (2000/1), for Italy (1960.1 – 1997.2) and Canada (1961.1 – 1997.2). The reason why we do not use quarterly data is that we have no appropriate quarterly series for net government debt and for government investment for both countries. For pre-tax income y we use GDP at market prices, for government expenditures g the sum of government consumption and investment and for net taxes t the difference between government expenditures and the deficit of the government. For c we use aggregate

[8] When decomposing Δy_t as $E_{t-1}\Delta y_t + (\Delta y_t - E_{t-1}\Delta y_t)$ for consumer types 1 and 2 we would find that $\Delta y_t - E_{t-1}\Delta y_t$ equals $be_t^g - 2lE_{t-1}t_t e_t^t$, so that the effect of tax shocks depends on the debt level for these consumers as well. However, unlike the reaction of type 3 consumers, the higher the debt level the more these consumers decrease consumption after a positive tax shock. To identify type 3 consumers we thus must have a sufficient number of these consumers so that on average positive tax shocks have more non-Keynesian effects as the debt level rises.

consumption. The construction of these variables is similar to that in Giavazzi, Jappelli and Pagano (1998).
All variables are in real per capita terms. The deflator is the GDP deflator. Semi-annual population data are constructed by dividing the data for the population between 15 and 64 years of age (which are available on a semi-annual basis) by the ratio of the population of 15-64 to total population, which can be calculated on a yearly basis. For b we use the net government debt to GDP ratio. All government data refer to general government. All variables are seasonally adjusted[9].

The reason for using net government debt is that gross debt will misrepresent the real sustainability of the government's financial situation. Rational consumers can be expected to take into account the possibility that many governments can liquidate assets (quickly) to settle the debt.
From a theoretical viewpoint it would probably be more appropriate to use a different proxy for pre-tax income, namely 'national disposable income' (as defined in the National Accounts statistics from OECD). This concept gives a more complete picture of income since it includes net factor incomes and net transfers received from abroad. However, it is not possible to construct this concept on a semi-annual basis. Therefore we proxy pre-tax income by GDP [10].

3.3 Generating the regressors.

To obtain the regressors to be used in the estimation, we need forecasting equations for the change in y, g and t, which will allow us to decompose the change in y, g and t into a forecastable part and a white noise part [11]. Both parts are then used in the estimation of the consumption change (20)[12]. We start by estimating the following unrestricted four-dimensional[13] VAR of order q',

[9] Codes. aggregate consumption – CPAA; pre-tax income – GDP; government expenditures – CGAA+SAVG-NLG; net-taxes – SAVG+CGAA; deflator – PGDP; population – POPT; net government debt – GNFL. For Italy the government debt series starts later than the first sample point (in 1964.1).
[10] Other studies that proxy pre-tax income through GDP include Becker and Paalzow (1996) and Evans and Karras (1996, 1998).

[11] Note that from the model it is not certain whether e_t^y is white noise. We ignore this in the empirical analysis.
[12] Usually in the literature only lagged stationary *changes* of the relevant variables are used as 'instruments' or forecasting variables (see most Euler equation studies). This basically assumes that there is no cointegration

(21) $X_t = A_0 + \sum_{i=1}^{q'} \Pi_i X_{t-i} + \Phi D_t + e_t$

where $X_t = (c_t, y_t, g_t, t_t)$ is a data vector, A_0 is a constant, D_t contains dummy variables and ε_t is a 4-dimensional Gaussian vector white noise process (where the errors can be contemporaneously correlated). We let the constant enter unrestricted to allow for a linear time trend in the data. Further, the dummies enter unrestricted to allow for breaks in the linear time trend. The results are presented in table 1. Using system reduction tests and multivariate and univariate tests for normality and autocorrelation, we (almost) have serially uncorrelated Gaussian errors for Canada when q'=3 and for Italy when q'=5. For Canada no dummies are included, for Italy two dummies are included to take into account the crises in the seventies and nineties [14].

To determine the number of cointegrating vectors we use standard tests (trace, max) for cointegration (Johansen 1988, 1991), which are based on the estimated eigenvalues of the matrix $\Pi = I - \sum_{i=1}^{q'} \Pi_i$ (which contains the long-run information). The results can be found in table 1. For Canada these tests suggest that there is at least one cointegrating vector (but not more than one). For Italy we use dummies, so the critical values for these tests are not correct. An alternative approach (see Johansen 1995) is then to determine the number of cointegrating vectors r by looking at the eigenvalues of the process for the unrestricted VAR and the VAR under different restrictions for r (i.e the roots of the companion matrix). For Canada this approach suggests r=0 or r=1. If we assume that r=1, the results in table 1 suggest that the

between the variables. Obviously, if there is cointegration, using only lagged changes of the relevant variables leads to specification errors and loss of long-run information.

[13] The reason why we include four variables, instead of only y,g and t (the variables we need to generate regressors from) is that to forecast the change in income for instance, using past consumption makes sense. According to the permanent income hypothesis current consumption summarizes the individual's information about future income (see Campbell and Mankiw, 1990).

[14] For Canada we include no dummies since there are no interpretable outliers. The univariate normality tests suggest that the errors of the VAR are normally distributed with the exception of g where some excess kurtosis is present. The multivariate test for normality however is not able to reject normality. Further, the hypothesis of no autocorrelation in the errors cannot be rejected. For Italy two dummies DUMSEVEN and DUMNINE (table 1) are included to remove outliers from the recessions in the early-mid seventies and nineties. The resulting errors show no autocorrelation, though normality seems to be violated for t due to excess kurtosis. Since this is not due to interpretable outliers and since the multivariate test for normality does reject normality at the 10% level, but not at the 5% level, we proceed with estimation.

adjustment to long-run equilibrium is very slow. For Italy the probability that r=0 seems to be even larger.

