International Crowding Out: The U.S. Debt and Foreign Interest Rates

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Abstract

This study investigates the impact of changes in the real U.S. debt stock on the short-term interest rates of Canada, France, and Germany. The standard two country portfolio model is extended to examine whether increases in the real U.S. debt stock had a crowding out effect on international portfolios. The evidence presented suggests that international crowding out did not occur during the first monetary regime identified in the study, but did during the second. Thus, future increases in the real U.S. debt stock could have important implications for foreign capital markets.

Introduction

Rising U.S. federal budget deficits and the associated high level of debt have become important issues because of their potential to increase the U.S. rate of return on capital and to crowd out private investment. A growing body of literature concerned with estimating the impact of increases in government debt financing on interest rates known as portfolio crowding out has developed. Friedman [21] has shown that the outcome of the portfolio effect depends on the portfolio substitution and wealth effects and the net result may be either crowding out or crowding in. Because the sign of the portfolio effect can not be determined *a priori*, Placone, Ulbrich, and Wallace [34] suggest that this is an empirical issue.

The majority of the empirical studies find the relationship between U.S. interest rates and U.S. debt stock or deficits to be either statistically negative or insignificant. For instance, Mascano and Meltzer [32] report no significant impact of the deficit on either long- or short-term interest rates, while Dewald [16] concludes that the real deficit is not an important factor in the determination of long- or short-term interest rates. Evans [18] examines the impact of federal deficits on U.S. interest rates by using a broad historical survey. He concludes

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that since the Civil War period, there has been little evidence that increases in the deficit significantly contributed to higher interest rates. Tatom [38] presents evidence that the ratio of the deficit to the GNP is negatively correlated with the change in short-term interest rates. Similarly, Hoelscher [24] and Placone, Ulbrich, and Wallace [34] find no significant correlation between the debt stock and short-term interest rates. Plosser [35] concludes that there is little empirical evidence that increases in the government debt drives up yields.[1]

Nevertheless, the evidence on portfolio crowding out is not conclusive. In particular, Cebula [11] uses a systems approach and provides evidence that the ratio of the deficit to the GNP has a significant positive impact on the rate of change in short-term interest rates, while Hoelscher [25] reports that large deficits are strongly correlated with long-term interest rates. Barth, Iden, and Russek [4] reestimate several of the models that find the relationship between deficits and interest rates to be insignificant and, by making small changes in the specifications of the models, they obtain a significant positive correlation between interest rates and the deficit. In addition, Feldstein [19, 20] and Van de Water and Ruffing [40] maintain that the large deficits and debt burden incurred after 1980 led to increases in U.S. interest rates.

Although most studies that have measured the effect of increases in the U.S. debt concentrate on the U.S. economy, there is growing concern regarding the linkages between the U.S. and international financial markets and the impact of increases in the level of U.S. debt on interest rates in the international community. For instance, Fukao and Okuba [22] find a strong positive link between the U.S. short-term interest rates and the Japanese term structure of interest rates. Hartman [23] provides evidence that the Eurodollar market and the domestic U.S. money markets are closely related, while Cumby and Miskin [15] find a strong association between *ex ante* real interest rates in the United States and Europe. In addition, Hutchinson and Pyle [27] report that short-term real interest rates are systematically and positively associated with government budget deficits for the seven major industrial countries using pooled annual time series data.

This study measures the impact of changes in the real U.S. debt stock on short-term interest rates in Canada, France, and Germany by extending the two country portfolio balance model developed by Fukao and Okuba [22], Branson and Henderson [9], and Tobin [39]. This model permits the citizens of these countries to include U.S. securities in their portfolio and emphasizes portfolio substitution of international assets. If increases in the real U.S. debt stock are positively correlated with foreign interest rates, then U.S. debt may crowd out

[1]For a review of the empirical results, see Tatum [37] and the *Economic Outlook* [12].

foreign investment. This presents a problem for foreign government monetary control.

International Transmission of U.S. Debt

A variation of the international portfolio model developed by Fukao and Okuba [22], Branson and Henderson [9], and Tobin [39] is used to analyze the impact of changes in the level of real U.S. debt stock on the short-term interest rates of Canada, France, and Germany. The portfolio model presented is less restrictive than previous portfolio balance models (Branson, Halttunen, and Masson [10]; Bisignano and Hoover [6]; Fukao and Okuba [22]) because it takes a world portfolio approach and does not assume that one of the countries is small. This model allows for the simultaneous determination of U.S. and foreign short-term interest rates and exchange rates.

