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“Searching for Keynes”

**J. Stephen Ferris and
Stanley L. Winer**

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Searching for Keynes

by

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Please do not quote without permission. Comments welcome.

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This paper is dedicated to the memory of our colleague, W. Irwin Gillespie. We are grateful to our research assistants, Amanda Cahoon and Vincent Ngan, and to participants in seminars at Carleton and Queens' universities. Errors and omissions remain the responsibility of the authors.

Abstract

Since its publication over 60 years ago, *Keynes' General Theory of Employment, Interest and Prices* (1936) has substantially influenced both macroeconomic theory and popular opinion about what governments can and should do. However, the extent to which counter-cyclical stabilization has actually been attempted remains an open question. Investigation of this issue requires the construction of a counterfactual describing what the relationship between fiscal policy and transitory macroeconomic shocks would have been like 'after Keynes', if Keynesianism stabilization was not implemented. This counterfactual must allow for the possibility that after Keynes, as well as before, political pressure exerted by voters who find themselves in adverse circumstances may have led to the adoption of fiscal policies that look Keynesian, but are not.

We estimate such a counterfactual for Canada using consistent budgetary data for the period from 1870 to 1995 constructed by Irwin Gillespie (and updated by the authors), and use it to test for the presence of Keynesian elements in the fiscal policy choices of the Government of Canada. The estimating equations are based on an intertemporal probabilistic voting framework in which parties compete for support from two types of voters; those who are liquidity constrained and those who are not.

The Canadian case is of particular interest: the *White Paper on Employment and Income* in 1945 signalled the acceptance of Keynesianism in senior policy circles; one of Keynes' students, Robert Bryce, who dates the first Keynesian budget from 1939, played an important role for many years in the Department of Finance; and the fixed exchange rate policy conducted from 1962 to 1970 created an environment conducive to fiscal policy actions.

JEL Codes: D72, D78, E12, E62, H30, H60.

Keywords: Keynesianism, liquidity constraints, stabilization, probabilistic voting, permanent size of government

Searching for Keynes

This [revolutionary] extension of the role of the state was, implicitly, of a general and over-all nature, involving all departments of government; but in accordance with Keynesian economic theory, the greater part of this new responsibility came to focus on particular aspects of governmental operations—its fiscal and monetary policies; and what was called for in fiscal policy especially was an even more radical break with the traditions of the past.

H. Scott Gordon, 1965

1. Introduction

Since its publication over 60 years ago, *Keynes' General Theory of Employment, Interest and Prices* (1936) has substantially influenced both macroeconomic theory and popular opinion about what governments can and should do. However, the extent to which counter cyclical stabilization has actually been attempted remains an open question. We construct a framework that permits the strength of Keynesian elements in fiscal policy to be empirically investigated, and we apply this framework to Canadian data to assess the extent to which Keynesian stabilization was in fact attempted by the Government of Canada after 1945.¹ The Canadian case is of particular interest: the *White Paper on Employment and Income* in 1945 signalled the acceptance of Keynesianism in senior policy circles; one of Keynes' students, Robert Bryce, who dates the first Keynesian budget from 1939, played an important role for many years in the Department of Finance; and the fixed exchange rate policy conducted from 1962 to 1970 created an environment conducive to fiscal policy actions.

Keynesian stabilization is concerned with the transitory components of macroeconomic policy. The nature of these transitory components can be assessed only if those policy actions which depend on longer run trends can be separated from those which reflect responses to transitory macroeconomic events. A model of the permanent components (including the long run size of government) is therefore required. There is little work on such models in Canada or elsewhere, and this aspect of the research is of interest in its own right.

In addition to modeling the long run components of economic policy, a "search for Keynes" also requires the construction of a counterfactual that shows what would have happened in response to transitory shocks had Keynesian stabilization not been attempted. The difference between this counterfactual and an estimate of what the government actually planned to do in the face of transitory shocks forms the basis of our statistical test for the presence of Keynesian policies. In constructing the counterfactual, allowance must be made for the possibility that 'after Keynes', as well as before, political pressure exerted by voters who find themselves in adverse circumstances may have led to the adoption of fiscal policies that look Keynesian but are not.

The model of macroeconomic policy choices we use is an intertemporal, probabilistic voting framework

1. In addition to his influence on macroeconomic thinking, Keynes' arguments about the instability of the economy and the role for state intervention served as an important ideological pillar of the widely held view that favored a managerial state and a mixed economy (Hall 1989, 365). In this paper, we consider only the influence of Keynes on macroeconomic policy.

in which all policy actions are interpreted as part of an evolving political equilibrium. In this model, the governing political party balances the interests of two types of citizens, those who are liquidity constrained against those who are not.² Using the model, we show that policy in the counterfactual can be described by the sum of two components, as illustrated in Figure 1 for a single policy instrument; a long-run component determined in the absence of transitory deviations of economic activity from long run values, shown for convenience in the figure as being constant over time, and a transitory component that depends on the incumbent party's reaction to transitory shocks. In the figure, the transitory component of the counterfactual policy process 'after Keynes' is shown as being somewhat counter-cyclical in nature.

[Figure 1 here]

The counterfactual model is estimated with data for spending, tax and deficit policies of the Canadian federal government for the period from 1870 to 1938, using the late Irwin Gillespie's re-construction of the public accounts of Canada (1991). This long time period provides almost 70 years of information before Keynesian thinking could have been a factor in the making of Canadian fiscal policy. For the period 'after Keynes', the counterfactual is constructed by projecting the model estimated using data from the period before 1939 into the period after World War II.

Statistical tests for Keynesianism are based on consideration of the meaning of Keynesianism in our framework. While different interpretations, discussed at length in the paper, may reasonably be considered, in all cases we are lead to expect that if Keynesian stabilization was systematically attempted, there will be a significant correlation between a particular policy differential and expected transitory shocks in the Keynesian era, with the nature of the correlation depending on the particular interpretation of Keynesianism that is applied. For each fiscal instrument, the policy differential in question is the difference between our estimate of planned policy changes in the period 'after Keynes', and changes in the estimated counterfactual process over the same period. In terms of figure 1, where actual policy after Keynes is shown as being more strongly counter-cyclical than in the counterfactual, the policy differential is equal to the first difference in the policy residual calculated by subtracting the counterfactual process from an estimate of the actual policy process.

It should be noted that in this paper, we search for evidence of the adoption of Keynesianism only in fiscal policy processes. Although allowance is made in the empirical work for the existence of a government budget constraint that links together fiscal and monetary policy, identification of Keynesian elements in monetary policy is left for future research.

The rest of the paper proceeds in the following manner. In section 2 we critically review previous empirical research on Keynesianism in Canada. We also contrast our model to a related one used by Barro in his innovative work on the process governing the evolution of the deficit of the U.S. government from 1916. The basic model used to construct the counterfactual is presented in sections three and four, and the meaning of Keynesianism and corresponding tests for Keynesian policy are considered in section five. Estimating equations and statistical results are presented in section six. A brief conclusion completes the paper.

2. This distinction between types of voters is suggested by Campbell and Mankiw (1990).

2. A Brief Review of Previous Research

Most of the existing empirical research that has a bearing on the question of whether or not Keynesianism has actually been attempted involves separating changes in fiscal policies into a discretionary component that is attributed to changes in policy parameters like tax rates, and an automatic component attributed to fluctuations in economic activity at unchanged values of policy parameters.³ Typically in this approach, the discretionary component of fiscal policy is assumed to be government spending on goods and services, while the automatic component is assumed to be the remainder of non-interest spending - mostly transfers to persons - and taxes. Although application of this methodology usually has as its purpose the assessment of the effectiveness of macroeconomic policy from a Keynesian perspective, rather than to test for the effect of Keynesian ideas on policy actions, the resulting literature carries with it interesting implications for the present project.

Work of this sort in Canada includes Will (1967), Gillespie (1979), Boothe and Davidson (1993), Wilson and Dungan (1993) and Boothe and Petchey (1995). These studies generally conclude that the discretionary component of policy changes is small compared to the total, and often awkwardly timed from the perspective of Keynesian stabilization theory. Correspondingly, the automatic component is usually found to be large and counter cyclical in nature. Thus, on our reading, this literature suggests that the evidence for the adoption of Keynesianism in Canada is not strong, unless one argues that Keynesian thinking led to the deliberate use of, and increased reliance on, fiscal policies that act as automatic stabilizers of aggregate demand over the course of the business cycle.

The possibility that Keynesianism is associated with a discretionary increase in the reliance on programs and policies that are cyclically sensitive at unchanged parameter values can most clearly be assessed in a framework in which no a priori distinction between automatic and discretionary policy actions is required, as it is in the literature cited above. One might separate policy changes into discretionary and automatic components, and then ask if the relative importance of the automatic components has been increased. However, an answer in the affirmative implies that the automatic policies are in fact discretionary ones, and thus calls into question the initial classification. In the framework we employ, no distinction between active or discretionary policy, and passive or automatic policy, is made. All observed components of public policies at each point in time are regarded as part of a fiscal platform chosen by a governing party that is engaged in the struggle to maintain office. A decision by it not to change a policy parameter in the face of fluctuations in aggregate economic activity is considered to be just as active a policy as the opposite one.

In addition to dealing with the problem of distinguishing between automatic and discretionary policy, our

3. Closely associated with the automatic/discretionary decomposition is one that distinguishes between cyclical changes in budgetary deficits (due to changes in the automatic component of fiscal aggregates), and structural changes (due to changes in the discretionary components of fiscal aggregates). A large and interesting literature on Keynesianism from history of ideas perspectives should also be mentioned. In Canada this work includes Gordon (1965) and Campbell (1987, 1991). For an international comparison, see Hall (1989). The political context of Keynesianism is discussed in Hall, Buchanan and Wagner (1977) and Brenner (1994). It is clear from this literature that Keynes and Keynesianism had a profound influence on how policy makers thought about the economy and society in general. However, whether this change in thinking led to the persistent and substantial use of Keynesian stabilization policy is another matter.

reading of the existing literature also suggests that it is important to distinguish between planned and actual policy outcomes. Otherwise, an assessment about the role of Keynesianism may be biased because of the

mistakes that all governments make in forecasting economic activity. Given its expectations about the timing and size of future economic changes, a government may attempt to apply Keynesian thinking, and then simply fail to engineer the right timing or size of policy responses with respect to actual, as opposed to expected, activity, a result that would be consistent with some of the evidence about Canadian policy reviewed above. But in this case, in our view, policy is still Keynesian in its intent.⁴ It is for this reason that the policy differential defined earlier makes use of a model of planned policy changes in the post-Keynes period.

In innovative statistical work, Barro (1986) derives an estimating equation based on his tax-smoothing model of the public deficit, and uses it to explain the behaviour of U.S. federal deficits for the period from 1916 to 1985. He assumes that the government adjusts debt and taxation to smooth tax rates over time, given public sector spending. This means that deficits should rise when economic activity temporarily falls, or when government expenditures rise temporarily relative to some long run value, in order to prevent economically costly adjustments in tax rates.

Barro finds that the behaviour of deficits are generally in accordance with this view, though some results indicate that the increase in deficits associated with economic recession or with a temporary increase in government spending are larger than can be accounted for by the associated decrease in tax revenues (at unchanged tax rates) or increase in spending alone, as the pure tax-smoothing model requires. More importantly from our point of view, he finds no change in the data generating process governing public deficits between the interwar period, 1920-40, and the post World War II sample, 1948-82. These results, as a whole, are consistent with the existence of policy 'after Keynes' that looks Keynesian but is not, and which may possibly be due to the response of governments to the demands of liquidity constrained voters.

Our equations differ from those of Barro because they are based on a model of a competitive political system in which public spending, taxation and deficit financing are coherent parts of a political platform adopted by the incumbent party as part of its struggle for power, and because we allow for the existence of liquidity-constrained citizens. Tax smoothing on behalf of both types of voters is but one feature of the fiscal platform that may be politically profitable in this framework. Consumption smoothing for liquidity-constrained voters, the effects of interactions between responses to liquidity-constrained voters and the demands of voters that are not so constrained, redistributions between different types of voters, and changes in current policies in view of expected changes in the long-run level of activity also play a role.

3. A Probabilistic Voting Model of a Competitive Political Equilibrium

We begin with a model that is consistent with the hypothesis that Keynesian macroeconomic fiscal policy is not systematically employed. This is the basis for the construction of the counterfactual - our estimate

4. This argument also emphasizes the importance of modeling the expectations of policy makers about the macroeconomic environment.

of what policy would be like 'after Keynes' in the absence of any attempt to apply Keynesian theory. Tests for the existence of Keynesian policy are based on consideration of what the adoption of Keynesian thinking implies for the course of fiscal policy in this framework.