The long-run relationship we focus on in this paper is whether or not the government's intertemporal budget constraint is satisfied (see equation (6) in the model). This implies testing whether the no-Ponzi game condition is violated. With a positive interest rate and in a multi-period context, this condition is $\lim_{j\to\infty} \frac{b_{t+j}}{(1+r)^j} = 0$. It is satisfied if the growth rate of the debt is lower than the real interest rate. Hakkio and Rush (1991) argue that if we find that g and t are I(1) empirically and are cointegrated with cointegrating vector (1, -1) – a stationary deficit / surplus - we cannot reject that the intertemporal budget constraint is satisfied. Becker and Paalzow (1996) and Becker (1997) consider a four variable model with variable vector (c, y, g, t) – where c, y, g and t are defined as above. They argue that if a cointegrating vector of the form (0, 0, 1, -1) cannot be rejected, it cannot be rejected that the government intertemporal budget constraint is satisfied. Note that if we reject that (0, 0, 1, -1) is in the cointegrating space, it does not necessarily imply that the intertemporal budget constraint is violated. If the government has a non-stationary *surplus*, there is no problem. If the government *deficit* is non-stationary it means that the government will have to change its policy in the future if it wants to satisfy intertemporal budget balance.

In table 1 we test the null hypothesis that (0, 0,1, -1) is in the cointegrating space for both Canada and Italy using a standard likelihood ratio test (distributed χ^2 (3) since imposing r=1 implies there are no identifying restrictions and 3 *overidentifying* restrictions). For Canada intertemporal budget balance cannot be rejected. As expected, the speed of adjustment parameters suggest that adjustment to equilibrium is very slow. For Italy we reject that (0,0,1,-1) is in the cointegrating space. Since we cannot interpret a cointegrating vector for Italy if we assume r=1 (we also reject potential consumption-income relationships etc…), we impose r=0. For Italy we thus generate our regressors through a VAR in first differences. For Canada the cointegrating vector makes economic sense, so we assume r=1 and we estimate a restricted VECM (vector error correction model) with the theoretical cointegrating vector (0,0,1,-1) imposed.

For Italy dummies are used and there are two possible approaches. Either the terms containing dummies are taken as a part of the errors or they are taken as a part of the anticipated changes.

Table 1. Results of estimating (21) and applying Johansen's (1991, 1995) cointegration tests for Canada (1961:1-1997:2) and Italy (1960:01-1997:2).

System reduction tests(not reported): suggest q'=5 for Italy and q'=2 for Canada.

Multivariate and univariate diagnostic tests: suggest q'=5 and two dummies (DUMSEVEN,DUMNINE) for Italy and q'=3 and no dummies for Canada.

> all results hold with q'=3 for Canada and with q'=5 for Italy.

Multivariate tests [a]	**Canada**				**Italy**			
Autocorrelation (order 2)	F(32,174)=1.025 (0.439)				F(32,138)=0.822 (0.736)			
Autocorrelation (order 4)	F(64,154)=1.005 (0.478)				F(64,115)=1.325 (0.095)			
Normality [b]	χ^2 (8)=12.342 (0.137)				χ^2 (8)=14.62 (0.067)			
Univariate tests	**Canada**				**Italy**			
	c	**y**	**g**	**t**	**C**	**y**	**g**	**t**
Normality [b]	χ^2 (2)=5.346	χ^2 (2)=0.775	χ^2 (2)=6.778	χ^2 (2)=1.989	χ^2 (2)=0.616	χ^2 (2)=3.788	χ^2 (2)=4.823	χ^2(2)=6.432
	(0.069)	(0.679)	(0.034)	(0.370)	(0.735)	(0.150)	(0.089)	(0.040)
Excess Kurtosis	1.011	-0.309	1.317	0.393	-0.401	0.704	0.320	1.115
Skewness	0.400	0.224	0.555	0.096	-0.178	0.110	0.611	0.259
Cointegrating rank tests	**Canada**				**Italy**			
Eigenvalues Π	0.266	0.214	0.120	0.001	0.366	0.237	0.061	0.013
Trace [c]	48.27**	26.30	9.18	0.11	57.16	24.73	5.48	0.98
Max [c]	21.97*	17.12	9.07	0.11	32.43	19.25	4.50	0.98
Eigenvalues of Companion matrix (largest 4 ordered)	**Canada**				**Italy**			
	r=3	r=2	r=1		r=3	r=2	r=1	
	1.008	1.000	1.000		1.009	1.008	1.000	
	1.008	1.000	1.000		1.000	1.000	1.000	
	1.000	0.940	1.000		0.952	0.922	1.000	
	0.704	0.940	0.861		0.952	0.950	0.891	
Test to determine whether (0,0,1,-1) with variable vector (c,y,g,t) is in the cointegrating space.								
	Canada				**Italy**			
r=1: Likelihood ratio test [d]	χ^2(3)=4.503 (0.212)				χ^2(3)=27.730(0.000)			
	c	y	g	t				
Speed of adjustment parameters [e]	-0.012	-0.136	-0.056	-0.107				
	(0.028)	(0.056)	(0.025)	(0.038)				

Notes: For Canada no dummies are included. For Italy we work with two dummy variables. DUMSEVEN equals 1 in 73.1-75.1 and DUMNINE equals 1 in 91.2-93.1. [a] For the multivariate autocorrelation test we conduct a LM test (the null is no autocorrelation). We report the F-form of the test with p-value between brackets, since Doornik (1995) shows that the F-approximation behaves significantly better in small samples than the χ^2 form, without loss of power. [b] For the multivariate and univariate normality test (where the null is normality) we report the χ^2 statistic with p-value between brackets. [c] Significance of the trace and max test are denoted with * (10%) or ** (5%) only if no dummies have been used in the estimation of the VECM. For Italy, the critical values are no longer correct and we only look at the roots of the companion matrix. [d] The likelihood ratio test (only for Canada) is distributed χ^2 with degrees of freedom equal to the number of overidentifying restrictions with p-value between brackets. As r=1 the long run is identified and no identifying assumptions have to be imposed. Testing the vector (0,0,1,-1) then imposes 3 overidentifying restrictions. [e] Speed of adjustment parameters are reported with standard errors between brackets.