As a simplification, this model assumes that each country faces a world asset market, residents of both countries only hold their own currencies (no currency substitution), and that assets are gross substitutes. The flow of funds accounts table and variable definitions are presented in Table 1 using a similar notation as Fukao and Okuba [22].

The columns in Table 1 represent the balance sheet constraints and, following Branson and Henderson [9], these are expressed in the domestic currency. The foreign government and private sector balance sheet constraints are:

(1) $M_g + B_g = A_g$;

(2) $M_p + B_p + e(D_p) = W_p - K_p = N$;

and the U.S. government and private sector balance sheet constraints are:

(3) $e(M^*_g + D^*_g) = e(A^*_g)$;

(4) $e(M^*_p + D^*_p) + B^*_p = e(W^*_p - K^*_p) = e(N^*)$;

total world private financial wealth is:

(5) $N^W = N + e(N^*)$;

where:

e = the exchange rate, and

N and N^* = total private financial assets of the foreign country and of the United States denominated in the foreign country.

It should be noted that capital gains and loses may occur in both countries because of exchange rate variations, thereby resulting in a change in the total private financial wealth for each country. Fukao and Okuba do not allow for this possibility.[2]

The asset demand functions introduced are similar to those used by Fukao and Okuba except that they are symmetrical and that wealth is not fixed, something not examined in previous studies. The foreign demand for foreign money is specified as:

(6) $M_p = m(r,r^* + \varepsilon, N^W)$.

The components of the foreign demand for foreign and U.S. bonds follow Brainard and Tobin [7] in specifying as many parameters as the foreign money demand function, thereby avoiding asymmetrical restrictions. The foreign demand for foreign and U.S. bonds is given by the following two equations:

(7) $B_p = b(r,r^* + \varepsilon, N^W)$;

(8) $D_p = d(r,r^* + \varepsilon, N^W)$.

The U.S. demand for U.S. money and bonds and foreign bonds are given by the following three equations:

(9) $M_p^* = M^*(r,r^* + \varepsilon, N^W)$;

(10) $D_p^* = d^*(r,r^* + \varepsilon, N^W)$;

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[2]The modeling of the world wealth variable is a simplifying assumption that allows asset markets to respond to changes in the level of world wealth. As pointed out by Bisignano and Hoover [6], this avoids some of the problems associated with modeling net asset stocks. Furthermore, they argue that two country portfolio models should be based on gross instead of net asset stocks. This approach treats wealth as an endogenous variable in the short run and highlights the role of the exchange rate in revaluing world wealth to maintain portfolio equilibrium.

(11) $B_p^* = b^*(r,r^* + \varepsilon, N^W)$;

where:

r = the foreign interest rate
r^* = the U.S. interest rate, and
ε = the expected rate of depreciation of the domestic currency.

The asset markets are in equilibrium when the demand from the private sector equals the supply from the public sector. This is represented as follows:

(12) $m(r,r^* + \varepsilon,N^W) = M_g$;

(13) $b(r,r^* + \varepsilon, N^W) + b^*(r,r^* + \varepsilon,N^W) = B_g$;

(14) $m^*(r,r^* + \varepsilon, N^W) = eM_g^*$;

(15) $d(r,r^* + \varepsilon, N^W) + d^*(r,r^* + \varepsilon, N^W) = eD_g^*$.

World private financial wealth, N^W, is equal to the stock of all financial assets measured in the foreign currency that is available to private agents. Similarly, world desired wealth, N^D, is equal to the sum of assets demands. These are expressed as follows:

(16) $N^W = M_g + B_g + e(M_g^* + D_g^*)$;

(17) $N^D = M_p + B_p + B_p^* + e(M_p^* + D_p^* + Dp)$.

The consolidated world balance sheet constraint states that all excess demands must equal zero. Thus:

(18) $(M_g-M_p) + (B_g-B_p-B_p^*) + e(M_g^*-M_p^*) + e(D_g^*-D_p-D_p^*) = 0$.

Following Branson and Henderson [9], it is assumed that exchange rate expectations are static ($\varepsilon = 0$).[3] Therefore, this model expresses the endogenous variables: the foreign interest rate (r), the U.S. interest rate (r*), and the exchange rate (e) as a function of the foreign and U.S. debt stock and the foreign and U.S. monetary base.