To begin, a brief overview of the general structure of the model may be helpful. We assume that all voters cast their ballots on the basis of an assessment of the level of utility they can expect to enjoy as a result of the adoption of policy platforms proposed by the incumbent and by the (single) opposition party. A policy platform consists of combinations of levels of non-interest spending on public services g_{t+s} , taxes-less-transfers to persons t_{t+s} , and the size of the deficit Δb_{t+s} for the present and all future periods that political parties think is of interest to voters. All voters are assumed to know with certainty what each party proposes to do in the current and in all future periods if elected, and which platform will leave them with a higher expected level of welfare, given the anticipated nature of economic conditions. Voters also have views about the ability or willingness of the parties to carry through with policies promised for the future - these views are assumed for simplicity to be unrelated to the current or future values of any policy instrument.

Voters differ only with respect to their ability to transfer funds through time under all circumstances. In this respect, we assume that the electorate consists of two sorts of people. The first type of individual is assumed to encounter a liquidity constraint that restricts the ability to transfer funds across time at the market rate of interest. An example is an individual who faces an expectation of losing his job and knows, if this occurs, that he will be unable to borrow enough on expected future income to finance the level of consumption that would appropriate relative to permanent income. No such individual would be indifferent to the course of fiscal policy over the course of business cycles, preferring more current government spending, less current taxation and thus a larger current deficit when activity declines. The welfare of type one individuals depends in part on transitory components of income and employment experience.

A second set of individuals is not liquidity constrained, so that this kind of person can arrange his or her activities so that the subjective marginal rate of time preference is equal to the objective rate of interest. These individuals wish to have public services provided and taxes levied in relation to their permanent - rather than current - income. In addition, they are indifferent to any party's proposed deficit policy (i.e., the time distribution of tax payments).

Neither party knows with certainty how any particular voter of either type will behave at the polls, though they do know something about the average behaviour of voters. Each party is forced by competition with the other and by the threat of entry of new parties to formulate policies in each period strictly as a means of maximizing the total expected vote that it can expect from the electorate as a whole. The information about the voters and the economy that parties possess is common knowledge, and this information does not allow them to serve party interests at the expense of the electorate. The assumption that voting is probabilistic insures that the objective function of each party is continuous in its policy choices, and opens up the possibility that an electoral equilibrium exists despite that fact that policy platforms are multi-dimensional so that the median voter theorem cannot be applied.⁵

5. Further discussion of vote-cycling and the role of probabilistic voting behavior in establishing an equilibrium where otherwise a vote-cycle would exist is provided by Enelow and Hinich (1989) and Hinich and Munger (1994, 1996).

Parties are forced by political competition to take the future into account because, and to the extent that, voters do. In formulating current and future policies, the parties must observe flow government budget constraints that apply to policy choices. In the Nash equilibrium that results each period, party platforms (the policies proposed for current and future periods) converge, current and anticipated government budget constraints are satisfied, and all voters make rational economic decisions.

To describe the model and its properties in more detail, we consider in turn the nature of government budget constraints and the structure of the private economy, individual voting behaviour, the properties of the total expected vote functions, the existence of a Nash equilibrium, and the method used to characterize the full political and economic equilibrium.

3.1 The nature of government budget constraints and the private economy

As noted, the constraints on the choice by any party of a vote-maximizing fiscal platform include a set of flow government budget constraints for the current and all future periods,

$$g_{t+s} + (1 + r_{t+s}) \cdot b_{t+s-1} = t_{t+s} + b_{t+s} ; \quad s = 0, 1, \dots, \infty. \quad (1)$$

where the set of fiscal policy variables to be chosen by each party at time t is $\{g_t, \dots, g_{t+s}, \dots, g_\infty; t_t, \dots, t_{t+s}, \dots, t_\infty; b_t, \dots, b_{t+s}, \dots, b_\infty\} = \{g, t, b\}$.

By successive substitution for b_t , and imposition of the no-Ponzi game condition that neither households nor governments can be net borrowers at infinity, $\lim_{s \rightarrow \infty} \prod^s R^s b_{t+s} = 0$, where $R^s = [1/(1+r_{t+s})]$ and $\prod^s R^s = [1/(1+r_{t+1})][1/(1+r_{t+2})] \dots [1/(1+r_{t+s})]$ and $\prod^0 R^0 = 1$, the constraints in (1) could be combined into one intertemporal constraint (through period s) of the form

$$(1+r_{t+s})b_{t+s-1} - \sum^s \prod^s R^s (t_{t+s} - g_{t+s}) = 0. \quad (2)$$

However because b_{t+s-1} in (3) is given, this procedure eliminates public debt as a policy variable from the model, and for this reason we shall continue to use the set of flow constraints (1) rather than the intertemporal constraint (3). We do not wish to prejudge which particular policy instrument, if any, provides better evidence of Keynesianism, nor do we wish to prejudge the issue of whether individual voting behaviour or the strategy of political parties is cognizant of the existence of a long-run budget constraint that excludes a permanent level of borrowing. (Recall that we shall assume that parties are forced by competition to make use of the same information that voters hold, not that voters necessarily recognize the no-Ponzi condition).

The private economy is represented by a function $H(\cdot)$ that incorporates the way in which public policies impinge on the private choices of voters in a general equilibrium. The function below is assumed to represent both the technological and market transformation possibilities facing society together with the induced reaction of the private sector to the changing private incentives that arise from given government expenditure, tax and debt policies. Note that because liquidity constraints affect the choices of some voters

and can to some extent be affected by government spending, tax and deficit policies, the general equilibrium consequences of the assumed liquidity constraint are included in the H function:

$$H(\mathbf{g}, t, \mathbf{b}, \mathbf{x}) = 0. \quad (3)$$

where the vector \mathbf{x} represents the set of factors that determine the longer run or trend evolution of public policy. Note that H allows in general for the effect of both the level and the change in the stock of debt on economic activity in any period.

3.2 Individual voting behaviour

Let individuals have time separable direct utility functions such that the expected utility of individuals has the following characteristic form:

$$E_t u_t = \sum \beta^s E_t \mu(\mathbf{g}_{t+s}, c_{t+s}, l_{t+s}); \quad s = 0, 1, \dots, \infty \quad (4)$$

where utility is assumed to increase with increases in government spending, \mathbf{g}_{t+s} , private consumption, c_{t+s} , and leisure, l_{t+s} ; where β is the subjective discount factor (i.e., $\beta = 1/(1+\rho)$, where ρ is the rate of time preference); and $\beta^s = [1/(1+\rho)]^s$. Individuals choose the values of c_{t+s} and l_{t+s} that maximize the discounted value of utility subject to the general equilibrium structure of the economy $H(\cdot)$ and the set of \mathbf{g} 's, t 's and \mathbf{b} 's proposed by political parties.

Using $E_t U^2$ to represent the indirect expected utility of voter type 2 who is not liquidity constrained we have that

$$E_t U^2 = \sum \beta^s E_t \mu[c_{t+s}^*(H(\cdot)), l_{t+s}^*(H(\cdot)); \mathbf{g}_{t+s}]; \quad s = 0, 1, \dots, \infty \quad (5)$$

where the starred values reflect the optimal private choices of individuals and the levels of \mathbf{g} are parameters for each individual. Using U^1 to represent the indirect utility of voter type 1 who is liquidity constrained,

$$E_t U^1 = \sum \beta^s E_t \mu[c_{t+s}^*(H(\cdot); \mathbf{y}_t), l_{t+s}^*(H(\cdot); \mathbf{y}_t); \mathbf{g}_{t+s}]; \quad s = 0, 1, \dots, \infty. \quad (6)$$

$E_t U^1$ differs from $E_t U^2$ in that the liquidity constrained individual's relative evaluation of government versus private goods depends upon the realization of a vector of stochastic current period variables \mathbf{y}_t .

Note that \mathbf{y}_t measures the extent to which the liquidity constraint is binding on type 1 individuals. In what follows we assume that \mathbf{y} is defined as a deviation from a permanent or long run value that is welfare improving for liquidity constrained voters, such as the deviation of actual output from its long run equilibrium level. An increase in (any of) the components of \mathbf{y} above their long run levels relaxes part of the liquidity constraint for, and so is associated with, an increase in the utility of liquidity constrained people.

Individuals are assumed to vote for a political party based on two factors: first, the level of individual utility offered by the proposed party platform compared to that offered by the alternative; and, second, the non-policy characteristics of the party such as candidate personalities, perceived competency, and reputation for actually carrying out promises made about future policy actions. This second component is exogenous to the model, and, in particular, is assumed to be independent of the value of any policy instrument.

More formally, the level of utility received by a representative voter, j , of type h ($= 1,2$) for the program platform offered by party, k , is described by

$$V_j^h = E_t U^h [g(k), t(k), b(k)] + \xi_j^h = E_t [U^h(k)] + \xi_j^h ; \quad (7)$$

where the $E_t U^h$ function is the indirect expected utility function described above (in (5) and (6)) and the ξ_j^h describes the level of utility generated by the non-policy related characteristics of the party and its candidates.

Given that the political process consists of an incumbent party (i) together with one opposition party (o), we denote the value of the difference in the non-policy characteristics of the parties for voter j of type h as

$$\phi_{ji}^h = \xi_{ji}^h - \xi_{jo}^h. \quad (8)$$

ϕ_{ji}^h is the nonpolicy bias of the voter in favour of the incumbent party. By definition, this nonpolicy bias is independent of g , t , b , $H(\cdot)$ and y_t .

The voting behaviour of individual j can now be described. The probability that individual j in group h votes for the opposition, o , rather than the incumbent, i , is

$$P_{jo}^h = \begin{cases} 1 & \text{if } E_t [U^h(o)] - E_t [U^h(i)] > \phi_{ji}^h \\ 0 & \text{otherwise} \end{cases} \quad (9)$$

where $E_t [U^h(o)]$ and $E_t [U^h(i)]$ represent the levels of expected utility associated with the policy platforms of the opposition and incumbent parties. To get voter j on side, the opposition must 'deliver' enough economic welfare to overcome the nonpolicy bias of this voter in favour of the incumbent.

We assume that from the perspective of both political parties, the nonpolicy bias of a representative voter from group h for the incumbent party, ϕ_{ji}^h , is known to be uniformly distributed over the interval $[\phi_{\min}^h, \phi_{\max}^h]$. Representing the cumulative distribution function of ϕ_{ji}^h as F , both parties view the probability in any time period t that a representative individual in group h will vote for the opposition, F_{ot}^h , as equal to the cumulative probability that ϕ_{ji}^h is less than the period t utility differential generated by the opposition party:

$$F_{ot}^h [E_t (U^h(o)) - E_t (U^h(i))] = \alpha_h \{ [E_t (U^h(o)) - E_t (U^h(i))] - \phi_{\min}^h \}, \quad (10)$$

where

$$\alpha_h = \partial F_{ot}^h / \partial (E_t (U^h(k))) = 1 / (\phi_{\max}^h - \phi_{\min}^h) \quad (11)$$

is the sensitivity of the individual voting probability to a change in welfare ϕ_{ji}^h .

A further assumption that $[E_t U^h(o) - E_t U^h(i)]$ lies everywhere within the interval on which ϕ_{ji}^h is defined ensures that, as far as the political parties are concerned, every voter will have some positive probability of voting for it, although that probability may be very small in some circumstances. Consequently, no party will ignore any voter of either type, even though it remains true that those groups of voters that are more sensitive to one party will continue to receive better treatment by that party's strategists. If this were not true, and the probability that some voters will support one of the parties falls to zero, vote-cycling rather than an equilibrium may occur as the party in question has nothing to lose by promising to tax this sort of voter highly, leading these voters to seek relief from the opposition, which will then prompt a response from the first party, and so on.⁶

Since each individual's voting behaviour is probabilistic as seen by the parties, and the probability that each voter will support either party is always positive, a small change in a party platform will produce at most a small change in voting probabilities. Thus, the probabilistic nature of voting makes the objective function of each party continuous in its policy instruments rather than being discontinuous at various points if voting is strictly deterministic.⁷ This continuity of electoral objectives opens up the possibility that a Nash equilibrium in the electoral game exists despite the fact that the policy space is multi-dimensional.

3.3 Party objectives and the existence of a Nash equilibrium

Assume that from a population of size N , both parties think that there are N_1 type 1 voters, and thus that a constant fraction of the population, $\lambda = N_1/N$, is liquidity constrained. Liquidity-constrained voters may want the government to do something about this situation. The remaining fraction of type two voters, $1-\lambda = (N-N_1)/N$, is assumed to respond only to changes in permanent income. Given (10), the expected number of votes that the opposition party continually maximizes, $EV(o)$, may then be written as

$$EV(o) = N_1 \lambda_1 F_{o1}^1 + N_t (1-\lambda_1) F_{o2}^2, \quad (12)$$

The expected vote for the incumbent is $EV(i) = N_1 - EV(o)$.

