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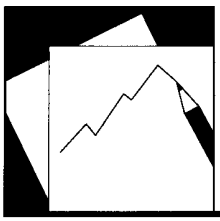

IMF Working Paper

Private Sector Consumption and Government Consumption and Debt in Advanced Economies: An Empirical Study

Rina Bhattacharya and Sanchita Mukherjee

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Private Sector Consumption and Government Debt in Advanced Economies: An Empirical Study

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Abstract

This paper explores the hypothesis that the propensity to consume out of income varies in a non-linear fashion with fiscal variables, and in particular with government debt per capita. Using data from eighteen OECD countries the paper examines whether there is any empirical evidence to support the hypothesis that households move from non-Ricardian to Ricardian behavior as government debt reaches high levels and as uncertainty about future taxes increases. Our results provide support for this hypothesis, and also suggest that private and government consumption are substitutes in the household utility function.

JEL Classification Numbers: E21, E62, H63

Keywords: Fiscal Policy; Private Consumption; Government Debt; non-Ricardian behavior.

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I. INTRODUCTION

1. The possibility that fiscal policy may have non-Keynesian effects, and in particular the idea that fiscal consolidation can be expansionary even in the short run, has stimulated interest among academic economists and policy-makers since at least the early 1990s. The sovereign debt crisis in Greece in early 2010 heightened market concerns about the sustainability of public debt in a growing number of advanced countries, mostly in southern Europe, and has forced many of them to tighten their fiscal policies. Policymakers in these countries are having to delicately balance the need to reassure the financial markets and credit rating agencies against the danger of jeopardizing the fragile recovery of their economies.

2. A few countries, for example Canada and Ireland, have managed in the past to significantly reduce their fiscal deficits—by around 10 percent of GDP—over a relatively short period of time. However, countries that are currently undertaking fiscal adjustment are in a unique situation from a historical perspective in at least two ways. First, rarely have so many major economies faced the need to cut their budget deficits at the same time. Second, many countries that undertook fiscal consolidation in the past were able to offset the adverse impact on output through expansionary monetary policy and/or by devaluing their exchange rates. Today most advanced countries have little or no scope to further loosen their monetary policies or, in the case of the euro zone economies, to devalue. Hence the subject of 'expansionary' fiscal consolidations has come to the fore of the fiscal policy arena.

3. This paper is a follow-up to Bhattacharya (1999) and explores further the hypothesis that the propensity to consume out of income is not constant but varies, perhaps in a non-linear fashion, with fiscal variables. We first set up a theoretical model that yields a non-linear relationship between private consumption and government debt. We then go on to derive time-varying estimates of the propensity to consume out of current gross household income for eighteen OECD countries, and find evidence that the estimated propensity to consume varies in a non-linear fashion with government net debt per capita. Apart from updating the data set and increasing the number of countries in the study, the empirical results differ from Bhattacharya (1999) in two other ways. First, we look at the ratio of government net debt to gross household income, instead of as a ratio to GDP.[2] Second, we test for a different non-linear specification in the relationship between the propensity to consume out of gross household income and government net debt per capita. To the best of the authors' knowledge, empirical evidence from cross-country data in support of a non-linear relationship between the marginal propensity to consume and the ratio of government debt to household income has not been reported in the academic literature to date.

[2] The idea is that the higher the level of government debt relative to household income, the greater the uncertainty about future taxes and also the higher the likelihood that taxes on households would have to be raised sooner rather than later in order for the government's inter-temporal budget constraint.

4. Section II presents a brief review of the academic literature on non-Keynesian effects of fiscal policy. Section III presents a modified version of Sutherland's (1997) model that provides the theoretical basis for the consumption function that is estimated, in which private consumption per capita varies in a non-linear fashion with government debt per capita. Further technical details of the models are elaborated on in the Technical Appendix. Section IV presents the empirical results and uses panel data estimation techniques to test for an empirical relationship between the propensity to consume out of current gross household income and government debt per capita. Section IV presents the main conclusions.