Because the model does not rely on the small country assumptions used by Fukao and Okuba [22], it is not possible *a priori* to sign the impact of changes in the foreign debt stock or the U.S. debt stock on foreign interest rates without restricting the parameters of the model.[4] Friedman [21] shows that in a closed economy, portfolio crowding out or crowding in depends on the wealth effects and the relative substitutability between domestic money, domestic debt, and real capital. Branson [8] and Bisignano and Hoover [9] show that these ambiguous results are also characteristic of open economy portfolio balance models in the presence of conflicting wealth and substitution effects and that the parameter solution depends on the relative substitutability of assets within the private sector's portfolio.[5] Despite these theoretically indeterminate results, Van de Water and Ruffing [40] maintain that the large debt incurred after 1980 could have important implications for the impact of changes in the U.S. debt stock on interest rates in the future. Furthermore, Placone, Ulbrich, and Wallace [34] note that empirical estimation of the cross-country effects provides valuable information for policy formulation.

Estimation

Reduced form parameters of a macroeconomic relationship may reflect policy actions by the monetary authorities and, as Lucas [30] and Levich [29] argue, these may become unstable in the face of changes in monetary policy. As a change in monetary policy represents a basic shift in the economic structure, this may alter an economic agent's response to information in the economy. To address this problem, two U.S. monetary regimes are identified with the first period extending from 1973:II to 1979:III and the second from 1979:IV through 1987:II. This represents the change in monetary policy by the Federal Reserve

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[3]This is consistent with the efficient markets hypothesis since $e_{t+1} = e_t + E(De_t \hat{O} I_t) + u_t$, where I_t is the information available in time t and u_t is a random error term.

[4]Friedman [21] has pointed out that the restriction of parameters places severe restrictions on the underlying utility function.

[5]See Backus [2] for a discussion of the impact of wealth effects on the signs of parameters in portfolio balance models.

Board in October 1979 from pegging the federal funds rate to targeting monetary aggregates. In addition, as noted by Van de Water and Ruffing [40], the second monetary regime is characterized by a significant increase in the debt financing due to dramatic increases in U.S. deficits.

To measure the impact of changes in the real U.S. debt stock on foreign interest rates, the following reduced form equation is estimated:[6]

$$(19)\quad lnr_{it} = \alpha_{0i} + \alpha_{1i} \times D + \alpha_{2i}\ln(B_g)_{it} + \alpha_{3i}\ln(M_g)_{it} + \alpha_{4i}\ln(D^*_g)_t + \alpha_{5i} \times D \times \ln(D^*_g)_t + \alpha_{6i}\ln(M^*_g)_t + \alpha_{7i} \times D \times \ln(M^*_g)_t + u_{it};$$

where:

r = foreign short term-interest rates;

B_g = real foreign debt stock;

D^*_g = real U.S. debt stock;

M_g = real foreign monetary base;

M^*_g = real U.S. monetary base;

u = stochastic error term;

$*$ = U.S.;

i = 1,2,3 = Canada, France, Germany;

t = 1973:II to 1987:II;

D = 0 if $t \leq$ 1979:III; 1 otherwise.

The dummy variable (D) is used to test the impact of the change in monetary policy on the stability of the real U.S. debt stock variable. A specification including dummy variables for the foreign variables was tested ($D \times \ln(M_g)_t$, and $D \times \ln(B_g)_t$); however, F-tests revealed that the foreign dummy variables were insignificant and thus dropped from the specification. The parameter estimate of the real U.S. debt stock variable is represented by α_{4i} before the change in monetary policy and $\alpha_{4i} + \alpha_{5i}$ after the change. If α_{5i} is significant, then the parameter estimate for α_{4i} is unstable. The standard error

[6]The complete derivation of the reduced form and the comparative static properties for the domestic interest rate are available from the authors on request.

for $(\alpha_{4i} + \alpha_{5i})$ is derived from the relationship $var(\alpha_{4i} + \alpha_{5i}) = var(\alpha_{4i}) + var(\alpha_{5i}) + 2cov(\alpha_{4i}, \alpha_{5i})$.

The data examined are quarterly data, and the period chosen reflects the floating exchange rate period. The short-term interest rates for Canada and the United States are three month T-bill rates while the short-term interest rates for Germany and France are call money rates. The data for the monetary base, debt stock, and the three month T-bill rates are from the *International Financial Statistics* tapes published by the IMF. The unemployment rates, call money rates, GNP implicit price indexes for the United States, Canada, and Germany, and the CPI for France, Canada, and the United States used for deflating nominal variables are from the *Main Economic Indicators* published by the OECD.