The former approach assumes that crises are not predictable and remain so, while the latter approach assumes that agents could forecast the crises in the seventies and nineties. This is rather unlikely at the beginning of the crisis, but not after some time given that a crisis lasts several periods. We report the results for both approaches.

3.4 Estimation of the consumption function.

Once we obtain the anticipated and unanticipated parts of the change in y, g and t from the estimated VECM, we can estimate the consumption function. Pagan (1984) argues that regression equations like (20) with generated regressors can be estimated in two steps: after generating the regressors as explained above, the change in consumption Δc_t is regressed on the regressors by OLS. OLS delivers *consistent parameter estimates*[15] as long as 1) the variables $E_{t-1}\Delta t_t$, $E_{t-1}\Delta g_t$, $E_{t-1}\Delta y_t$ and the q lags of Δy_t, Δg_t and Δt_t are uncorrelated with e_t^c and 2) the variables e_t^y, e_t^g and e_t^t are uncorrelated with e_t^c within the same period. The first condition is true by construction since the fitted values were constructed using data until t-1 and the actual values of the q lags in Δy_t, Δg_t and Δt_t start in t-1. The second condition cannot be tested but must be imposed to identify the model (see Muellbauer 1983, Bean 1986). The interaction terms (with b_{t-1}) will be uncorrelated with e_t^c, since the debt ratio is measured at the beginning of t [16].

There could be some contemporaneous correlation 1) between the constructed variables e_t^y, e_t^t and e_t^g, 2) between the constructed variables $E_{t-1}\Delta t_t$, $E_{t-1}\Delta g_t$, $E_{t-1}\Delta y_t$ and 3) between Δy_{t-j}, Δg_{t-j} and Δt_{t-j} (for j=1,…,q). The reason for this is that fiscal policy will most likely respond to changes in the economy within the period, partly through discretionary measures and partly through cyclical developments. On the other hand, the economic environment will also respond to changes in fiscal policy. Therefore we report the correlations between these variables. We find that for Canada, the above correlations are high for taxes and pre-tax income. Taxes are influenced both by cyclical developments and by discrete policy measures. Conversely, they influence the economic environment (unless Ricardian equivalence holds).

[15] From Pagan (1984 – model 4) OLS standard errors on the surprise terms will be correct; those on the fitted values will be underestimated however. We do not know of any papers discussing the consequences of interacting the generated regressors with other variables and discussing the consequences of adding lags as well.
[16] The interaction terms are stationary. Their explanatory power does not stem from the debt ratio alone since the coefficient on bt-1, if bt-1 is added to the estimated regression as a separate regressor, is not significant.

To limit potential problems of multicollinearity we construct a cyclically adjusted tax shock $\tilde{e}_t^t$, a cyclically adjusted anticipated tax change $E_{t-1}\Delta\tilde{t}_t$ and cyclically adjusted tax changes $\Delta\tilde{t}_{t-j}$ (j=1,…q). This cyclical adjustment is explained in appendix B. Note that since the cyclical correction is based on OECD *simulated* tax elasticities, potential measurement error in the cyclically adjusted variables may be less problematic in terms of measurement error than if the correction were based on *estimated* elasticities. For Canada we report the results with the use of cyclically adjusted tax variables. For Italy, we use cyclically unadjusted tax variables since the correlations between taxes and pre-tax income here is low.

To determine the number of lags q in (20) we start by adding sufficient lags and eliminate terms through the use of a Wald test. We then look whether the reduced equation performs better in terms of the Schwarz criterion. If this is the case, we maintain the reduction and see whether we can reduce it further. We do not reduce beyond q=1. This leads to the choice q=1 for both Italy and Canada. To test the joint significance of parameters in (20) to determine the presence of type 1 and/or type 2 consumers, we also use a Wald test.

4. Results.

The results of estimating (20) for Canada and Italy are presented in table 2. For Canada we present the results using cyclically adjusted tax shocks and (anticipated) tax changes. The results without cyclical adjustment are similar, though the significance of the estimates is generally lower (unreported). For both Canada and Italy there are indications that type 3 consumers are present since we find $\rho_5 > 0$ for both countries. It thus seems that when the debt ratio rises, tax shocks get unconventional non-Keynesian effects on private consumption. In the model these effects can only be triggered by perfectly informed type 3 consumers. The effects of tax shocks seem to switch as the net debt to GDP ratio approaches the threshold of about 30% for Canada and 60 % for Italy (though the latter number is tentative given the insignificance of ρ_4 for Italy). Though the 30% threshold for Canada may seem rather low, using an entirely different framework Bhattacharya (1999) has found a critical value for the debt ratio, beyond which Keynesian effects turn to non-Keynesian, of about 30% (in a panel of 12 OECD countries). We find a similar, though insignificant effect for government expenditures in Canadian data. For Italy we find that ρ_7 is insignificant and has the wrong

Table 2. Results of estimating (20) with semi-annual data for Canada (1961:1-1997:2) and Italy (1960:1-1997:2).