As we have already pointed out, the continuity of these expected vote functions for each party are insured by the probabilistic structure of voting behaviour. If the set of feasible platforms from which the parties choose is compact and convex, a unique Nash equilibrium in the electoral game will exist if, after substitution of all relevant constraints on policy choices, each expected vote function is also strictly concave in each policy instrument for each platform chosen by the opposition. (see Owen 1995, Theorem IV.6.2). The concavity of expected vote functions is discussed at length in Enelow and Hinich (1989) and Hinich

6. For an interesting discussion of how vote-cycling may emerge when the probability of support from some voters falls to zero due to polarization of party platforms, see Usher (1994).

7. If the probability that a voter supports a party is either zero or one, a small change in a platform direct at this voter will cause a discrete jump in support from the voter at some point, a situation that prevents the emergence of a Nash equilibrium.

and Munger (1994). Here we simply note that this assumption amounts to saying that each party can define an optimal political platform. We shall assume that all of these conditions required for the existence of a Nash equilibrium are satisfied.

In the Nash equilibrium, policy platforms converge and the identity of the party in power is incidental to the determination of the policies actually adopted. Given strict concavity of the expected vote functions and the fact that voting depends only on utility differences, no party can gain a lasting advantage by adopting a platform that differs from that of the opposition (see Enelow and Hinich 1989 for a formal proof of convergence under these conditions). Since party platforms converge in an equilibrium, we may drop subscripts identifying the party when it is convenient to do so, and refer only to the governing party or government.⁸

3.4 The characterization of the equilibrium policy platform: a Representation Theorem

A convenient feature of the Nash equilibrium in the probabilistic voting framework is that the equilibrium values of the policy variables chosen by the successful party can be characterized, or represented, by maximizing a particular weighted sum of individual expected utilities. (Coughlin and Nitzan, 1981). To see that this is so, we first write the first order conditions defining the vote maximizing choices for one typical policy instrument that must be satisfied at the Nash equilibrium. For convenience, we consider government non-interest spending g .

Assuming for the moment that all relevant constraints (i.e., (1) and (3)) have been substituted into the expected vote functions (12), the first order conditions for the choice of g that must be satisfied for both parties at the Nash equilibrium has the following general form:

$$\begin{aligned}\partial EV/\partial g_t &= N_t \lambda \alpha_1 [\partial(E_t U^1)/\partial g_t] + N_t (1-\lambda)\alpha_2 [\partial(E_t U^2)/\partial g_t] \\ &= \theta_1 [\partial(E_t U^1)/\partial g_t] + \theta_2 [\partial(E_t U^2)/\partial g_t] \\ &= 0,\end{aligned}\tag{13}$$

where party and time subscripts have been temporarily omitted, $\theta_1 = N_t \lambda \alpha_1$, $\theta_2 = N_t (1-\lambda)\alpha_2$, and the α_i are as defined in (11). Analogous conditions hold for the other policy instruments. (We shall see below that the θ 's in (13) represent the effective weight given by each political party to the welfare of the representative voter in each group in a full political and economic equilibrium. These weights combine the relative size of each group with the sensitivity of voting behaviour to a change in individual welfare.)

Now consider maximization of the following 'political support function' S after the same constraints as are embodied in (12) have been substituted into this objective function:

$$S = \theta_1 \cdot E_t U^1 + \theta_2 \cdot E_t U^2\tag{14}$$

8. In the empirical work, allowances will be made for the possibility that the identity of the party in power affects the nature of policy choices, and for the possible existence of electoral cycle effects.

where the θ 's are as defined in (13). It is straightforward to see that the first order condition for the maximization of S with respect to the choice of g_t will be exactly the same as that given in (13). The strict concavity of the expected vote functions insures that a solution to the first order conditions for maximizing S is a global maximiser of expected votes. Hence a policy platform that solves the problem of maximizing S subject to the government budget constraints and the equilibrium structure of the economy is identical to the common policy platform adopted by the parties in a Nash equilibrium of the electoral game. We shall refer to the equivalence of the solution to the first order conditions for the problem of maximizing the political support function S and the Nash equilibrium policy platform as the 'Representation Theorem'.⁹

The nature of the support function that can be used to characterize the equilibrium shows that policy outcomes in a competitive political system reflect a balancing of the opposing and heterogeneous interests within the electorate. It also shows that the θ 's can be used to represent the relative effective political influence that each type of voter exerts on the equilibrium outcome. If the θ for some type of voter increases, the expected utility of that type of voter will be given a greater weight in the Nash equilibrium.

4. Towards A System of Reduced Form Estimating Equations

Using the Representation Theorem, the equilibrium policy platform can be modelled in a more detailed manner by solving the following optimization problem. Here, in the Nash equilibrium, the incumbent party (or government) chooses levels of current and future values of policy instruments, given past values, in the light of voters' views about the future including their beliefs about the feasibility and effects of proposed current and future policies. To simplify notation, we temporarily ignore the distinction between expected and known quantities, and treat the x 's and y 's as single variables although in general they may refer to vectors of long-run factors and transitory shocks respectively:

$$\begin{aligned} \text{Max } \mathcal{L}_t = & \theta_{1t} \cdot \sum^{\infty} \beta^s E_t \mu^1 [g_{t+s}(H(.)), c^*_{t+s}(H(.)), \ell^*_{t+s}(H(.)); y_{t+s}] \\ & \{g_{t+1}, \dots, g_{t+s}, g_{t+s+1}, \dots, t_{t+1}, \dots, t_{t+s}, t_{t+s+1}, \dots, b_{t+1}, \dots, b_{t+s}, b_{t+s+1}, \dots\} \\ & + \theta_{2t} \cdot \sum^{\infty} \beta^s E_t \mu^2 [g_{t+s}(H(.)), c^*_{t+s}(H(.)), \ell^*_{t+s}(H(.))] \quad (15) \\ & + \sum^{\infty} \psi_{t+s} \{[\prod^s R^s] [t_{t+s} + b_{t+s} - g_{t+s} - (1 + r_{t+s})b_{t+s-1}]\}, \end{aligned}$$

where the expectation E_t is understood to be conditional on information available at time $t-1$ and the summation run from $s=0$ to $s=+\infty$. Note that we use a current period Lagrangian. The future matters only because voters care about it. The parties are forced to cater to the wishes of the electorate in each period, whether these demands are myopic or farsighted.

The first order conditions for an internal optimum for g_{t+s} , t_{t+s} and b_{t+s} at time $t+s$ are

9. We use the term Representation Theorem for convenience, though it was not used in the original work by Coughlin and Nitzan (1981). Coughlin and Nitzan's result is somewhat different than that stated here since they used a different specification of voting densities, and are interested in both necessary and sufficient conditions for maximization of a support function to represent the Nash equilibrium.

$$\partial \mathcal{L} / \partial g_{t+s} = \beta^s \{ \theta_1 E_t [\mu_g^1(H(x_{t+s}, y_{t+s}))] + \theta_2 E_t [\mu_g^2(H(x_{t+s})))] \} - \prod R^s \psi_{t+s} = 0, \quad (16)$$

$$\partial \mathcal{L} / \partial t_{t+s} = \beta^s \{ \theta_1 E_t [\mu_t^1(H(x_{t+s}, y_{t+s}))] + \theta_2 E_t [\mu_t^2(H(x_{t+s})))] \} + \prod R^s \psi_{t+s} = 0, \quad (17)$$

$$\begin{aligned} \partial \mathcal{L} / \partial b_{t+s} = & \beta^s \{ \theta_1 E_t [\mu_b^1(H(x_{t+s}, y_{t+s}))] - \theta_2 E_t [\mu_b^2(H(x_{t+s})))] \} - \beta^{s+1} \{ \theta_1 E_t [\mu_b^1(H(x_{t+s+1}, y_{t+s+1}))] \\ & + \theta_2 E_t [\mu_b^2(H(x_{t+s+1})))] \} + \prod R^s [\psi_{t+s} - \psi_{t+s+1}] = 0. \end{aligned} \quad (18)$$

From the first order conditions, two things are immediately apparent. First, optimal vote maximizing behaviour means that government spending, taxes and borrowing will be varied until each becomes equally productive (on the margin) as a way of winning votes. This is reflected in the symmetric form of the equations and the equality of their marginal benefit to the same Lagrangian multiplier and hence to each other¹⁰.

Second, from (18) we allow for the possibility that $\psi_{t+s+1} \neq \psi_{t+s}$. Even when we follow the traditional literature by assuming that $\partial(\theta_2 E_t \mu^2) / \partial b_t = 0$ everywhere for type 2 voters, type 1 voters remain liquidity constrained with $\partial(\theta_1 E_t \mu^1) / \partial b_t \neq 0$, so that government borrowing strategy can increase their utility by loosening period specific individual budget constraints and thereby gain additional support. Such action is costly in terms of support from type 2 voters, however, so that liquidity constraints will not be completely eliminated in a political equilibrium.

We are interested in what the set of first order conditions (16)-(18) imply for changes in the levels of the policy variables over time. Beginning with government spending we can generate predictions for changes in the level of government spending over time by comparing the first order conditions across adjacent time periods $t+s-1$ and $t+s$, using the Lagrangian for a given period, say time t .¹¹ In this manner we find, from (16), that the marginal rate of substitution across time in the use of public expenditure when there are no constraints on the government's borrowing is

$$\left[\frac{E_t \beta^s [N_t \lambda \alpha_1 \mu_g^1(H(x_{t+s}))] + N_t (1 - \lambda) \alpha_2 \mu_g^2(H(x_{t+s}, y_{t+s}))]}{E_t \beta^{s-1} [N_t \lambda \alpha_1 \mu_g^1(H(x_{t+s-1}))] + N_t (1 - \lambda) \alpha_2 \mu_g^2(H(x_{t+s-1}, y_{t+s-1}))]} \right] = \left[\frac{R^s \psi_{t+s}}{\psi_{t+s-1}} \right] \quad (19)$$

which simplifies to

$$\left[\frac{E_t [\lambda \alpha_1 \mu_t^1(x_{t+s}; y_{t+s}) + (1 - \lambda) \alpha_2 \mu_t^2(x_{t+s})]}{E_t [\lambda \alpha_1 \mu_t^1(x_{t+s-1}; y_{t+s-1}) + (1 - \lambda) \alpha_2 \mu_t^2(x_{t+s-1})]} \right] = \left[\frac{(1 + \rho) \psi_{t+s}}{(1 + r_{t+s}) \psi_{t+s-1}} \right] \quad (20)$$

10. In interpreting the equation for debt (18), allowance should be made for the optimal spreading of interest payments over time, reflected in the presence of the Lagrange multiplier with subscript $t+s+1$ payments. As Kenny and Toma (1997) show, this result generalizes across multiple tax and spending alternatives.

11. This keeps the decision maker the same across adjacent time periods (so that the Euler equation represents a consistent set of decision makers) and means that cohort changes are reflected in the x_{t+s} 's.

where we assume that r_{t+s} is observable and $\beta = (1+\rho)^{-1}$ is a constant. Similarly for taxes under the same conditions,

$$\left[\frac{E_t[\lambda \alpha_1 \mu_g^1(x_{t+s}; y_{t+s}) + (1-\lambda) \alpha_2 \mu_g^2(x_{t+s})]}{E_t[\lambda \alpha_1 \mu_g^1(x_{t+s-1}; y_{t+s-1}) + (1-\lambda) \alpha_2 \mu_g^2(x_{t+s-1})]} \right] = \left[\frac{(1+\rho) \Psi_{t+s}}{(1+r_{t+s}) \Psi_{t+s-1}} \right] \quad (21)$$

An analogous equation for debt applies, but we do not state it here since we shall use the derived equations for expenditures and taxes and the government budget constraint (1) to derive an estimating equation for the government deficit.

To progress to estimating equations, we need to add specificity to the underlying indirect utility functions. If we assume that type 1 utility functions are separable in the current and transitory income variables, then because individuals in the model are distinguished only by the impact of the liquidity constraint,

$$\mu^1(x, y) = \mu^1(x) + \mu^1(y) = \mu^2(x) + \mu^1(y). \quad (22)$$

The left hand side of equations (20) and (21) can then be represented as

$$\left[\frac{E_t[\lambda \alpha_1 \mu_z^1(y_{t+s}) + (\lambda \alpha_1 + (1-\lambda) \alpha_2) \mu_z^2(x_{t+s})]}{E_t[\lambda \alpha_1 \mu_z^1(y_{t+s-1}) + (\lambda \alpha_1 + (1-\lambda) \alpha_2) \mu_z^2(x_{t+s-1})]} \right] \quad (23)$$

$$= \left[\frac{E_t[\mu_z^2(y_{t+s}) + \gamma \mu_z^1(x_{t+s})]}{E_t[\mu_z^2(y_{t+s-1}) + \gamma \mu_z^1(x_{t+s-1})]} \right]; \quad z = \{g, t\},$$

where the second line is formed by dividing the top and bottom by $(\lambda \alpha_1 + (1-\lambda) \alpha_2)$ and by using $\gamma = [N_t \lambda \alpha_1 / (N_t \lambda \alpha_1 + N_t (1-\lambda) \alpha_2)] = N_{1,t} \alpha_1 / (N_{1,t} \alpha_1 + N_{2,t} \alpha_2) < 1$. Note that γ is interpretable as the relative political weight of type 1 voters in the political process.