Results

Because the Federal Reserve pegged the federal funds rate during the first monetary regime and targeted monetary aggregates during the second monetary regime, the real monetary base is assumed to be endogenous. Instruments for the real U.S. and Canadian monetary base were formed using current and lagged levels of the unemployment rates, dummy variables, and lagged levels of interest rates and monetary base in a method consistent with Barro [3] and Mishkin [33]. Instruments for the real German and French monetary base were formed using current and lagged levels of real GNP, dummy variables, and lagged levels of interest rates and monetary base in a manner similar to Hoffman and Schlagenhauf [26] and Atesoglu [1].

Equation (19) was estimated by a seemingly unrelated regression estimation technique (SUR) to correct for contemporaneous correlation across equations.[7] The instrumental SUR results for Canada, France, and Germany are presented in Tables 2, 3, and 4. The equation explained between 76 percent to 84 percent of the squared variation in interest rates, and the root mean squared error (RMSE) was between 0.1359 to 0.1698. D-W tests revealed that the presence of first and fourth order autocorrelation was insignificant. This suggests that the explanatory power of this specification is relatively high.

Equation (19) also was tested using monthly estimates of the real market value of privately held U.S. and Canadian gross federal debt derived by Cox [13] and Cox and Hasley [14] to test the robustness of this specification. The parameter estimates for April 1973 to December 1984 were similar to the quarterly results for the same period. All of the significant parameter estimates

[7]The SAS procedures REG, AUTOREG, and the iterative procedure SYSNLIN with the option ITSUR were used for estimation.

were of the same sign and of the same relative magnitude. These results suggest that the specification is moderately robust.[8]

There are two principal findings of this study based on the parameter estimates from equation (19). The first is that changes in the real foreign debt stock (Bg) were negatively correlated with French and German short-term interest rates with significant parameter estimates for Germany. Although the real Canadian debt stock was positively correlated with Canadian short-term interest rates, their parameter estimates were insignificant. This evidence suggests that crowding out has not occurred in Canada, France, or Germany because of increases in their own debt. These results are consistent with other empirical studies for the United States [16, 18, 22, 24, 32, 34, 35, 37, 38].

The second finding shows that the real U.S. debt stock (D_g^*) was negatively correlated with short-term interest rates in Canada and France with significant parameter estimates for France during the first U.S. monetary regime of pegging the federal funds rate. Although the Canadian parameter estimates were negative and the German parameter estimates were positive, both were insignificant. This evidence suggests that increases in the real U.S. debt stock did not contribute to higher foreign short-term interest rates nor constrain the foreign government from issuing additional debt over this time period. These results are also consistent with the empirical studies cited above.

It was also found that the parameter estimates for the real U.S. debt stock were stable between monetary regimes for France and Germany. Nevertheless, in the second U.S. monetary regime, where the Fed targeted monetary aggregates and the Treasury engaged in debt financing, the U.S. debt stock variable was significant and positively correlated with Canadian short-term interest rates. This suggests that increases in real U.S. debt could have contributed to increases in Canadian short-term interest rates. Therefore, there is evidence of international crowding out for Canada after the change in U.S. monetary policy in 1980 consistent with the results obtained by Kool and Tatom [28]. They point out that "the interaction between the U.S. and Canadian financial markets reflects the large degree of integration of these economies and their geographic relation."

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[8]In another test for robustness, equation (19) was estimated in first differences. The results showed that only five of the 14 significant parameters changed sign. Nevertheless, as autocorrelation was not present in the original specification, first differencing may result in inefficient estimates and also introduce autocorrelation that was not present before differencing [31]. In addition, Engle and Granger [17] argue that if the variables in the model are co-integrated, then first-differencing will produce biased estimates. Therefore, despite the encouraging results, first differencing may be inappropriate for this specification.

Conclusion

This study presents an international portfolio balance model to examine the impact of changes in the level of the real U.S. debt stock on the short-term interest rates of Canada, France, and Germany. The model extends the Fukao and Okuba [22] framework by eliminating the small country assumption and highlighting the role of the exchange rate in revaluing world wealth. Nevertheless, by relaxing these assumptions, the impact of changes in the international portfolio could not be determined *a priori* and, therefore, the parameters of the model were estimated empirically.