	Canada **(q=1)**	Italy **(q=1)**	
Coefficient / Variable		**Results 1**	**Results 2**
ρ1 / $E_{t-1}\Delta t_t$ [a]	-0.475	0.076	0.007
	(0.308)	(0.156)	(0.162)
ρ2 / $E_{t-1}\Delta g_t$	-0.373*	-0.459**	-0.450**
	(0.194)	(0.212)	(0.192)
ρ3 / $E_{t-1}\Delta y_t$	0.535**	0.289**	0.329**
	(0.155)	(0.111)	(0.114)
ρ4 / e_t^t [a]	-0.327**	-0.494	-0.719
	(0.148)	(0.380)	(0.525)
ρ5 / $e_t^t b_{t-1}$ [a]	1.053**	0.806*	1.119*
	(0.427)	(0.447)	(0.619)
ρ6 / e_t^g	0.272	-0.236	-0.119
	(0.249)	(0.539)	(0.477)
ρ7 / $e_t^g b_{t-1}$	-0.592	0.510	0.413
	(0.627)	(0.680)	(0.587)
ρ8 / e_t^y	0.297**	0.254**	0.271**
	(0.059)	(0.080)	(0.080)
d_1^t / Δt_{t-1} [a]	0.031	-0.116	-0.088
	(0.078)	(0.112)	(0.115)
d_1^g / Δg_{t-1}	0.117	0.203	0.276*
	(0.129)	(0.154)	(0.160)
d_1^y / Δy_{t-1}	-0.077	0.096*	0.112**
	(0.060)	(0.056)	(0.054)
R^2adj.	0.407	0.427	0.427
DW	2.063	1.985	2.057
BG(1)	0.519	0.949	0.819
Wald tests			
Γ_1	0.304	0.526	0.520
Γ_2	0.090	0.052	0.043
Γ_{1+2}	0.002	0.000	0.000
Correlations			
$\Delta t_t - \Delta y_t$	0.629	0.197	0.197
$E_{t-1}\Delta t_t - E_{t-1}\Delta y_t$	0.838	0.202	0.186
$e_t^t - e_t^y$	0.508	0.214	0.172
$\Delta\tilde{t}_t - \Delta y_t$	0.367		
$E_{t-1}\Delta\tilde{t}_t - E_{t-1}\Delta y_t$	0.687		
$\tilde{e}_t^t - e_t^y$	0.215		

Notes: [a] estimation results for Canada are with cyclically adjusted tax variables. For Italy Results 1 (Results 2) apply to the case where the regressors are generated by including the dummies DUMSEVEN and DUMNINE in the shocks (in the antcipated changes) – see section 3.3. Newey-West standard errors between brackets. * (**) denotes significance at 10 % (5%) level. DW is the Durbin Watson statistic. BG(1) denotes the p-value of a Breusch-Godfrey test for autocorrelation of order 1 (the null is no autocorrelation). Γ_1 is the p-value of a Wald test of the null hypothesis that there are no type 1 consumers, i.e a test of $r_1 = d_1^t = 0$. Γ_2 is the p-value of a Wald test of the null hypothesis that there are no type 2 consumers, i.e a test of $r_2 = d_1^g = 0$. Γ_{1+2} is the p-value of a Wald test of the null hypothesis that there are no type 1 and type 2 consumers, i.e a test of $r_1 = d_1^t = r_2 = d_1^g = r_3 = d_1^y = 0$.

sign. These results for the perfectly informed permanent income consumer are in line with the model by Perotti, at least as far as the reaction to tax shocks is concerned.

It seems that a model with only type 3 consumers (responding to current shocks only) would not be describing the data very well since we cannot reject that consumption also responds to anticipated changes in pre-tax income and to anticipated government expenditures. Moreover, for Italy, there seems to be a response to a one-period lagged income change as well. The additional consumers we present in this paper can explain these findings better than the additional liquidity constrained consumer in Perotti's model whose change in consumption is equal to the change in disposable income. The latter consumer type would respond to anticipated income and anticipated tax changes but not to anticipated changes in government expenditures nor to lagged income changes.

In table 2 we report the p-values of three Wald tests of the null hypothesis that type 1 and/or type 2 consumers are absent. For both Canada and Italy we strongly reject the absence of both type1 and type 2 consumers. Stated differently, we strongly reject that there are only type 3 consumers (who respond to current shocks only). For both Italy and Canada we cannot reject that there are no type 1 consumers, i.e consumers who are imperfectly informed and have no idea of the government budget constraint. On the other hand, we do reject the absence of type 2 consumers for both countries at the 10% level of confidence (in all the results). Based on these tests we tend to conclude that some consumers are imperfectly informed about aggregate variables, although they are aware of the financing decisions of the government. It is tempting to link this to the debt problems in these countries, though this is not captured by the model since the model assumes time-invariant consumer fractions.

Somewhat problematic for this conclusion is, however, that for Canada no lagged changes enter the regression in a significant way. This could be due to estimation problems because the anticipated changes in taxes, income and government expenditures are constructed with (and thus correlated with) lagged changes in income, taxes and government expenditures. It could also be that most of the adjustment occurs immediately after the shock, for instance in the 3 months after the shock. In that case quarterly data would be more useful to capture the adjustment. Due to limited data availability we must work with semi-annual data however.
If we exclude these possibilities, the absence of lagged variables in (20) implies that in the periods after a shock there is no or not much adjustment anymore. Thus it could be that the

significance of the parameter on the anticipated government expenditure change ($\rho_2 < 0$) is not the result of the presence of type 2 consumers but is caused by something different, for instance, private consumption and government expenditures being Edgeworth substitutes (see Karras 1994, Evans and Karras 1996, 1998). In this case Canadian data could be described by Perotti's model augmented with the possibility of an Edgeworth relationship. The same cannot be said for Italy however, where lagged income changes do seem to play a role.

Note that we have assumed so far that the error in (20) e_t^c is not autocorrelated. However, due to for instance time aggregation problems or durable consumption issues (see Campbell and Mankiw 1990), it could be that the error has autocorrelation of the MA(1) form. To avoid inconsistent estimation it would then be necessary to construct the anticipated changes in pre-tax income, net taxes and government expenditures (see section 3.3) using data from t-2, t-3,… and not from t-1,t-2,…. Patterson and Pesaran (1992) suggest that to avoid a loss of quality in the forecasted variables by using this reduced information set, the first-order MA process in the error can be estimated parametrically. We thus add an MA(1) term to (20) and test the significance of its coefficient. It is not significant for both countries. Moreover the Breusch-Godfrey test for serial correlation cannot reject the null hypothesis of no autocorrelation of order 1. This confirms that the procedure used in section 3.3 is correct and that the estimates should be consistent.

