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A Nominal Theory of the Nominal Rate of Interest and the Price Level: Some Empirical Evidence

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Abstract

This paper aims to investigate the impact of the bond/money ratio on the nominal interest rate. The econometric model chosen fits a dynamic panel data for Canada, Japan and US over the period 1980-2006. We found empirical evidence that Ricardian Equivalence does not hold. The analysis indicates, for the three countries, that the bond/money ratio affects the nominal interest rate.

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1. Introduction

Roughly fifty years ago, Bowen, Davis and Kopf (1960) wrote a note presenting a case for the "classic view" that bond financing of public expenditures – unlike pay-as-you-go financing – places a burden on future generations. Robert Barro (1974), dealing with an intimately related issue, cast a model in which government debt does not affect the perceived net wealth of households (Martins, 1979). David Ricardo pointed out that they might conceivably treat the future taxes servicing the government debt as exactly offsetting it. Barro (1974) has shown that maximizing households will actually do so if they accurately anticipate future taxes, if they face perfect capital markets, and if they have effectively infinite horizons. The Ricardian equivalence proposition (REP), clearly stated in Barro (1974), is said to hold if households do treat future servicing taxes as an exact offset to the government debt (Evans, 1993). Both publications stimulated much debate about the rule of government bonds in macroeconomics (Martins, 1979).

The empirical evidence for REP is usually investigated following two approaches. The first seeks effects of government deficits on interest rates, while the second analyses the impact of a fiscal policy variable, e.g. public debt, on the behavior of an aggregated macroeconomic variable, which could be either consumption or savings, for example (Rodrigues, 2006).

The empirical evidence presented by Hoelscher (1986) confirms the theoretical prediction that deficits cause long-term interest rates to rise. The regression results indicate that this deficit-interest rate connection is strong, robust and very significant for the postwar period and for sub periods within the larger period under analysis. The author explains that since long term rates are more closely related to many consumer and business spending decisions than are short-term rates, the crowding-out effects of deficits spending are potentially serious. Conversely, Evans (1987) contests the belief that larger budget deficits – whether occurring in the past or present or expected to occur in the future means higher interest rates. His paper presents empirical evidence inconsistent with this belief. In this context, other authors such as Correia-Nunes and Stemitsiotis (1995) and Lindé (1998) confirm the theoretical prediction that larger budget deficits cause higher interest rates.

Correia-Nunes and Stemitsiotis (1995) investigate a possible association between larger budget deficits and high nominal and real long term interest rates. Their regression results show that the linkage between large deficits and high interest rates is statistically strong during the 1970-93 period for ten major industrial countries and at the world level.

Lindé (1998) studies the empirical relation between nominal interest rates and government budget deficits. The strategy employed is similar to that of Evans (1985, 1987a, 1987b, 1988) in the sense that he uses a conventional macro model as his point of departure for the empirical investigation. According to the empirical results, larger budget deficits spell higher interest rates, as posited by conventional macroeconomic theory. Here we investigate a possible association between public debt and nominal interest rate, although the main evidence about REP is focused on consumption models rather than on interest rate models.

Martins (1980) develops a theory of nominal income and interest determination under the assumption that the only relevant distinction between money and bonds lies in their holding periods. Individuals take full account of the government budget constraint and do not concern themselves with discounting future tax liabilities associated with the issue of government bonds. According to this theory, the price of bonds is analogous to the price level, and the nominal rate of interest is determined by the bond/money ratio and bears no close relationship to the rate of expansion of the price level.

Based on Martins (1980) we can rewrite his fundamental equation as $R_t = B_t/M_t$ where$R_t = (1 + i_t)$. The subscript t represents the time, i represents the nominal interest rate, B represents the stock of bonds and M represents the stock of money. Applying logs in both sides of the equation one obtains the differential equation

$$d \log(R_t) = d \log(B_t) - d \log(M_t) \tag{1}$$

Notice that the interest rate elasticities with respect to bonds and money supply are unitary. In this context, an increase of bond/money ratio always results in an increment of interest rate. However, if we consider a stochastic model, under estimation, it is possible that both elasticities fail to be unitary. In this sense the elasticity of money could be higher or lower than the elasticity of public bonds. Therefore a general statistical model would note impose any direction for the difference. The actual relation would be statistically tested.