Taking the logarithm of either (20) or (21) and using (23), we find the general form of the two first order conditions for g and t is

$$\ln[\gamma E_t \mu_z^1(y_{t+s}) + E_t \mu_z^2(x_{t+s})] - \ln[\gamma E_t \mu_z^1(y_{t+s-1}) + E_t \mu_z^2(x_{t+s-1})] \quad (24)$$

$$= \rho - r_{t+s} + D[\ln \Psi_{t+s}]; \quad z = \{g, t\},$$

where, to simplify the second equality, we have used the approximation, $\ln(1+q) \approx q$ for $q = \{\rho, r\}$ and the

D operator to denote first differences, i.e., $D[\ln \psi_{t+s}] = \ln(\psi_{t+s}) - \ln(\psi_{t+s-1})$.¹²

We proceed further by taking a Taylor series approximation of equations (24) for the policy variables g and t . Here we discuss in the case of government spending, with details left for the Appendix. We linearize about the long run path of g , \hat{g}_{t+s} , $s = 0, 1, 2, \dots$, defined as the path of government spending that would occur, given expectations of x , if all expected transitory deviations from the long run equilibrium path of the economy, the y 's for different periods, are equal to zero. This is a natural choice in the present context since Keynesian stabilization emphasizes shorter run policy actions in response to transitory shocks. As will be seen below, linearization around the long run or permanent level of policy instruments leads to an interesting, empirically implementable model of the transitory part of government policy actions.

At each point in time, the permanent path of government spending is determined by solving the Lagrangian (15) for policies of current and future periods under the condition that all expected y 's are zero. This longer run component of government spending incorporates consumption smoothing on behalf of voters in response to expected movements in the longer run factors such as the long run rate of growth of real income and the degree of urbanization. To permit a clear distinction in the estimating equations between the role of liquidity constraints and of other factors, the permanent component of g and other policy variables is also defined to incorporate government responses to the expected occurrence and intensity of war.¹³

In defining the permanent or long run component of a policy instrument, we have in mind a situation where government policy variables move around longer run paths defined by expected values of underlying trends in the economy and society. In the absence of war, this permanent component would depend on the expected full-employment path of the economy.¹⁴ We shall return to the interpretation of this longer run or permanent component of policy instruments after the result of linearizing equation (24) for g is recorded.

In the linearization of (24), the Taylor series is terminated after the set of first order derivatives. To insure

12. The relationship of (24) to that arising in Hall (1978) is of interest. In a rational expectations-permanent income model of the sort used by Hall, μ_z^1 is absent and $\psi_{t+s} = \psi_{t+s-1}$ since there are no impediments to liquidity constrained voters (or their government) shifting budgetary resources through time. If then ρ and r were also constants, equation (24) would then reduce to one that is analogous to that used by Hall and others, namely

$$\ln[E_t \mu_z^2(x_{t+s})] - \ln[E_t \mu_z^2(x_{t+s-1})] = \rho - r; \quad z = \{g, t\}.$$

i.e., (the log of) expected marginal utility with respect to each policy instrument is a martingale process. Following Hall, this equation could be converted to an estimating equation by assuming that x_{t+s}^e is observable, by removing the expectation operator for x_{t+s} , and adding to the right side an error term with zero mean and that is uncorrelated with any information available at time $t+s-1$.

13. Thus, the permanent or long run component of policy we employ differs from that of Barro (1990, part III), where his permanent component is defined such the effects of wars are excluded.

14. For an early model of government that embodies the idea of a long-run or 'permanent' component to current policy outcomes, see Alt and Chrystal (1983).

that we remember that the result concerns what the government plans to do in a political equilibrium given expectations of future events, we add the superscript "e" to policy instruments and partial derivatives where appropriate, and to the longer run factors x and the transitory shocks y on which government plans are based.

To provide more structure to the result, we also assume that the expected marginal utility generated by a change in the policy variable is linearly related to the expected level of the state variables y_{t+s}^e and x_{t+s}^e , as in $E_t \mu_g^1 = a + by_{t+s}^e$ and $E_t \mu_g^2 = c + dx_{t+s}^e$, where the scalars a and c are positive and both b and d are negative, and in addition we assume that $(\partial y / \partial g_{t+s})^e \approx (\partial y / \partial g_{t+s})^e$. To further simplify the result, we assume that the indirect utility functions are separable in the policy instruments so that cross partial derivatives in the policy instruments are all zero. Then (see the Appendix for further details), when the left side of (24) is linearized around the point defined by $g^e = \hat{g}(x_{t+s}^e, x_{t+s-1}^e, y_{t+s}^e = 0, y_{t+s-1}^e = 0)$ and the result is equated to the right side of (24) and rearranged, we have:

$$\Delta g_{t+s}^e = \Delta \hat{g}_{t+s} + \frac{[\rho - r_{t+s}^e + D \ln(\psi_{t+s})]}{(X_{t+s}^e)^{-1} \gamma b (\partial y / \partial g_{t+s})^e} - \frac{(y_{t+s}^e - y_{t+s-1}^e)}{(\partial y / \partial g_{t+s})^e} - \frac{d(x_{t+s}^e - x_{t+s-1}^e)}{\gamma b (\partial y / \partial g_{t+s})^e} \quad (25)$$

where Δg^e denotes that the equation is an approximation for the planned change in government spending, $\Delta g_{t+s}^e = (g_{t+s}^e - g_{t+s-1}^e)$, $X_{t+s}^e = \gamma a + c + dx_{t+s}^e > 0$, $X_{t+s-1}^e = \gamma a + c + dx_{t+s-1}^e > 0$, and we have used the assumption that $X_{t+s-1}^e (X_{t+s}^e)^{-1} \approx 1$.

Finally, (25) can be given one further useful simplification. Inspection of (18) indicates that $D \ln(\psi_{t+s})$ is a function of y_{t+s} through $E_t \mu_b^1$.¹⁵ Assuming that this relationship is linear allows us to write $D \ln(\psi_{t+s}) = \phi (y_{t+s} - y_{t+s-1}) > 0$ with $\phi > 0$. This allows us to rewrite (25) as

$$\Delta g_{t+s}^e = \Delta \hat{g}_{t+s} + \frac{(\rho - r_{t+s}^e)}{Z_{t+s}} + \frac{(\phi - (X_{t+s}^e)^{-1} \gamma b) (y_{t+s}^e - y_{t+s-1}^e)}{Z_{t+s}} - \frac{d(x_{t+s}^e - x_{t+s-1}^e)}{\gamma b (\partial y / \partial g_{t+s})^e}, \quad (26)$$

where $Z_{t+s} = (X_{t+s}^e)^{-1} \gamma b (\partial y / \partial g_{t+s})^e < 0$. In interpreting the sign of Z_{t+s} in (26), recall that y^e is defined so that a positive value represents aggregate output above its long run expected level. Thus we expect that an increase in g^e will increase in y^e and make $(\partial y / \partial g_{t+s})^e > 0$. The discussion of (26) relies on this assumption, although the estimating equations allow for either sign on the partial derivative. Then since $X_{t+s}^e > 0$ and $b < 0$, $Z_{t+s} < 0$. This also implies that the coefficient on $(y_{t+s}^e - y_{t+s-1}^e)$ is negative.¹⁶ Since $d < 0$ and $\gamma > 0$, the coefficient on the last term in (26) is positive, so that the effect of an increase in $(x_{t+s} - x_{t+s-1})$ is

15. From (18), using $\mu_b^2 = 0$, $D(\psi_{t+s}) = [\theta_1 \beta' / \Pi^* R^*] [E_t \mu_b^1 (y_{t+s}) - \beta E_t \mu_b^1 (y_{t+s+1})] > 0$ if and only if the liquidity constraint is expected to be increasingly binding. That is, as y_{t+s} increases relative to y_{t+s+1} , $E_t \mu_b^1 (y_{t+s})$ and hence $D(\psi_{t+s})$ falls. The resulting positive relationship between Δy and $D(\psi)$ is represented by $D \ln(\psi_{t+s}) = \phi (y_{t+s} - y_{t+s-1})$ with $\phi > 0$.

16. That is, with $\phi > 0$, $(X_{t+s}^e)^{-1} \gamma b < 0$ so that $[\phi - (X_{t+s}^e)^{-1} \gamma b] > 0$.

negative.¹⁷

Equation (26) and its counterpart for current taxation and deficit financing are the basis for the empirical implementation of the model. To interpret each component in equation (26), it is useful to recall the meaning given to the permanent component of the change in the policy instrument, $\Delta \hat{g}_{t+2}$ in (26). This component incorporates all politically optimal intertemporal responses to expected changes in the x 's except those arising because of the existence of liquidity constraints and transitory shocks to aggregate economic activity. It includes consumption smoothing on behalf of taxpayers in response to expected changes in the x 's that would occur over a longer horizon when the y 's are expected to be zero. However, under electoral pressure from the opposition, an optimizing government will also moderate its attempt to achieve optimal consumption smoothing on behalf of its non-liquidity constrained taxpayers as it attempts to deal with the economic and political consequences of liquidity constraints. This aspect of government fiscal policy is captured by the last three terms in equation (26). Similar concerns are reflected in the equations for taxes and debt to be presented later.

The first reason for having a planned change in g depart from $\Delta \hat{g}_{t+2}$ is if $\rho \neq r_{t+2}$. If the rate of time preference exceeds the interest rate, individuals will prefer their consumption earlier rather than later, leading to a higher government spending earlier in the planning horizon. For any given value of y , this reduces the need for spending intended to deal with liquidity problems.

The second reason, represented by the third term in (26), incorporates reactions to expected transitory shocks. Because an expected increase in transitory income this year over last diminishes the scale of the liquidity constraint in the community relative to last year, it reduces political support for government spending relative to last year and results a smaller planned change in g than otherwise.¹⁸

The third and last reason for adjusting the planned rate of spending growth relative to the long run path involves the rate at which government spending adjusts to changes in the underlying permanent variables. This is represented by the last term in (26), the effect of which is to reduce the planned increase in g relative to its long run value. Since the government responds optimally to the intertemporal wishes of their voters, expected increases in x 's lead individuals to want to spread additional lifetime consumption, including for public goods, smoothly over time, including the present. As a result, given $(\partial y / \partial g_{t+2})^e > 0$, such actions reduce the magnitude of the liquidity problem and moderate the need for short-run government spending.

The equation for Δt_{t+2}^c corresponding to (26) can now be presented as

17. In the special case of the steady state defined by $y_{t+2}^c = y_{t+2-1}^c = 0$, $x_{t+2}^c = x_{t+2-1}^c = x^*$, $r_{t+2} = \rho$, and $\psi_{t+2} = \psi_{t+2-1}$, $\Delta g_{t+2}^c = \Delta \hat{g}_{t+2} = 0$.

18. Because a change in government spending itself affects transitory income, a second order effect will moderate the scale of the two primary effects. This is captured in Z_{t+2} in the third term of (26) and $\partial y / \partial g_{t+2}^c$ in the fourth.

$$\Delta t_{t+s}^e = \Delta \hat{t}_{t+s} + \frac{(\rho - r_{t+s})}{W_{t+s}} + \frac{(\phi - (V_{t+s}^{-1})\gamma f)(y_{t+s}^e - y_{t+s-1}^e)}{W_{t+s}} - \frac{k(x_{t+s}^e - x_{t+s-1}^e)}{\gamma f(\partial y / \partial t_{t+s})^e}, \quad (27)$$

where $E\mu_1^e = e + f \cdot y_{t+s}^e < 0$ and $E\mu_2^e = h + k \cdot x_{t+s}^e < 0$, so that higher taxation reduces utility, and f and k are both positive, implying that the negative effect of taxation is reduced as y and x increase. We assume that $(\partial y / \partial t_{t+s})^e$ is negative and that the negative effect of taxation on welfare is increasing at the margin.¹⁹ While V_{t+s}^e and W_{t+s} have the same general form as X and Z , they must be interpreted in terms of the effects that taxes have on income and utility, i.e., $W_{t+s} = (V_{t+s}^e)^{-1} \gamma \cdot f \cdot (\partial y / \partial t_{t+s})^e > 0$ with $V_{t+s}^e = \gamma e + h + kx_{t+s}^e < 0$. This implies that the coefficient on $(y_{t+s}^e - y_{t+s-1}^e)$ is positive. Moreover, the coefficient on $(x_{t+s}^e - x_{t+s-1}^e)$ is negative, so that an expected increase in x leads to an increase in taxation. It follows that while the equation for Δt_{t+s}^e appears symmetric in form to that for Δg_{t+s}^e , the negative effect of taxes on utility makes the individual coefficients opposite in sign. (The absolute values of each corresponding coefficient in (26) and (27) also differ.)