5. Conclusions.

We model an economy consisting of three types of consumers: (i) consumers who are imperfectly informed about aggregate variables and who do not incorporate the government budget constraint (ii) imperfectly informed consumers who pierce the government veil (iii) fully informed permanent income consumers. The reaction of the latter type to fiscal policy depends on the level of government debt.

We have indications that in Canada and Italy, two high-debt countries, type 2 and type 3 consumers may be present. The presence of type 3 consumers is derived from the fact that the level of government debt influences the effects of fiscal policy (mainly the effects of tax shocks) in both countries. The likely presence of other consumers than type 3 is derived from the fact that consumption in both Canada and Italy is excessively sensitive to current income and government expenditures. We find that the results in Italy are more in line with our model of imperfectly informed consumers than the results in Canada, although the absence of type 2 consumers can be rejected for both countries.

A final result is that we cannot reject intertemporal budget balance for the government in Canada, though adjustment to equilibrium seems very slow.

References.

Allen, C. (1997). A Supply-Side Model of the UK Economy: an application of non-linear cointegration. In Allen, C. and Hall, S., editors, Macroeconomic modelling in a changing world, pages 169-198. John Wiley & Sons.

Bean, C.R. (1986). The estimation of 'surprise' models and the 'surprise' consumption function. Review of Economic Studies LIII :497-516.

Becker, T. (1997). An investigation of Ricardian Equivalence in a common trends model (1997). Journal of Monetary Economics 39 : 405-431.

Becker, T. and Paalzow, A. (1996). Real effects of budget deficits : theory and evidence. Swedish Economic Policy Review 2 :343-383.

Bohn, H. (1991). The sustainability of budget deficits in a stochastic economy. Journal of money, credit and banking 27 : 257-271.

Bhattacharya, R. (1999). Private sector behaviour and non-Keynesian effects of fiscal policy. IMF Working Paper 99/112.

Blanchard, O.J. (1990). Comment on Giavazzi and Pagano. In Fischer, S., editor, NBER Macroeconomics Annual 1990, pages 111-116. MIT Press, MA, USA.

Campbell, J.Y. and Mankiw, G.N. (1990). Permanent income, current income and consumption. Journal of Business and Economic Statistics, 8 : 265-279.

Demery, D. and Duck, N.W. (2000). Incomplete information and the time series behaviour of consumption. Journal of applied Econometrics 15 : 355-366.

Evans, P. and Karras, G. (1996). Private and government consumption with liquidity constraints. Journal of international money and finance 15(2) : 255-266.

Evans, P. and Karras, G. (1998). Liquidity constraints and the substitutability between private and government consumption : the role of military and non-military spending. Economic Inquiry XXXVI : 203-214.

Giavazzi, F. and Pagano, M. (1995). Non-Keynesian effects of fiscal policy changes : international evidence and the Swedish experience. NBER Working Paper, number 5332.

Giavazzi, F., Jappelli T. and Pagano, M. (1998). Searching for Non-Keynesian effects of fiscal policy. Unpublished manuscript.

Granger, C.W.J (1993). Modelling non-linear relationships between long-memory variables. Manuscript.

Hakkio, C.S. and Rush, M. (1991). Is the budget deficit too large ? Economic Inquiry XXIX : 429-445.

Hamilton, J.D (1994). Time Series Analysis. Princeton University Press.

Heylen, F. and G.Everaert (2000). Succes and failure of fiscal consolidation in the OECD : a multivariate analysis. Public Choice 105 : 103-124.

Johansen, S. (1988). Statistical analysis of cointegration vectors. Journal of Economic dynamics and control 12(2/3) :231-254.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. Econometrica 59(6) : 1551-1580.

Johansen, S. (1995). Likelihood-based inference in cointegrated vector autoregressive models. Oxford University Press.

Karras, G. (1994). Government spending and private consumption : some international evidence. Journal of Money, Credit, and Banking 26(1) : 9-22.

Muellbauer, J. (1983). Surprises in the consumption function. The Economic Journal (supplement) : 34-50.

OECD (2000). All data from Economic Outlook CDROM version 2000/1 ; elasticities from Sources and Methods.

Pagan, A. (1984). Econometric issues in the analysis of regressions with generated regressors. International Economic Review 25(1) : 221-247.

Patterson, K.D. and Pesaran, B. (1992). The Intertemporal elasticity of substitution in consumption in the US and the UK. Review of Economics and Statistics 74: 573-584.

Perotti, R. (1999). Fiscal policy in good times and bad. Quarterly Journal of Economics, september: 1399-1436.

Pischke, J. (1995). Individual income, incomplete information and aggregate consumption. Econometrica 63 (4): 805-840.

Sutherland, A. (1997). Fiscal crises and aggregate demand : can high public debt reverse the effects of fiscal policy ? Journal of Public Economics, 65 : 147-162.

Zaghini, A (1999). The economic policy of fiscal consolidation : the European experience. Paper presented at the EEA Conference, Spain, September.

Appendix A1. Derivation of (1).