Evidence is presented that suggests that increases in the real U.S. debt stock did not contribute significantly to increases in foreign short-term interest rates during the period 1973:II through 1979:III. Hence, during the first monetary regime there is no evidence of cross-country crowding out effects associated with U.S. deficits. Nevertheless, during the period from 1979:IV through 1987:II, the years of the Reagan deficits, increases in the real U.S. debt stock were correlated significantly with increases in Canadian short-term interest rates.

The results present some evidence that increases in the real U.S. debt stock associated with large fiscal imbalances could hamper foreign government monetary control and foreign capital formation. In addition, the evidence presented here argues that some of the impacts associated with U.S. fiscal imbalances may have been exported to other countries through world financial markets, lending support to arguments for increased future international economic policy coordination.

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Table 1
Flow of Funds Accounts Table

		Foreign Central Bank	Private	U.S. Central Bank	Private
Foreign	Monetary Base	M_g	M_p	0	0
Denominated	Debt	B_g	B_p	0	B_p^*
Dollar	Monetary Base	0	0	M_g^*	M_p^*
Denominated	Debt	0	D_p	D_g^*	D_p^*
Surplus or	Deficit	A_g	$W_p - K_p$	A_g^*	$W_p^* - K_p^*$

M_g = Monetary base outstanding supplied by the foreign central bank.

M_p = Foreign residents' holdings of cash and deposits at the foreign central bank.

B_g = Liabilities of the foreign government to the private sector (total foreign debt stock).

Table 1 (continued)

B_{p^*} = Foreign residents' holdings of the foreign government's debt.

M_{g^*} = Monetary base outstanding supplied by the Federal Reserve System.

M_{p^*} = U.S. residents' holdings of cash and deposits at the Federal Reserve System.

D_g = Total liabilities of the U.S. government

D_p = Foreign residents' holdings of U.S. government securities.

D_{p^*} = U.S. residents' holdings of U.S. government securities.

B_{p^*} = U.S. residents' holdings of the foreign government's debt.

A_g = Accumulated fiscal surplus of government.

W_p = Private sector's total assets.

K_p = Private sector's real assets.

Table 2

Instrumental SUR Parameter Estimates of Equation (19) for Canada

Variable	Parameter Estimate (t-stat in parentheses)
Intercept	4.57
	(2.12)
Dummy	-3.57
	(-4.24)
Canadian Debt	0.33
	(0.76)
Canadian Monetary Base	1.15
	(1.81)
U.S. Debt: First Period	-0.43
	(-0.83)
U.S. Debt Dummy	1.14
	(2.60)
U.S. Debt: Second Period	0.71
	(2.16)
U.S. Monetary Base: First Period	-1.96
	(-2.06)
U.S. Monetary Dummy	1.75
	(1.03)
U.S. Monetary Base: Second Period	-0.21
	(-0.15)
R^2 =	0.76
RMSE =	0.1476

Table 3

Instrumental SUR Parameter Estimates of Equation (19) for France

Variable	Parameter Estimate (t-stat in parentheses)
Intercept	4.26
	(13.19)
Dummy	-2.90
	(-3.66)
French Debt	-0.09
	(-0.86)
French Monetary Base	-0.15
	(-0.69)
U.S. Debt: First Period	-0.62
	(-1.95)
U.S. Debt Dummy	-0.37
	(-1.18)
U.S. Debt: Second Period	-0.99
	(-2.33)
U.S. Monetary Base: First Period	-1.41
	(-1.48)
U.S. Monetary Dummy	6.68
	(4.65)
U.S. Monetary Base: Second Period	5.27
	(3.92)
R^2 =	0.77
RMSE =	0.1359

Table 4

Instrumental SUR Parameter Estimates of Equation (19) for Germany

Variable	Parameter Estimate (t-stat in parentheses)
Intercept	4.24
	(12.54)
Dummy	-5.79
	(-4.21)
German Debt	-1.54
	(-4.63)
German Monetary Base	1.79
	(4.43)
U.S. Debt: First Period	0.07
	(0.17)
U.S. Debt Dummy	0.85
	(1.19)
U.S. Debt: Second Period	0.91
	(1.02)
U.S. Monetary Base: First Period	-2.85
	(-2.46)
U.S. Monetary Dummy	6.28
	(3.47)
U.S. Monetary Base: Second Period	3.43
	(1.78)
R^2 =	0.84
RMSE =	0.1698