Equation (27) incorporates tax smoothing in two ways. First, tax smoothing in response to expected changes in the permanent factors is incorporated into $\Delta \hat{t}$. By definition, the long run planned change in taxes incorporates all politically optimal intertemporal responses to expected changes in the x 's except for those that arise because of liquidity constraints.

The remaining three terms in (27) involve tax smoothing as part of the government's intertemporal plan to deal with induced changes in liquidity that occur as it adjusts to both the evolution of its long run desired size, and in response to the emergence of transitory shocks. The latter shocks impact first on voters who are liquidity constrained and only later, through changes in marginal tax rates, on those who are not liquidity constrained. For example, as y falls and type 1 voters become marginally more liquidity constrained, an easing of their tax burden will allow the government to win votes by permitting type 1 voters greater flexibility in smoothing their consumption and labor supply decisions. However, as the government responds to type 1 voters, the change in the current tax burden impinges on the plans of type 2 voters (previously optimized in $\Delta \hat{t}$) and this begins to lose the government votes. Equation (27), then, reflects a balancing of political cost in relation to these two groups and explains the role of the political weighting factor, γ , in setting the optimal adjustment path. A similar response emerges as part of the government's intertemporal optimizing response to expected changes in the x 's and is captured by the last term in (27). In this case, tax adjustments for changes in permanent factors will have spillover effects on liquidity that alter the way that the government would have responded in the absence of these considerations.

5. The Meaning of Keynesianism, and Implied Tests for Keynes

The preceding model incorporates normal political responses to the demands of liquidity constrained voters. It does not include Keynesian stabilization. The questions now arise as to exactly what Keynesianism means in this framework, and how the strength of Keynesian elements in public policy may

19. When $\partial(E\mu_1^e) / \partial t = f(\partial y / \partial t_{t+s}) < 0$ the decline in welfare following a tax increase increases with the tax burden.

be assessed. In this section we address these issues.

5.1 Keynesianism as a productivity shock

One reason why voters would value short run fiscal intervention more highly is if they believe that Keynesianism represented an innovation in the effectiveness of fiscal intervention on economic activity. Fiscal policies could become more productive in influencing the cycle either through the adoption of new policies that were truly innovative, or through the expanded scale or scope of previous existing policies. The government would not undertake such a set of policies, or any other for that matter, in a competitive political environment unless the proposed policy innovation had substantial popular support, even if the government alone possessed the necessary knowledge.

To see how government spending would be altered by 'Keynesianism' of this kind, it is useful to examine the coefficients of government spending in equation (26) more carefully. Utilizing the simplification that the ratio of marginal products across time is roughly one, it can be seen that except for the initial coefficient of $\Delta \hat{g}_{t+2}$ (which is 1), each of the other coefficients in (26) contains the term $\partial y / \partial g_{t+2}$ in the denominator. Here $\partial y_{t+2} / \partial g_{t+2}$ represents the effect of government spending on transitory income this period (presumably positive in sign) and hence measures the effectiveness of government spending in reducing the impact of the liquidity constraint.²⁰ It follows that the discovery of a mechanism by which government policy can better change income and so better relieve the hardship caused by liquidity constraint will be mirrored in a rise in the size of $\partial y / \partial g_{t+2}$. Because this productivity term enters the denominator of each coefficient in (25), or equivalently, in (26), greater productivity in government intervention means a decrease in the absolute size of each of these coefficients, while $\Delta \hat{g}_{t+2}$ is unaffected. Correspondingly, each of the coefficients in (27) and (29) will decrease in absolute value as $\partial y / \partial t_{t+2}$ becomes more negative.

While it may initially seem surprising that an increase in the effectiveness of fiscal intervention reduces the size of all coefficients in (26), the government is optimizing expected votes both before and after Keynesian thinking has been introduced, and there is no political profit in diverting more resources to dealing with liquidity constraints than is necessary. Diverting resources towards type 1 voters reduces support from voters who are not liquidity constrained, and the government can increase overall support by easing back on the extent of government intervention.

Each coefficient in (26) measures one short run reason for actual government spending departing from permanent or long run level. Because the transition between positions of long run equilibrium invoke changes in spending that feedback into the liquidity constraint, the short run benefit of expanding government spending encounters diminishing returns. Hence, if government spending is judged to be more effective at each point in time, less intervention is required to accomplish the same effect, so that actual spending should come to correspond more closely to the level of spending implied by the long run equilibrium.

20. Note that even though the technical effectiveness of government spending on transitory income is assumed to be independent of the level of both y_{t+2} and x_{t+2} , the political value of fiscal intervention will vary with the cycle (because the income generated through intervention is valued more highly in the trough of a business cycle where the liquidity constraint is more binding).

Tests for the presence of Keynesian elements in fiscal policy outcomes suggested by the preceding argument may be implemented as follows. In the absence of Keynesianism, planned policy may still be counter cyclical. However, the advent of Keynesianism as productivity shock will lead to planned spending that tends to be less counter cyclical in nature than it would be if the pre-Keynesian policy process remained in force. Consider the differential policy process D_g defined as

$$D_g = [\Delta g^c \text{ 'after Keynes' } - \Delta g^c \text{ in the counterfactual}]$$

where, to recall, the counterfactual is a prediction of what policy outcomes for the period after 1945 would have been if the data generating process governing pre-Keynesian policy applied. D_g will be positively correlated with transitory deviations y^c if a Keynesian productivity shock has occurred. (This is the opposite pattern to the one illustrated by the policy residuals in Figure 1). The pro-cyclical pattern for D_g will be revealed by a positive and significant coefficient on y^c in a regression explaining calculated values of D_g .

Since the counterfactual pattern of taxation will exhibit the opposite correlation with respect to temporary deviations, the analogous policy residual for t^c , D_t , will be negatively correlated with process for y^c , or counter cyclical if a 'productivity shock' occurred. The correlation of D_t and y^c may also be investigated using a simple regression.

Because D_g will move pro-cyclically, and D_t counter-cyclically,

$$D_{\Delta b} = [\Delta(\Delta b^c) \text{ 'after Keynes' } - \Delta(\Delta b^c) \text{ in the counterfactual}]$$

will be positively correlated with y^c , or procyclical, if Keynesianism as productivity shock occurred, provided that change in interest payments consistent with the 'after Keynes' and with the counterfactual policy processes are taken into account. Note since $\Delta b = \Delta g - \Delta t$ both contemporaneously and in the long run, $D_{\Delta b} = D_g - D_t$ and the three policy differentiable constitute a seemingly unrelated system.

A priori, we cannot tell which component of fiscal policy will exhibit the strongest correlation with aggregate shocks.

5.2 Keynesianism as recognition of the external benefits for both types of voters generated by relaxing the liquidity constraint on type 1 voters

Keynesian policies may also stem from a widespread realization by voters that a reduction in the impact of liquidity constraints allows constrained agents to realize more of their "notional" trading plans, thereby opening new market opportunities for other liquidity and non-liquidity constrained individuals. Keynesianism in this sense involves a recognition of the externality inherent in the liquidity effect, and can be interpreted as a greater appreciation of the potential role for government as an internalizing agent through government stabilization policies. This second interpretation of Keynesianism is not inconsistent with the first.

A recognition by the community that it is economic for the government to internalize these external benefits would appear in the model as a rise in the utility generated by government action, and hence as a rise in

the expected political benefit of using fiscal policy for departing from the desired equilibrium path. More explicitly, with $E\mu_g^1 = a + b y_{t+}^c$ [with $a > 0$ and $b < 0$], a rise in the value to the community of using g in relation to the liquidity constraint would appear in equations (25) or (26) as a rise in parameter a and/or a rise in the value of b . Considering the effect of such changes in parameters using (25), we see that greater recognition of the value of using the internalizing powers of the state will increase the reasons for actual government spending departing from its equilibrium desired path in the short run.²¹ An analogous argument holds with respect to equation (27) for Δt^c . The result for Δb^c is ambiguous.

Compared to the counterfactual defined in the absence of any sort of Keynesian policy, policy processes for g^c , t^c and Δb^c will tend to be more strongly counter cyclical than in the counterfactual.

The differential policy process for these variables defined earlier will therefore be correlated with y^c in a manner that is exactly opposite of the correlations derived under the first interpretation of Keynesianism. As shown in Figure 1, D_g will be negatively correlated with y^c or counter cyclical. Analogously, D_t will be positively correlated with y^c or procyclical. And after controlling for interest payments, $D_{\Delta b}$ will be countercyclical.

5.3 Political influence, Keynesianism and unrelated structural shifts

So far we have assumed that the political influence of the two types of voters remains unchanged. Before turning to the implementation of the statistical tests described above, it is of interest to ask what happens in the model if the relative political weight of type 1 or liquidity constrained voters increases for some reason. Such a change does not involve the adoption of Keynesianism as we have interpreted it above.

The relative political weight of type 1 voters is captured by the value of γ in equations (26) and (27). Using equation (26) to illustrate, a rise in γ will have an ambiguous effect on the behaviour of government spending since this parameter appears in both the numerator and denominator of the third term on the right side. Thus, a change in the relative political influence of the two types of voters cannot be unambiguously identified with a particular change in fiscal policy processes. The essential reason is that in the present model, policy reflects a balancing of the interests of all voters. This doesn't rule out a change in a policy process due to a shift in the relative political weight of one or the other type of voter, and for this reason it is possible that a policy shift 'after Keynes' may be erroneously identified as Keynesian when in fact neither of the two interpretations of Keynesianism provided earlier applies.

More generally, it should be noted that policy processes may shift for many reasons 'after Keynes' besides those related to in adoption of Keynesianism; structural changes in the economy following the second world war and the OPEC oil embargo of 1973, for example, may also lead to shifts in policy processes as voters interests are abruptly altered. Therefore, evidence of structural change in the process governing fiscal policy choices will not be decisive by itself in any search for evidence of Keynesian policy. In our view, better evidence concerning Keynesianism is provided by a study of the effect of transitory macroeconomic shocks on the policy differentials D_g , D_t , and $D_{\Delta b}$.

21. A rise in the value of parameter a , and/or a rise in the value of b , results in an increase in the absolute value of the coefficient on the second right-hand term in equation (25).

6. Testing for Keynes in Four Steps: Preliminary Results

The empirical application of the model of planned fiscal policy and the tests for Keynesianism derived above may be conveniently summarized with a set of four steps:

Step 1: Estimate the long run size of g and t simultaneously using seemingly unrelated regression, and derive the implied equation for the net deficit using the government budget restraint

Empirical application of equations (26) and (27) as a model of planned fiscal policy actions presupposes the existence of estimates of the long run or permanent policies \hat{g} and \hat{t} . To construct these variables, we use two extreme methods of attributing the serial correlation in the data to either these permanent components, or to the residual components. Since $(\hat{g} - g) = (\hat{g} - g^c) + (g^c - g)$, these residual components consist of a planned transitory component $(\hat{g} - g^c)$, and a contemporaneous policy error $(g^c - g)$. Analogously for taxes.

Method 1 uses the regression

$$g = \alpha_1' \cdot x + [\alpha_2 g_{-1} + \alpha_3 g_{-2} + \epsilon_g], \quad (28)$$

and an analogous equation for taxes, where $\epsilon_g = (\hat{g} - g^c) + (g^c - g)$. Long run (non-interest) public expenditures are then estimated as $\hat{g} = 1/(1 - a_2 - a_3) \cdot (a' x)$, the long run value of g implied by (28), where 'a' denotes an estimate of the corresponding parameter. In this case, the intertemporal pattern of adjustment of policy instruments depends substantially on government responses to liquidity problems, as well as on contemporaneous policy errors. (Analogously for \hat{t} and Δb)

Method 2 uses the same regression. However, in this case the contemporaneous predicted value from (28), is used to estimate \hat{g} , and lagged dependent variables are assumed capture the intertemporal adjustment of the permanent size of government. The assumption behind this second method is that response to liquidity problems arise only within the very short period, and do not have an important intertemporal component.

Both equations are estimated as a seemingly unrelated system over the entire sample period from 1870 to 1995. Enforcement of the government budget restraint requires that the coefficients of lagged dependent variables be constrained to be equal across equations.²²

Explanatory variables and estimation results for the long run component of real non-interest spending per capita, real taxes per capita, and the implied equation for the real deficit net of interest payments and return on investments, are given in Table 1. The fiscal policy data used are Gillespie's (1991) revised public accounts data, updated from 1990. The explanatory variable Permanent Income, or x^c in terms of model notation, is the predicted value from a regression over the period 1872-1995 of real gnp per capita on a constant, two lags of real gnp, the fraction of the labor force in agriculture, and the current and two lagged values of U.S. industrial production.

22. The equality of coefficients is for a given lag length across equations.

[Table 1 here]

The explanatory variables in Table 1 are intended to capture the determinants of the permanent or long run evolution of government policy instruments. Since the predicted values from the equations in Table 1 are to be used to isolate government responses to transitory macroeconomic shocks over the course of business cycles, the permanent size of government is defined here to include the effect of the world wars.