All consumers i=1,…,n maximize,

(A1.1) $$E_t\{u(c_{it-1})+u(c_{it})+u(c_{it+1})\}$$

where time preference is assumed to equal zero and where u is a quadratic utility function given by,

(A1.2) $$u(c_{it})=c_{it}-(a/2)c_{it}^2$$

where a>0. Marginal utility is positive as long as $c_{it}<1/a$. Maximization occurs subject to the following budget constraint (where the real interest rate is assumed to equal zero),

(A1.3) $$c_{it-1}+c_{it}+c_{it+1}=y_{it-1}-t_{it-1}+y_{it}-t_{it}+y_{it+1}-t_{it+1}$$

The first order condition is given by,

(A1.4) $$u'(c_{it-1})=E_{t-1}u'(c_{ij})$$

where j = t,t+1.
Calculating u' from (A1.2) and substituting into (A1.4) we obtain,

(A1.5) $$E_{t-1}c_{ij}=c_{it-1}$$

for j=t,t+1. Taking expectations at t-1 of the RHS and LHS of (A1.3) and using (A1.5) gives the following result,

(A1.6) $$3c_{it-1}=E_{t-1}[y_{it-1}-t_{it-1}+y_{it}-t_{it}+y_{it+1}-t_{it+1}]$$

The budget constraint (A1.3) can also be written as,

(A1.7) $$c_{it} + c_{it+1} = y_{it-1} - t_{it-1} - c_{it-1} + y_{it} - t_{it} + y_{it+1} - t_{it+1}$$

Taking expectations at t from the LHS and RHS of (A1.7) and using the result that $E_t c_{it+1} = c_{it}$ we obtain,

(A1.8) $$c_{it} = (1/2)E_t\left[y_{it-1} - t_{it-1} - c_{it-1} + y_{it} - t_{it} + y_{it+1} - t_{it+1}\right]$$

After subtracting c_{it-1} from both sides of (A1.8) and using (A1.6), we obtain (1) in the main text.

Appendix A2. Wold decomposition.

In this section we show how to obtain the Wold decomposition for Δg_{it} and Δg_{it+1} as given by equations (12) and (15). The structural model for Δg_{it} is given by (9) and (5). Despite the fact that the forcing variable Δg_t in (9) is unobservable, we can still say something about Δg_{it} by looking at its univariate time series representation. Provided that Δg_t is covariance stationary, we can solve for the Wold decomposition of Δg_{it}. From (5) we have that $\Delta g_t = g + (p-1)g_{t-1} + e_t^g$. Substitute this into (9) and use the fact that $g_{t-1} = g_{it-1} - e_{it-1}^g$ to find a univariate representation for Δg_{it},

(A2.1) $$\Delta g_{it} = g + (p-1)g_{it-1} - p e_{it-1}^g + e_t^g + e_{it}^g$$

Apart from the lagged g_{it} variable, we have a combination of various white noise errors. Given that g_{it} is observed, but g_t is not, these components cannot be identified. To capture this, we can write the combination of errors as an MA(1) process where m_{it} is white noise,

(A2.2) $$e_t^g + e_{it}^g - p e_{it-1}^g = m_{it} - k m_{it-1}$$

To impose the white noise structure on m_{it}, two conditions must hold. The first is that the error term is serially uncorrelated, thus,

(A2.3) $E(m_{it}m_{it-1}) = 0$

Since (A2.2) implies that $m_{it} = km_{it-1} + e_t^g + e_{it}^g - pe_{it-1}^g$, it is required for (A2.3) to hold that,

(A2.3 ’) $kE(m_{it-1}^2) + E\left(m_{it-1}(e_t^g + e_{it}^g - pe_{it-1}^g)\right) = 0$

Since it follows from lagging (A2.2) that $m_{it-1} = e_{t-1}^g + e_{it-1}^g$ and using the assumption that there is no correlation between e_t^g and e_{it}^g (both contemporaneous and at all leads and lags), (A2.3’) implies,

(A2.4) $s_{m_i}^2 = (p\ /k\ )s_{e_i}^2$

(note that $s_{e_i}^2$ and $s_{m_i}^2$ are assumed to be constant over time *and* across consumers).

The second condition is that the unconditional variance of the RHS of (A2.2) is equal to the unconditional variance of the LHS of (A2.2),

(A2.5) $(1+k^2)s_{m_i}^2 = (1+p^2)s_{e_i}^2 + s_{e_g}^2$

Thus (A2.4) and (A2.5) are two equations in two unknowns κ and $s_{m_i}^2$. We now look for the relevant κ* that satisfies (A2.4) and (A2.5). From (A2.4) we know that since π >0 we will have κ* > 0. Substituting (A2.4) into (A2.5) we obtain,

(A2.6) $k^2 + 1 = \left(\frac{(1+p^2)s_{e_i}^2 + s_{e_g}^2}{p\,s_{e_i}^2}\right)k$

which is a quadratic of the form $ak^2 + bk + c = 0$ with a=c=1 and $b = -\frac{(1+p^2)s_{e_i}^2 + s_{e_g}^2}{p s_{e_i}^2}$. To have at least one real solution κ* the condition must hold that $b^2 \geq 4$. This condition holds for all possible values of π, $s_{e_i}^2$ and $s_{e_g}^2$ (except π = 0, $s_{e_i}^2 = 0$). The two roots are given by $k_1 = (1/2)(-b + \sqrt{b^2 - 4})$ and $k_2 = (1/2)(-b - \sqrt{b^2 - 4})$. Using the solution κ* into (A2.2) and substituting this into (A2.1) we obtain,

(A2.7) $\Delta g_{it} = g + (p - 1)g_{it-1} + m_{it} - k^* m_{it-1}$

Using the fact that for period t-1 (A2.7) can be written as $g_{it-1} = g + m_{it-1}$ and substituting this into (A2.7) we obtain,

(A2.8) $\Delta g_{it} = pg + m_{it} + (p - 1 - k^*)m_{it-1} = a^g + m_{it} + f_1 m_{it-1}$

with $a^g = pg$ and $f_1 = p - 1 - k^*$.

Equation (A2.8) equals (12) in the main text. Note that, given 0<π≤1 and κ*>0, we have f_1 < 0. Only if π>κ*, we will also have f_1> -1. Note that only the solution κ_2 will lead to f_1 > -1. We thus have $|f_1| < 1$, which implies that shocks that occur further in time have a smaller effect and which implies that the lag polynomial φ(L) can be inverted.