The most important implication of the Martins' model is that in a world which the decisions to accumulate wealth are associated with spending decisions, and in which the only difference between money (M) and bonds (B) lies in their holding periods, the nominal interest rate (i) is basically determined by the bonds/money ratio. In this sense, the nominal rate of interest is determined by the relative supply of bonds with respect to money, and bears no relationship to the rate of inflation. This result implies that the Fisherian theory of nominal interest rate (Fisher [1930], chaps. 2 and 19) does not hold. This article tests REP using Martins (1980) model fitting the statistical model

$$R_{lt} = f\left(\frac{B_{lt}}{M_{lt}}, \frac{B_{lt-1}}{M_{lt-1}}, \ldots, \frac{B_{lt-p}}{M_{lt-p}}, z_{lt}^1, \ldots, z_{lt}^k\right) + u_{lt} \tag{2}$$

Here $(1 + i_{lt}) = R_{lt}$. The subscript l represents Canada, Japan and US and $t$is year. The analyses cover the period 1980-2006. The $z^j$are contextual variables.

2. Empirical Results

As a proxy for the nominal interest rate we use the lending interest rate. This information and the stock of money are available in Word Bank (2008). Lending interest rate is the rate charged by banks on loans to prime customers. We use as a proxy for money M1. Data are in current local currency.

As a proxy for the government debt or bonds we use the general government gross debt. General government gross debt (national currency) comprises the stock (at year-end) of all government gross liabilities (both to residents and nonresidents). To avoid double counting, the data are based on a consolidated account (eliminating liabilities and assets between components of the government, such as budgetary units and social security funds). General government should reflect a consolidated account of central government plus state, provincial, or local governments. The source of data is the IMF (2008).

The contextual variables are all dummy variables to differentiate the countries. The basis is the US. All variables are measured in natural logs. Our choice of countries was dictated by data availability. Only Canada, Japan and the US provided a long enough time series for the analysis on public debt.

2.1 Panel Data Analysis

The dynamic panel model we use follows Arellano and Bover (1995) and Blundell and Bond (1998). Table I shows the estimation results for the basic model

$$R_{lt} = \beta_0 + \beta_1 R_{l,\,t-1} + \beta_2 R_{l,\,t-2} + \beta_3 (B/M)_{lt} + \beta_4 (B/M)_{l,\,t-1}$$

$$+ \sum\nolimits_{l=1}^{2} \delta_l D_l + \sum\nolimits_{=1}^{2} \alpha_l D_l (B/M)_{l,\,t} + \sum\nolimits_{l=1}^{2} \gamma_{\,l} D_l (B/M)_{l,\,t-1} + \eta_{\,l} + \varepsilon_{\,lt} \quad (3)$$

where η_i is a random effect for country $i$and $\varepsilon_{it}$is an error component not showing serial correlation of second order. The model imposes different intercepts and different bond/money coefficients for each country and common effects for the lagged interest rates.

Table I – Estimation Results (Stata 10 output)

Variables	Coefficients	Robust Sd	p-values
R_{t-1}	0.813	0.052	< 0.001
R_{t-2}	-0.197	0.044	< 0.001
$(B/M)_t$	0.040	0.005	< 0.001
$(B/M)_{t-1}$	-0.047	0.001	< 0.001
$D_1(B/M)_{1\,t}$	-0.023	0.012	0.048
$D_1(B/M)_{1,\,t-1}$	0.038	0.004	< 0.001
$D_2(B/M)_{2,\,t}$	-0.032	0.004	< 0.001
$D_2(B/M)_{2,\,t-1}$	0.021	0.003	< 0.001
D_1	-0.020	0.014	0.145
D_2	0.002	0.008	0.807
Constant	0.286	0.071	< 0.001

The test for the presence of second order autocorrelation has a p-value of 19,8% and the model seems to be adequate. All variables are significant at the 5% level, except the dummies. We can see from Table II that the net effect of (B/M) is negative and statistically significant for Japan and US and it is positive and statistically significant for Canada.

Table II – Long Run Net Effects

Countries	$\beta_3 + \alpha_l$	$\beta_4 + \gamma_l$	Long run net effect	Sd	p-value
Canada	0.017	-0.009	0.008	1.73E-14	< 0.001
Japan	0.008	-0.026	-0.018	6.36E-14	< 0.001
US	0.040	-0.047	-0.007	2.90E-14	< 0.001

Conclusions

We found empirical evidence that the nominal interest rate is not independent of the bond/money ratio and therefore that the Ricardian Equivalence proposition is not valid for US, Japan and Canada for the period 1980-2006. We found the net effect between bond and money elasticities positive for Canada and negative for Japan and the US. Theoretically the net effect should be positive. We point out two major reasons to explain negative empirical result for Japan and the US. Firstly is that Martins (1980) model is valid only for closed economies and the IMF measurement of government debt comprises all government gross liabilities for both residents and non residents. Finally the theoretical model assumes the debt formed exclusively by treasury bills. Furthermore, the theoretical model does not assume measurement of stock of debt by a discounted flow of government bonds. This, very likely, is the case with the IMF data.

A suggestion for further investigation involves an extension of Martins (1980) model for an open economy. This line of research should take into account possible financial linkages among the countries that might transfer REP to the exchange rate.

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