The long run model also includes a dummy variable for the depression interval from 1930 to 1938 and a shift variable taking the value of 1 from 1930 on. In this respect, it is important to recall that the counterfactual 'after Keynes' is to be based on a model estimated with data from the period before Keynesianism could have been a factor in policy determination. It is therefore necessary to control for the effects of extraordinary events such as the great depression that occurred 'before Keynes' which, for reasons that should not be prejudged, have not reoccurred afterwards. It is of interest to note that the estimated coefficients of the depression variables indicate that the level of taxation was temporarily reduced during the depression years, and that, ceteris paribus, the depression as a whole led to a permanent increase in the level of taxation and reduced reliance on deficit financing.

Step 2: Use the estimates in Table 1 to fit equations (26) and (27) using seemingly unrelated regression, and derive the implied equation for the net deficit from the government budget restraint.

For estimation purposes, reduced form equations (26) and (27) and the implied equation for the deficit using the budget restraint may be written in terms of actual changes in policy variables less the change in the corresponding long run component, the latter being estimated using one or the other of the methods described in step one. Here the original model is reinterpreted so that all variables are in real per capita terms, and the deficit is defined net of interest payments and return on investments:

$$(\Delta g_{t+2} - \Delta \hat{g}_{t+2}) = \gamma_1 + \gamma_2 (r_{t+2}^c) + \gamma_3 (\Delta y_{t+2}^c) + \gamma_4 (\Delta x_{t+2}^c) + \epsilon_{t+2}^g \quad (29)$$

where $\epsilon_{t+2}^g = (\Delta g_{t+2} - \Delta g_{t+2}^c)$, and $\gamma_2 > 0$, $\gamma_3 < 0$, $\gamma_4 < 0$;

$$(\Delta t_{t+2} - \Delta \hat{t}_{t+2}) = \tau_1 + \tau_2 (r_{t+2}^c) + \tau_3 (\Delta y_{t+2}^c) + \tau_4 (\Delta x_{t+2}^c) + \epsilon_{t+2}^t \quad (30)$$

where $\epsilon_{t+2}^t = (\Delta t_{t+2} - \Delta t_{t+2}^c)$, and $\tau_2 < 0$, $\tau_3 > 0$, $\tau_4 > 0$;

$$\begin{aligned} & [\Delta(\Delta b_{t+2} - r_{t+2} b_{t+2-1}) - \Delta(\Delta \hat{b}_{t+2} - \hat{r}_{t+2} \hat{b}_{t+2-1})] \\ & = \beta_1 + \beta_2 (r_{t+2}^c) + \beta_3 (\Delta y_{t+2}^c) + \beta_4 (\Delta x_{t+2}^c) + \epsilon_{t+2}^b \end{aligned} \quad (31)$$

where $\epsilon_{t+2}^b = (\Delta b_{t+2} - \Delta \hat{b}_{t+2})$ and $\beta_i = (\gamma_i - \tau_i)$ for all i .

These equations are of a type that have not to our knowledge been used before to investigate the determinants of macroeconomic policy instruments. While no constant term appears in equations (26) and (27), one is added here by separating the terms in $(\rho - r_{t+2}^c)$ on the right side of each of these equations into

a component that depends on ρ , assumed to be constant, and a part that depends on r_{t+s}^e . The coefficients for the two parts will not be equal when the need for estimating the expected real interest rate r^e is taken into account. The expected real interest rate r^e may be estimated by including past real interest rates in each equation, or by instrumenting the current value of r with lagged values (see, for example, Holtz-Eakin et al 1994, fn 10). In either case, allowing the constant term to vary freely provides further flexibility in the construction of a proxy for r^e , as well as for expectations of the y 's and the x 's.

In the system above, the ϵ 's are error terms that reflect mistakes made by governments in forecasting relevant information, and which lead to deviations of planned and actual changes in policy instruments. The coefficients and the errors across the three equations at each point in time are related because the government budget restraint connects policy choices. In particular, $\beta_i = (\gamma_i - \tau_i)$, and $\epsilon_{t+s}^b = \epsilon_{t+s}^g - \epsilon_{t+s}^t$. The errors may also be correlated over time if aggregate shocks are. The errors are assumed to be uncorrelated with all explanatory variables - forecasting by government is rational in the sense that no information available at time $t+s-1$ can be used to improve forecasts of activity in the next period.

Results of seemingly unrelated regression of the equations for expenditures and taxes, using alternatively each of the methods for estimating the long run components of policy, are given in Table 2 for the period 1872 to 1995. (In this draft, the implied equation for the deficit is not calculated, and the actual long government bond rate is used instead of an instrument or lagged values). Here the explanatory variable Δx^e is the change in the predicted value of per capita real GNP calculated using the regression described in Table 1 for the period 1872 - 1995 (corresponding to observations on the dependent variables). The expected change in the transitory measure of activity used is $\Delta y^e = [\text{actual change in real GNP per capita} - \Delta x^e]$. This measure of Δy^e is negatively correlated with deviations of the unemployment from its long run trend after 1919, the first date for which unemployment figures in Canada are available.²³ It is not correlated with lagged values of y , and for estimation purposes can be considered a predetermined variable. This means that the estimates in Table 2 are robust with respect to the possibility that Keynesian stabilization may have effectively altered the observed values of Δy^e , thereby inducing correlation between the errors in the estimating equations and this explanatory variable.

[Table 2 here]

The equations are estimated over period 'before' (1874-1938) and 'after Keynes' (1948-1995), allowing for lags in the construction of the data and the need to include an autoregressive term of order 1. The period of World War II is excluded; the model of contemporaneous policy changes works badly when this extraordinary period is included in the sample. The signs of coefficients are generally in accord with predictions made in section 2 and noted in the first column of the table, with the main exception being the sign of the coefficient of Δx^e in the tax equation, as discussed below.

As shown in the table, a positive transitory shock $\Delta y^e > 0$ directly loosens liquidity constraints and, as

23. We cannot use the unemployment rate in estimating equations (29) - (31) because the period 'before Keynes' is too short for reliable estimation. However, we can and do use it at a later step when testing for Keynesian elements in the transitory part of planned policy changes.

expected, leads to a significant increase in Δt^e around its long run trend. The effect on spending is always insignificant (with the expected negative sign appearing only for the period after 1947). These results indicate that the level of current taxation is more sensitive than spending to transitory shocks, before as well as 'after Keynes'. The implied effect of a transitory shock on deficit financing is negative, and is significant when method 2 is used to estimate \hat{g} . As a whole, these results show that relative to long run values, transitory shocks alter the split between current and deficit financing but not the level of spending.

An increase in expected long run income Δx^e that indirectly lessens the pressure on the government exerted by liquidity constrained voters results in significant declines in current spending relative to its long run level, as predicted by the model. The implied effect on deficit financing is also negative, with one exception where the coefficient is not significant. However, the coefficient on Δx^e in the tax equation is not positive, but negative and significantly so for the early period, except for the period after 1947 using method 2 for \hat{g} when the coefficient is not significant. (It remains to be seen if experimentation with alternative long run models or with lag structures, not yet completed for this draft of the paper, will alter this result.)

Step 3: Use the pre- or 'before Keynes' (1874-1938) estimates of (29) and (30) to forecast into the period 'after Keynes' (1947-1995), and generate a counterfactual explanation for the period 'after Keynes'. Compute the policy differentials D_g , D_t , and D_{Δ_b} which compare the counterfactual with the best "in period" model of contemporary fiscal plans.

From section three, the policy differential for government spending is:

$$\begin{aligned} D_g &= [\Delta g^e \text{ 'after Keynes' } - \Delta g^e \text{ in the counterfactual}] \\ &= \Delta g^e_{ak} - \Delta \hat{g}_c \\ &= (\Delta g^e - \Delta \hat{g})_{ak} - (\Delta g^e - \Delta \hat{g})_c, \end{aligned} \tag{32}$$

where subscript 'ak' denotes estimation of equation (29) over the period 'after Keynes', and 'c' denotes the counterfactual for the same period based on a forecast using coefficients from the same equation estimated over the period 'before Keynes'. The third equality in (32) follows from the fact that by construction, $\Delta \hat{g}$ is the same both under Keynesianism and in the counterfactual. Analogously for D_t . Using the government budget restraint, $D_{\Delta_b} = (D_g - D_t)$.

In words, the policy differentials are estimated in the following manner. The estimated coefficients of the equation for $(\Delta g^e - \Delta \hat{g})$ for the period from 1874 to 1938 (see Table 2) are used to forecast into the post-war period from 1947 to 1995. This provides the counterfactual estimate $(\Delta g^e - \Delta \hat{g})_c$. The same equation (29) fitted over the period from 1947 to 1995 yields the estimate of planned policy choices 'after Keynes', $(\Delta g^e - \Delta \hat{g})_{ak}$, which might include Keynesian policy responses to transitory shocks, and the differential D_g is computed. This procedure undoubtedly places a heavy burden on the coefficients estimated using data from the period 'before Keynes', but this is a necessary step in the process of uncovering the influence of Keynesian ideas. The calculated policy differentials are then used as an input into the next step.

Step4: Estimate $D_g = \delta_0 + \delta_1 y^e$, and $D_i = \eta_0 + \eta_1 y^e$ as a seemingly unrelated system. Compute the coefficients in $D_{\Delta_b} = \xi_0 + \xi_1 y^e$ using the identities $\xi_0 = \delta_0 - \eta_0$ and $\xi_1 = \delta_1 - \eta_1$.

If

$\delta_1 \leq 0$ and $\eta_1 \geq 0$ and $\xi_1 \leq 0$, with at least one statistically significant strict inequality,
..... there is evidence of textbook Keynesianism;

$\delta_1 \geq 0$ and $\eta_1 \leq 0$ and $\xi_1 \geq 0$, with at least one statistically significant strict inequality,
.....there is evidence of Keynesianism as productivity shock;

$\delta_1 = 0$ and $\eta_1 = 0$ and $\xi_1 = 0$ (all coefficients statistically insignificant) ,
.....there is no evidence of Keynesianism.

The results for step three are found in Table 3, where two different estimates of the transitory shock y^e are used for each method of calculating the permanent components of the policy instruments; the expected deviation of current from long run expected income, as in Tables 1 and 2, and the expected deviation of the unemployment rate from its long run trend, the latter calculated as the difference between the actual unemployment rate and a 'best' moving average representation of the unemployment rate.²⁴ (Note: the implied equations for D_{Δ_b} are not given in Table 3 in this draft.)

[Table 3 here]

It should be recalled that it is the regressions in Table 3, and not tests for structural shifts, that are crucial in the present context. While the process governing fiscal policy plans may shift after World War II for various reasons, what matters is whether or not the policy differentials $D(\cdot)$ as defined above are significantly related to transitory shocks.

The results shown in Table 3 depend on which method is used to derive measures of the transitory components of policy actions, and on which measure of the transitory shock y^e is used. Generally speaking, and perhaps surprisingly, comparison of panel (1) vs (3) and of panel (2) vs (4) indicates that use of Method 2 in Part B of the table - where liquidity constraints are assumed to have, at most, short run and transitory consequences for government policies - results in larger and more significant estimated responses to the transitory shock. Moreover, for each method of attributing intertemporal adjustment of policy instruments to liquidity constraints, comparison of panel (1) vs (2) and of panel (3) vs (4) shows that the use of the history of unemployment rate to generate a measure of y^e generally produces larger estimated responses of the policy differentials than does use of the history of real income.

The results in panels (2), (3) and (4) indicate the existence of text-book Keynesianism; 'after Keynes', non-

24. To economize on the use of the unemployment data, which only begins in 1919, we model the long run rate of unemployment with a constant and four moving average terms (longer lags are not significant). It may be noted that the simple correlation of the deviation of the unemployment rate from its trend with the deviation of real output from its long run trend is low (about - 0.1) over the 1946 to 1995 period. This low correlation is the reason that we use the unemployment rate as a basis for measuring transitory shocks in addition to using real output.

interest spending is higher when negative shocks occur, and taxation is lower, compared to the counterfactual. The use of Method 1 with y^e measured using real income indicates that Keynesian stabilization was not attempted since the coefficients of both δ_1 and η_1 are insignificant, but these results are contradicted by those in panel 2. Our tentative conclusion is that the results in Table 3 as a whole indicate that text-book Keynesianism was attempted in the post-war period.

In the context of the model we have implemented, text-book Keynesianism as a form of policy activism stems from a heightened recognition of the consequences for welfare of the externalities associated with liquidity constraints. This does not exclude the possibility that the adoption of Keynesian ideas also led to the belief that a given government action would have a greater impact on economic activity. But acting on the latter view by itself leads, in the present model, to the opposite signs on the coefficients in the policy differential equations than are actually observed in Table 3. Hence, while Keynesianism as productivity shock may still be present in the data, it is at most of secondary importance.