We can do the same exercise for Δg_{it+1} to obtain equation (15). We can write,

(A2.9) $\Delta g_{it+1} = g + (p - 1)g_{it} + e_{t+1}^g + e_{it+1}^g - p e_{it}^g$

Imposing,

(A2.10) $e_{t+1}^g + e_{it+1}^g - p e_{it}^g = m_{it+1} - k m_{it}$

again leads to conditions (A2.4) and (A2.5) from which κ* is derived. Substitution of κ* into (A2.10), followed by substitution of (A2.10) into (A2.9) and then using backward substitution leads to, (A2.11) $$\begin{aligned}\Delta g_{it+1} &= g + (p-1)g + p(p-1)g + m_{it+1} + (p-1-k^*)m_{it} + (p-1)(p-k^*)m_{it-1} \\ &= a^g + m_{it+1} + f_1 m_{it} + f_2 m_{it-1}\end{aligned}$$

which equals (15) in the main text.

Appendix A3. Derivation of (16), (17) and (18).

Type 1 consumers.

We assume that m1 consumers do not know that the government must obey its intertemporal budget constraint. To obtain the consumption rule for the m1 consumers of type 1 we use (10), (11), (13) and (14) into (1). This leads $\forall$i =1,…,m1 to,

(A3.1) $\Delta c_{it} = b^y h_{it} - b^t u_{it}$

where $b^y = (1 + q_1 / 2)$ and $b^t = (1 + y_1 / 2)$.

Using (10) and (11) into (A3.1) we obtain,

(A3.2) $\Delta c_{it} = (b^y / q(L))\Delta y_{it} - (b^t / y(L))\Delta t_{it} - (a^y b^y / q(L)) + (a^t b^t / y(L))$

Note that the sum of the two last terms is a constant, which we name d_1. Aggregating the resulting equation for Δc_{it} over the m1 consumers, we obtain the change in per capita consumption from period t-1 to t of consumers of type 1 as given by equation (16).

Type 2 consumers.

We assume that m2 type 2 consumers take into account the intertemporal budget constraint of the government. They have no information on aggregate net-taxes and aggregate government expenditures. They observe their own tax payments t_{it} and t_{it+1} however and know that these are used to finance debt and government expenditures in t and t+1. We can assume that each individual i belonging to the group of consumers of type 2 (i=m1+1,…,m1+m2) incorporates the following constraint,

(A3.3) $t_{it} + t_{it+1} = g_{it} + g_{it+1} + b_{it-1}$

which if averaged over all consumers will lead to equation (6). We can now solve the model for the m2 incompletely informed consumers (type 2). First substitute (A3.3) into (1). Then, use (10), (12), (13) and (15) into (1). This leads ∀i =m1+1,…,m1+m2 to,

(A3.4) $\Delta c_{it} = b^{y} h_{it} - b^{g} m_{it}$

where $b^{y} = (1 + q_1 / 2)$ and $b^{g} = (1 + f_1 / 2)$. Using (10) and (12) into (A3.4) gives,

(A3.5) $\Delta c_{it} = (b^{y} / q(L))\Delta y_{it} - (b^{g} / f(L))\Delta g_{it} - (a^{y} b^{y} / q(L)) + (a^{g} b^{g} / f(L))$

Note that the sum of the two last terms is a constant, which we name d_2. Aggregating the resulting equation for Δc_{it} over m2 consumers, we obtain the change in per capita consumption from period t-1 to t of consumers of type 2 as given by equation (17).

Note from both (A3.1) and (A3.4) that at the individual level the change in consumption is white noise. If in period t a persistent aggregate shock occurs, consumption will be adjusted. In the following period, due to the persistence of the shock, the consumer will again be surprised. The consumption change is thus orthogonal to the information set of the imperfectly informed consumer, but not orthogonal to last period's aggregate shock.

Type 3 consumers.

Using (2) and (3) into (1) for n-m1-m2 consumers with perfect information, we can write for i=m1+m2+1,…,n,

(A3.6) $\Delta c_{it} = (1/2)(E_t - E_{t-1})\left[y_t - t_t + y_{t+1} - t_{t+1}\right] + (1/2)e^{y}_{it} - (1/2)e^{t}_{it}$

Following Perotti (1999) we can write (A3.6) as,

$$\text{(A3.7)} \quad \begin{aligned} &\Delta c_{it} = (1/2)\left[(y_t - E_{t-1}y_t) + (E_t y_{t+1} - E_{t-1}y_{t+1}) - (t_t - E_{t-1}t_t) - (E_t t_{t+1} - E_{t-1}t_{t+1})\right] \\ &+ (1/2)e_{it}^{y} - (1/2)e_{it}^{t} \end{aligned}$$

Using that $e_t^g = g_t - E_{t-1}g_t$ and the fact that from a first-order Taylor expansion of t_t^2 around $E_{t-1}t_t$, we obtain $t_t^2 - E_{t-1}t_t^2 = 2E_{t-1}t_t e_t^t$ (see Perotti 1999)[17], we can derive from (4) that,

$$\text{(A3.8)} \quad y_t - E_{t-1}y_t = b e_t^g - 2\,l\,E_{t-1}t_t e_t^t + e_t^y$$

Further, from (4) it also follows that,

$$\text{(A3.9)} \quad E_t y_{t+1} - E_{t-1}y_{t+1} = b\,(E_t g_{t+1} - E_{t-1}g_{t+1}) - l\,(E_t t_{t+1}^2 - E_{t-1}t_{t+1}^2)$$

Using (5) we can derive that $E_t g_{t+1} - E_{t-1}g_{t+1} = p e_t^g$ and using a first-order Taylor expansion we can write $E_t t_{t+1}^2 - E_{t-1}t_{t+1}^2 = 2E_{t-1}t_{t+1}(E_t t_{t+1} - E_{t-1}t_{t+1})$. Substituting these results into (A3.9) we have,

$$\text{(A3.10)} \quad E_t y_{t+1} - E_{t-1}y_{t+1} = b p e_t^g - (2\,l\,E_{t-1}t_{t+1})(E_t t_{t+1} - E_{t-1}t_{t+1})$$