Significance of effects is one thing and empirical importance is another. It is possible that Keynesian stabilization was implemented, but in magnitudes that were, for all practical purposes, irrelevant. In this respect, consider first the results of using real income to measure y^e . The estimates in panel 3 of Table 3 indicate that the increase in real per capita, non-interest expenditures is on average -14.7 percent of any change in the expected deviation of income from its long run value, while for taxation, the response is about +7.1 percent on average. Over the period 1947-1995, after rounding, the mean value of x^e (predicted real gnp per capita) is \$13,708 or about \$316 billion in total (in 1986 dollars). The average population size over this period is 21.42 million persons. For y^e (the expected deviation of real gnp per capita from x^e), the mean is \$-7.5 with a minimum of \$-440, a maximum of \$627, and a standard deviation of \$222 per person. The mean of g (real non-interest spending per capita) is \$2237, and the mean of t (real taxes per capita) is \$2167.

If a negative shock of one standard deviation in y^e is considered, the estimates in panel 3 indicate that g^e rises by about \$33 per capita (0.147×222), equal to 15% of the per capita shock, or about \$707 millions in total, and t^e falls by about \$16 ($.071 \times 222$) per capita, or about \$343 million in total, with the difference between expenditures and taxes showing up as an increase in the net deficit of about \$49 per capita, which is 22% of the per capita shock and \$1,050 millions in total.

Note that in this scenario, expenditures (including transfer payments) are at least as sensitive to economic fluctuations as are current tax revenues. It does not appear to be the case that so-called automatic stabilizers implemented through the income tax system are the only, or even the main, avenue for Keynesian stabilization efforts. This observation depends on the decomposition of total changes in any instrument into transitory and longer run components, and on our use of the policy differentials to compare the responsiveness of current transitory policy changes to transitory shocks with what would have happened under the structure of government observed 'before Keynes'.

The use of the unemployment rate to measure the transitory shock y^e yields a somewhat different picture. The mean value of the deviation of the unemployment rate from its long run trend over the period from 1947 to 1995, estimated as the difference between the actual unemployment rate and a moving average representation, is about 0.10, with a minimum of -1.8, a maximum of 3.45 and a standard deviation of 1.15 percentage points. The actual mean unemployment rate over the same period is about 6.6 percent.

The results in panel 4 using Method 2 indicate that a one standard deviation fall in the transitory component of unemployment leads to an increase in real per capita spending of about \$20.5 (17.79×1.15) and a fall in per capita taxes of about \$20.6 (-17.95×1.15), an approximately balanced budget change in spending of about \$439 millions in total. The results in panel 2 based on Method 1 indicate that in the same circumstances, spending rises by about \$25 per capita, equal to about 11 percent of the standard deviation shock to real per capita income and \$534 millions in total, while taxes fall by only \$8.8 per capita (4% of the shock to per capita income) or \$189 millions in total, indicating a reliance on deficit financing of about \$34 per capita or 15% of the standard deviation shock to transitory part of real per capita income.

7. Tentative Conclusions and Directions for Further Work

While the General Theory has undoubtedly exerted a profound influence on how economists, politicians, voters and policy makers generally think about the world, acting on such ideas is another matter. In this paper, we consider how one can search for evidence of Keynesianism using the history of actual macroeconomic policy choices. The task requires the construction of a counterfactual that illustrates what would have happened 'after Keynes', had Keynesian stabilization not been attempted. The construction of such a counterfactual provides several challenges, including the separation of public policy into longer run and transitory components, the modeling of policy responses to liquidity constrained voters even in the period 'before Keynes', as well as the need to define what Keynesianism actually means in this context.

The evidence presented here is consistent with "textbook" Keynesianism implemented through deficit financing of fiscal policy, in which transitory changes in spending play at least as important a role as changes in the current level of taxation. In the face of a one standard deviation negative shock to transitory activity, the combination of expenditure increases and tax reductions over and above what would have occurred had the counterfactual model applied, and which may be attributed to attempts at Keynesian stabilization, is on the order of from 15 to 22 percent of the transitory shock. The empirical relevance of these responses to transitory macroeconomic activity is a matter of judgement, but they do not seem insubstantial.

The response on the expenditure side of the budget is consistently in the right direction when judged by the text-book standard, a result that conflicts with other studies that are based on the distinction between automatic and discretionary budgetary changes. In assessing these conflicting results, one should note that the earlier studies do not control for intertemporal adjustments of the longer run path of public policy. (In this respect, it is of interest that omission of $\Delta \hat{g}$ and $\Delta \hat{t}$ from estimating equations (29) and (30) results in insignificant coefficients on Δx^e .) Nor do earlier studies explicitly allow for the possibility, confirmed by the results in Table 2, that even in the absence of Keynesianism, the transitory components of budgets may fluctuate with the cycle in response to political pressure exerted, directly and indirectly, by liquidity constrained voters.

It remains to be seen whether these results will stand up to more extensive testing. Issues that remain to be addressed include: further investigation of the importance of lag structures for the results in Tables 2 and 3; incorporation of electoral cycles and political partisanship which may affect the time path of policy instruments but which have not been included in the formal model; investigation of the effects of exchange

regimes; and testing for structural shifts in the policy differential equations to allow for the possibility that attempts at Keynesian stabilization effectively ended at some point.

Further work (in progress) also includes investigation of asymmetries in responses of the deficit to positive and negative shocks, in order to see if the extent of fiscal conservatism was less pronounced in the 20th century than in the nineteenth, as Buchanan and Wagner (1977) claim.

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Appendix: Linearization of First Order Conditions (24)

We proceed by taking Taylor series approximations of the left hand side of equations (24) for the policy variables g and t . Here we show the detail for the case of government spending only and expand about the long-run path of g , given the expected values of the permanent influences on government size, when the expected transitory deviations from the equilibrium path are equal to zero. That is, we linearize the first order equations around the long-run expected paths for g , $\hat{g}_{t+s} = g(x_{t+s}^e, y_{t+s}^e = 0, \dots)$ and $\hat{g}_{t+s-1} = g(x_{t+s-1}^e, y_{t+s-1}^e = 0, \dots)$, defined by solving the Lagrangian (15) for policies of period $t+s-1$ and $t+s$ under the specified conditions. For this purpose we consider the left side of (24) to be a function of expected quantities x^e and y^e .

Terminating the expansion after the set of second order terms, we find that the Taylor series expansion of the left hand side of (24) becomes

$$\begin{aligned}
 & \mathcal{F}(g_{t+s}^e = \hat{g}_{t+s}, g_{t+s-1}^e = \hat{g}_{t+s-1}, x_{t+s}^e, x_{t+s-1}^e, y_{t+s}^e = 0, y_{t+s-1}^e = 0) \\
 & \approx [\ln[\gamma E_t \mu_g^1(0) + E_t \mu_g^2(x_{t+s}^e)] - \ln[\gamma E_t \mu_g^1(0) + E_t \mu_g^2(x_{t+s-1}^e)]] \\
 & + [\gamma E_t \mu_g^1(0) + E_t \mu_g^2(x_{t+s}^e)]^{-1} \langle [\gamma E_t \mu_{gg}^1(0) + E_t \mu_{gg}^2(x_{t+s}^e)](g_{t+s}^e - \hat{g}_{t+s}) + [\gamma E_t \partial \mu_g^1 / \partial y_{t+s}^e](y_{t+s}^e) \rangle \\
 & - [\gamma E_t \mu_g^1(0) + E_t \mu_g^2(x_{t+s-1}^e)]^{-1} \langle [\gamma E_t \mu_{gg}^1(0) + E_t \mu_{gg}^2(x_{t+s-1}^e)](g_{t+s-1}^e - \hat{g}_{t+s-1}) + [\gamma E_t \partial \mu_g^1 / \partial y_{t+s-1}^e](y_{t+s-1}^e) \rangle.
 \end{aligned} \tag{A1}$$

where we have simplified by assuming that the indirect utility function is separable in the policy instruments so that the cross partial terms are all zero.

To evaluate this expression, we assume that the expected marginal utility generated by a change in the policy variable is linearly related to the expected level of the state variables y_{t+s}^e and x_{t+s}^e , as in $E_t \mu_g^1 = a + b y_{t+s}^e$ and $E_t \mu_g^2 = c + d x_{t+s}^e$, where the scalars a and c are positive and both b and d are negative. (The analogous assumptions about the effects of taxes and debt are also made.) Additional government spending then generates positive utility along the equilibrium path, but produces less additional value for larger positive values of both transitory and permanent income. These are assumptions of convenience in the present discussion - the empirical work allows b and d to take either sign.

Because the difference in logarithms equals the rate of growth of the inside variables, the first term of the expansion in (A1) when evaluated at \hat{g}_{t+s} and \hat{g}_{t+s-1} becomes

$$\frac{\gamma b(a - a) + d(x_{t+s}^e - x_{t+s-1}^e)}{\gamma E_t \mu_g^1(0) + E_t \mu_g^2(x_{t+s-1}^e)} = \frac{d(x_{t+s}^e - x_{t+s-1}^e)}{\gamma a + (c + d x_{t+s-1}^e)}. \tag{A2}$$

Repeating the use of linear marginal utility to evaluate the first order derivatives in (A1)²⁵ from (25) and combining these with (A2), our linear approximation to (24) becomes

25. Here $\partial E_t \mu_g^1 / \partial g_{t+s} = \gamma b (\partial y^e / \partial g)$ is assumed to be independent of the size of y^e ; $\partial E_t \mu_g^2 / \partial g_{t+s} = d (\partial x_{t+s}^e / \partial g_{t+s}) = 0$; $\partial E_t \mu_g^1 / \partial y_{t+s} = \gamma b$; and $\partial E_t \mu_g^2 / \partial y_{t+s} = 0$.

$$\begin{aligned}
& \frac{d(x_{t+s}^e - x_{t+s-1}^e)}{\gamma a + c + dx_{t+s-1}^e} + \frac{\gamma b(\partial y/\partial g_{t+s}^e)}{\gamma a + c + dx_{t+s}^e} (g_{t+s}^e - \hat{g}_{t+s}) - \frac{\gamma b(\partial y/\partial g_{t+s-1}^e)}{\gamma a + c + dx_{t+s-1}^e} (g_{t+s-1}^e - \hat{g}_{t+s-1}) \\
& + \frac{\gamma b}{\gamma a + c + dx_{t+s}^e} y_{t+s}^e - \frac{\gamma b}{\gamma a + c + dx_{t+s-1}^e} y_{t+s-1}^e = \rho - r_{t+s} + D[\ln \psi_{t+s}].
\end{aligned} \tag{A3}$$

It may be noted here that while similar variables have coefficients with the same general form across time in (A3), all coefficients are time dated and become equal only if the state variables are equal in adjacent periods. The same general form holds for t_{t+s} .

We can rearrange (A3) to solve explicitly for g_{t+s}^e (and for t_{t+s}). Using X_{t+s}^e to represent the time dated term representing the weighted sum of the first derivatives, $X_{t+s}^e = \gamma a + c + dx_{t+s}^e > 0$, we have

$$\begin{aligned}
g_{t+s}^e - \hat{g}_{t+s} &= \frac{[\rho - r_{t+s} + D \ln(\psi_{t+s})]}{(X_{t+s}^e)^{-1} \gamma b(\partial y/\partial g_{t+s}^e)} - \frac{1}{(\partial y/\partial g_{t+s}^e)} \left[y_{t+s}^e - \frac{y_{t+s-1}^e}{X_{t+s-1}^e (X_{t+s}^e)^{-1}} \right] \\
& - \frac{d(x_{t+s}^e - x_{t+s-1}^e)}{\gamma b(\partial y/\partial g_{t+s}^e) X_{t+s-1}^e (X_{t+s}^e)^{-1}} + \left[\frac{(g_{t+s-1}^e - \hat{g}_{t+s-1})}{X_{t+s-1}^e (X_{t+s}^e)^{-1}} \right] \left[\frac{(\partial y/\partial g_{t+s-1}^e)^e}{(\partial y/\partial g_{t+s}^e)} \right].
\end{aligned} \tag{A4}$$

To interpret this equation, note that since $X_{t+s}^e = \gamma a + c + dx_{t+s}^e$ and $X_{t+s-1}^e = \gamma a + c + dx_{t+s-1}^e$, then $X_{t+s-1}^e (X_{t+s}^e)^{-1} \approx 1$. In addition, we assumed earlier that $\partial y/\partial g_{t+s-1}^e \approx \partial y/\partial g_{t+s}^e$. Using these approximations and rearranging, (A4) reduces to

$$\Delta g_{t+s}^e = \Delta \hat{g}_{t+s} + \frac{[\rho - r_{t+s} + D \ln(\psi_{t+s})]}{(X_{t+s}^e)^{-1} \gamma b(\partial y/\partial g_{t+s}^e)} - \frac{(y_{t+s}^e - y_{t+s-1}^e)}{(\partial y/\partial g_{t+s}^e)} - \frac{d(x_{t+s}^e - x_{t+s-1}^e)}{\gamma b(\partial y/\partial g_{t+s}^e)}. \tag{A5}$$

where $\Delta g_{t+s}^e = (g_{t+s}^e - g_{t+s-1}^e)$. Equation (A5) is equation (25) in the text.