Using (6) and $E_t g_{t+1} - E_{t-1}g_{t+1} = p e_t^g$, we can write

$$\text{(A3.11)} \quad E_t t_{t+1} - E_{t-1}t_{t+1} = (1+p)e_t^g - e_t^t$$

Substituting (A3.11) into (A3.10) we obtain,

$$\text{(A3.12)} \quad E_t y_{t+1} - E_{t-1}y_{t+1} = b p e_t^g - (2\,l\,E_{t-1}t_{t+1})((1+p)e_t^g - e_t^t)$$

---

[17] Note for this derivation that Jensen's inequality for a convex function implies $E_{t-1}t_t^2 > (E_{t-1}t_t)^2$. Perotti's expression does not take into account this difference. Introducing a constant to capture it would not change the analysis.

Substituting (A3.8), (A3.11) and (A3.12) into (A3.7) and using $e_t^t = t_t - E_{t-1}t_t$, we can write,

(A3.13) $\Delta c_{it} = g^g e_t^g + g^t e_t^t + (1/2)e_t^y + (1/2)e_{it}^y - (1/2)e_{it}^t$

where $g^g = (1/2)\big((p+1)\big[b - (1 + 2lE_{t-1}t_{t+1})\big]\big)$

$g^t = l\left(E_{t-1}t_{t+1} - E_{t-1}t_t\right)$

On aggregation across n-m1-m2 consumers we obtain (18) in the main text.

The effects of expenditure shocks are given by γ^g . Suppose there is a negative unitary expenditure shock in period t. Then the present discounted value (PDV) of government expenditures will decrease with (1+π) and the PDV of income will decrease with $(1+p)b$. Since expenditures are exogenous, by (6), taxes will also decrease with (1+π) diminishing tax distortions with $(1+p)2lE_{t-1}t_{t+1}$ and increasing income. The strength of these opposite effects will determine whether the effects of government expenditure shocks are Keynesian ($\gamma^g > 0$) or non-Keynesian ($\gamma^g < 0$). Notice that γ^g is time-varying. The larger the initial debt level b_{t-1} the larger $E_{t-1}t_{t+1}$ (by (6)) and the more likely it is that government expenditure shocks have non- Keynesian effects. Intuitively, because of the convexity of tax distortions the expected decrease in t_{t+1} that follows after for instance a negative shock in expenditures, will lead to a larger increase in wealth and consumption if $E_{t-1}t_{t+1}$ was large to begin with than if initially $E_{t-1}t_{t+1}$ and b_{t-1} were small.

For type 3 consumers tax shocks will always have non-Keynesian effects as long as the expected path of taxes is upward sloping. This is the assumption Perotti makes [18]. Suppose that taxes increase in t, causing an increase in distortions of $2lE_{t-1}t_t$. Since g is assumed exogenous the tax increase in t will induce a tax decrease in t+1, causing a decrease in distortions of $2lE_{t-1}t_{t+1}$. The overall change in the PDV of income is given by $2l(E_{t-1}t_{t+1} - E_{t-1}t_t)$ (half of which is consumed in t). Intuitively, if taxes increase in t, taxes can be lower in t+1 so $E_t t_{t+1}$ could fall. Because of the convexity of tax distortions, this will lead to less distortions, a higher permanent income and more consumption.

[18] The justification for an upward sloping expected taxation path can be found in Perotti (1999).

Appendix B. On the construction of the cyclically adjusted variables.

Suppose total taxes T are a function of income Y and other factors Λ. Total taxes are the sum of n different tax categories (i=1,…,n) that are a function of Y and Λ and m tax categories (i=n+1, n+m) that are only a function of Λ. Then the total differential of T can be written as,

(B.1) $$dT(Y,\Lambda) = \sum_{i=1}^{n} \frac{\partial T_i}{\partial Y} dY + \sum_{i=1}^{n+m} \frac{\partial T_i}{\partial \Lambda} d\Lambda$$

This can also be written as,

(B.2) $$dT(Y,\Lambda) = \sum_{i=1}^{n} s_i \frac{T_i}{Y} dY + \sum_{i=1}^{n+m} \frac{\partial T_i}{\partial \Lambda} d\Lambda$$

where σ$_i$ is the elasticity of tax category i with respect to income. Introducing a time dimension, $[dT(Y,\Lambda)]_t$ can be e_t^t, $E_{t-1}\Delta t_t$ or Δt_t and $[dY]_t$ can be e_t^y, $E_{t-1}\Delta y_t$ or Δy_t. The cyclically adjusted variable $\left[\sum_{i=1}^{n+m} \frac{\partial T_i}{\partial \Lambda} d\Lambda\right]_t$ is then $\tilde{e}_t^t$, $E_{t-1}\Delta\tilde{t}_t$ or $\Delta\tilde{t}_t$.

We can for instance write the cyclically adjusted tax shock in period t as,

(B.3) $$\tilde{e}_t^t = e_t^t - \sum_{i=1}^{n} s_i \left(\frac{T_i}{Y}\right)_t e_t^y$$

Note that we assume that the elasticities σ$_i$ are time-invariant, which is probably a safe assumption. Perotti (1999) for instance argues that these tax elasticities show minimal variation over time. OECD (2000) has published tax and expenditure elasticities for 20 countries (including Canada and Italy) for 4 tax categories (corporate taxes, personal taxes, indirect taxes and social security) and one expenditure category (unemployment related). We refer to OECD (2000) for the limitations of these elasticities. We calculate a time series of the weight of these taxes in GDP. Using these weights and elasticities we can calculate time series for cyclically adjusted tax shocks and (anticipated) tax changes for Canada.

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