A List of Definitions and Assumptions Used in the Derivation of Estimating Equations

$$\lambda = N_1 / N$$

$$\alpha_h = \partial F_k^h / \partial (E_t(U^h(k))) = 1 / (\phi_{\max}^h - \phi_{\min}^h)$$

$$\theta_1 = N_1 \lambda \alpha_1$$

$$\theta_2 = N_1 (1-\lambda) \alpha_2$$

$$\gamma = N_1 \alpha_1 / (N_1 \alpha_1 + N \alpha_2) < 1$$

$$\mu^1(x, y) = \mu^1(x) + \mu^1(y) = \mu^2(x) + \mu^1(y).$$

$$\partial(\theta_2 E_t \mu^2) / \partial b_t = 0$$

$$E_t \mu_g^1 = a + b \cdot y_{t+2}^c > 0; a > 0, b < 0$$

$$E_t \mu_g^2 = c + d \cdot x_{t+2}^c > 0; c > 0, d < 0$$

$$E \mu_t^1 = e + f \cdot y_{t+2}^c < 0; e < 0, f > 0$$

$$E \mu_t^2 = h + k \cdot x_{t+2}^c < 0; h < 0, k > 0$$

$$\partial(\theta_1 E_t \mu^1) / \partial b_t \neq 0$$

$$\partial(\theta_2 E_t \mu^2) / \partial b_t = 0$$

$$\partial y / \partial g_{t+2-1} = \partial y / \partial g_{t+2} > 0$$

$$\partial y / \partial t_{t+2-1} = \partial y / \partial t_{t+2} < 0$$

$$(\partial^2 y / \partial t_{t+2}^2) < 0$$

$$X_{t+2}^c = \gamma \cdot a + c + d \cdot x_{t+2}^c > 0$$

$$X_{t+2-1}^c = \gamma \cdot a + c + d \cdot x_{t+2-1}^c > 0$$

$$X_{t+2-1}^c (X_{t+2}^c)^{-1} = 1$$

$$Z_{t+2} = (X_{t+2}^c)^{-1} \gamma \cdot b \cdot (\partial y / \partial g_{t+2})^c < 0$$

$$W_{t+2} = (V_{t+2}^c)^{-1} \gamma \cdot f \cdot (\partial y / \partial t_{t+2})^c > 0$$

$$V_{t+2}^c = \gamma \cdot e + h + k \cdot x_{t+2}^c < 0$$

Figure 1
Planned Fiscal Policy 'Before' and 'After' Keynes

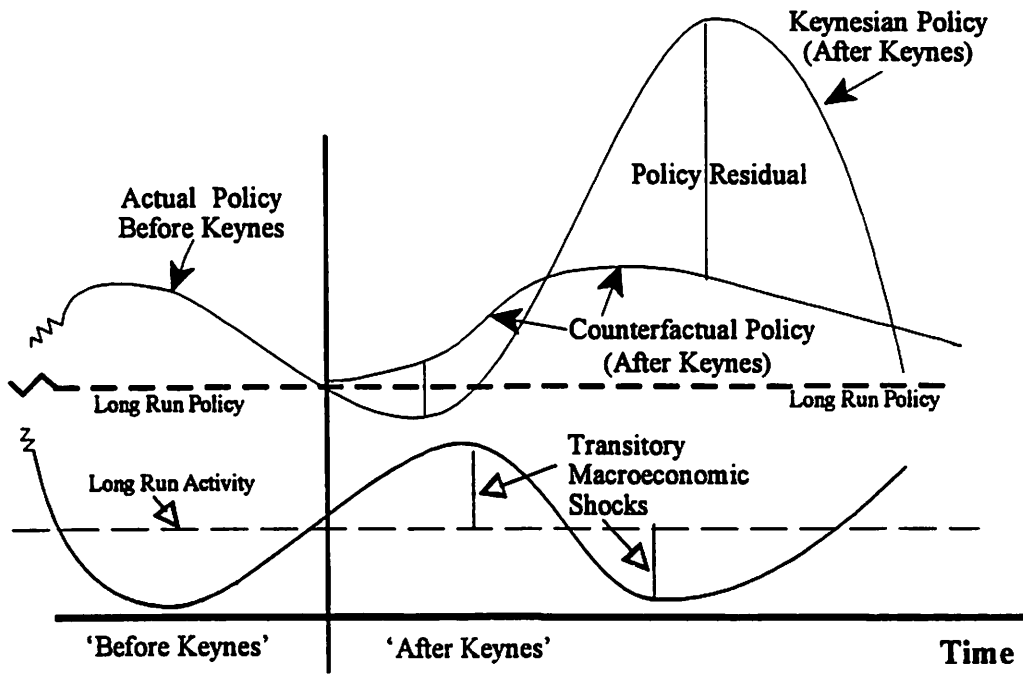


Table 1.

Long Run Values for \hat{g} , \hat{t} , and $[\Delta\hat{b}_t - r_t \hat{b}_{t-1}]$
Canadian Annual Data, 1872 - 1995, Iterative Seemingly Unrelated Regressions

	\hat{g} : Real Non-interest Government Spending Per Capita	\hat{t} : Real Taxes Per Capita	$[\Delta\hat{b}_t - r_t \hat{b}_{t-1}]$: Real Deficit Net of Interest and Return on Investments Per Capita
Constant	-149.70 (0.526)	-216.02 (1.43)	66.32 (0.242)
Permanent Income (x^*)	0.096* (4.20)	0.082* (6.51)	.014 (0.686)
Fraction of Labor Force in Agriculture	-1082.49* (2.65)	91.98 (0.423)	-1174.47* (3.00)
Immigration as a fraction of Population	-2110.28 (1.40)	-1257.23 (1.57)	-853.05 (0.590)
Population Size	-0.047* (2.43)	-0.018** (1.73)	-0.029 (1.58)
WWII	459.15* (6.02)	71.20** (1.83)	387.95* (5.41)
Fraction of Population below 17 years	17.49* (2.95)	2.73 (0.880)	14.76* (2.63)
Oil Shock dummy (=1, 1974 on; =0 otherwise)	213.94* (2.39)	-78.60** (1.65)	292.54* (3.39)
Depression dummy (=1, 1930 on; =0 otherwise)	45.39 (0.618)	143.70* (3.41)	-98.31 (1.43)
Depression Interval (=1, 1930 - 1938; =0 otherwise)	29.30 (0.382)	-111.57* (2.60)	140.87* (1.97)
Lagged Dependent Variable (constrained across equations)	1.128* (21.44)	1.128* (21.44)	1.128* (21.44)
Twice Lagged Dependent (constrained across equations)	-0.459* (9.36)	-0.459* (9.36)	-0.459* (9.36)
Sample Size	124	124	124
R ²	.988	.996	.844
D.W.	2.02	1.79	2.16

Notes to Table 1: * (**) denotes a coefficient significantly different from zero at 5% (at 10%). The first observation on the dependent variable is 1872. The implied bond equation in column four is: $[\Delta\hat{b}_t - r_t \hat{b}_{t-1}] = (\hat{g} - \hat{t})$, where $r_t \hat{b}_{t-1}$ refers to = debt interest payed to the private sector net of return on investments. Permanent Income (x^*) is the predicted value from a regression over the period 1872-1995 of real gnp per capita on a constant, two lags of real gnp, the fraction of the labor force in agriculture, and the current and two lagged values of U.S. industrial production.

Table 2

System Estimation of Equations (29) and (30)
Iterative Seemingly Unrelated Regressions

Variables (expected signs of coefficients)	<i>Method 1</i>		<i>Method 2</i>	
	1874 - 1938	1948 - 1995	1874 - 1938	1947 - 1995
Non-interest spending	$(\Delta g - \Delta \hat{g})$	$(\Delta g - \Delta \hat{g})$	$(\Delta g - \Delta \hat{g})$	$(\Delta g - \Delta \hat{g})$
r^e (+)	1.88 (1.19)	5.27** (1.92)	2.51* (3.06)	-4.29 (1.18)
Δy^e (-)	0.046 (1.30)	-0.001 (0.001)	0.004 (0.134)	-0.126 (1.39)
Δx^e (-)	-0.149* (3.86)	-0.327* (4.87)	-0.046* (2.27)	-0.147* (3.02)
Sample Size	65	48	65	49
R ²	.401	.438	.400	.385
D.W.	1.92	2.03	2.42	2.10
Taxation	$(\Delta t - \Delta \hat{t})$	$(\Delta t - \Delta \hat{t})$	$(\Delta t - \Delta \hat{t})$	$(\Delta t - \Delta \hat{t})$
r^e (-)	-1.141 (0.829)	-4.82 (0.866)	-0.283 (0.530)	3.57 (1.40)
Δy^e (+)	0.088* (2.70)	0.099 (1.57)	0.051* (3.03)	0.128* (2.02)
Δx^e (+)	-0.128* (3.63)	-0.067 (1.27)	-0.066* (4.97)	0.039 (1.15)
Sample Size	65	48	65	49
R ²	.423	.291	.432	.338
D.W.	1.33	1.79	1.62	2.26
Implied Net Deficit	$(\Delta b - \Delta \hat{b})$	$(\Delta b - \Delta \hat{b})$	$(\Delta b - \Delta \hat{b})$	$(\Delta b - \Delta \hat{b})$
r^e (+)	3.02 (1.51)	10.09 (1.10)	2.793* (2.92)	-7.86* (2.03)
Δy^e (-)	-0.042 (0.921)	-0.100 (0.957)	-0.047 (1.57)	-0.254* (2.80)
Δx^e (-)	-0.021 (.423)	-0.260* (2.91)	0.020 (1.13)	-0.186* (3.59)

Notes to Table 2: * (**) significantly different from zero at 5% (at 10%). Constant and common AR(1) term used in all equations is not reported. x^e is measured as in Table 1. $\Delta y^e = [\text{the actual change in real gnp per capita} - \Delta x^e]$. The real interest rate $r^e = [\text{the actual long term government bond rate} - \text{the rate of inflation}]$.

Table 3
Evidence of Keynesianism?
 Iterative Seemingly Unrelated Regressions, 1947-1995

A. Using Method 1 estimates of \hat{g} and \hat{t} : The intertemporal pattern of adjustment depends substantially on government responses to liquidity problems, as well as on contemporaneous policy errors.

(1) Shock y^* measured as expected deviation of gnp from its long run level

	δ_0	δ_1	AR(1)	
Real non-interest spending per capita: $Dg = \delta_0 + \delta_1 y^e$	30.87 (1.57)	0.028 (0.715)	0.523* (6.21)	$R^2 = .002$ DW = 2.20
	η_0	η_1	AR(1)	
Real taxes per capita: $Dt = \eta_0 + \eta_1 y^e$	30.94* (3.34)	-0.17 (1.16)	0.606* (7.55)	$R^2 = .101$ DW = 2.11

(2) Shock y^* measured as expected deviation of the unemployment rate from its long run level

	δ_0	δ_1	AR(1)	
Real non-interest spending per capita: $Dg = \delta_0 + \delta_1 y^e$	29.38 (1.83)	21.80* (3.42)	0.484* (5.69)	$R^2 = .255$ DW = 2.42
	η_0	η_1	AR(1)	
Real taxes per capita: $Dt = \eta_0 + \eta_1 y^e$	30.76* (3.90)	-7.61* (3.11)	0.582* (7.05)	$R^2 = .280$ DW = 2.52

B. Using Method 2 estimates of \hat{g} and \hat{t} : All dynamic adjustment attributed to the intertemporal evolution of the permanent component of fiscal instruments, and responses to liquidity effects are short run and transitory.

(3) Shock y^* measured as expected deviation of gnp from its long run level

	δ_0	δ_1	AR(1)	
Real non-interest spending per capita: $Dg = \delta_0 + \delta_1 y^e$	9.40 (0.864)	-0.147* (7.25)	.555* (6.59)	$R^2 = .455$ DW = 1.86
	η_0	η_1	AR(1)	
Real taxes per capita: $Dt = \eta_0 + \eta_1 y^e$	17.89* (2.06)	0.071* (3.38)	0.445* (4.69)	$R^2 = .219$ DW = 2.11

(4) shock y^* measured as expected deviation of the unemployment rate from its long run level

	δ_0	δ_1	AR(1)	AR(2)	
Real non-interest spending per capita: $Dg = \delta_0 + \delta_1 y^e$	9.40 (0.944)	17.79* (3.98)	.215* (2.20)	0.243* (2.55)	$R^2 = .333$ DW = 1.87
	η_0	η_1	AR(1)	AR(2)	
Real taxes per capita: $Dt = \eta_0 + \eta_1 y^e$	20.50* (2.54)	-17.95* (5.00)	.215* (2.20)	0.243* (2.55)	$R^2 = .219$ DW = 2.11

* significantly different from zero at 5%.