II. LITERATURE REVIEW

5. The traditional presumption that short-term fiscal multipliers are always positive has been challenged on both theoretical and empirical grounds. From a theoretical viewpoint it has been noted that once the impact on risk premiums and expectations are taken into account, the negative demand impact of lower fiscal deficits may be more than offset by an increase in private domestic demand. A growing empirical literature has also critically reassessed the short-term and long-term effects of fiscal policy among different countries and time periods. One of the more striking findings of this literature has been the possibility of negative fiscal multipliers connected to strong fiscal consolidations. The famous adjustment episodes in Ireland and Denmark in the 1980s – where consolidation was followed by a sharp upturn in growth – triggered several studies suggesting that negative multipliers may in fact be more widespread than suggested by conventional wisdom (Giavazzi et al, 2000).

6. There are primarily two mutually non-exclusive views to explain why fiscal adjustments can be expansionary. The first one, proposed by Giavazzi and Pagano (1990) and Blanchard (1990) and further explored by Bertola and Drazen (1993) and Sutherland (1997), emphasizes wealth effects on consumption and expectations of future tax liabilities. In addition, private demand reacts to the perceived credibility of the adjustment. The second view, proposed by Alesina and Perotti (1997a, 1997b) and Alesina and Ardagna (1998), emphasizes the supply-side effects of fiscal adjustment measures operating through the labor market.

7. Fiscal adjustments operate through both the demand side and the supply side. Two mechanisms may be at work on the demand side: (1) wealth effects on consumption, and (2) credibility effects on interest rates. When spending cuts are perceived as permanent, consumers anticipate a reduction in the tax burden and a permanent increase in their lifetime disposable incomes. Thus, in contrast to the Keynesian case, the wealth effect predicts that private consumption increases when government spending is cut. The size of the increase in private consumption depends on the absence of liquidity-constrained consumers and on the efficiency of financial markets. Similarly, while a tax increase should reduce private demand and be contractionary, in some cases it can be expansionary. This may be the case if tax hikes today imply a change of fiscal regime, so that consumers believe that previously anticipated larger tax increases will not be necessary in the future. Sutherland (1997) and Perotti (1999) show that the positive wealth-expectation effects should be stronger when fiscal

consolidation occurs in 'bad times', namely in situations characterized by high and/or rapidly rising public debt/GDP ratios.

8. The second source of expansionary effects of fiscal consolidations is the credibility argument on interest rates. At high or rapidly increasing levels, public debt may face a significant interest rate premium due to inflation or default risks. A fiscal consolidation, if perceived as permanent and successful, can bring about a discrete reduction in real interest rates. Here too initial conditions are important. Risk premia are likely to be significant only when the level of the debt/GDP ratio crosses some relatively high threshold (Alesina et al (1992)). Recent research by IMF staff suggests that the frequently cited cases of Ireland and Denmark could be stand alone cases and that the 'credibility' effect of fiscal consolidation on interest rates may not apply more generally (IMF (2010)).

9. The macroeconomic impact of fiscal adjustment measures will also depend on the stance of monetary policy. In the standard Keynesian model, a fiscal contraction can be expansionary or neutral if it is accompanied by a sufficiently lax monetary policy, which in a small open economy may take the form of devaluation. In particular, a devaluation at the onset of fiscal adjustment can help to maintain (or even increase) aggregate demand by giving a boost to exports, thereby offsetting—at least to some extent—the contractionary impact of any fall in domestic demand arising from the fiscal consolidation measures.

10. Fiscal consolidation measures may also have supply-side effects. Standard economic theory suggests that fiscal policy exerts opposite income and substitution effects on labor supply. If leisure and consumption are both normal goods, the wealth effect of income tax increases will reduce the demand for both and boost labor supply. The substitution effect on the other hand implies that higher income taxes should reduce labor supply. The conventional wisdom is that these neoclassical effects on labor supply are not very large empirically (Pencavel (1986)).

11. Case studies based on OECD country experiences suggest that fiscal adjustments that rely on cuts in current expenditures, and in particular on transfers and wages, have tended to be more durable and less contractionary than revenue-based consolidations. Alesina and Perotti (1995) was the first comprehensive empirical study, focusing on OECD countries, to conclude that successful adjustments are mainly expenditure based, with a focus on primary current expenditure. This result has been replicated and confirmed by a series of later studies (Alesina and Perotti (1997a), Alesina and Ardagna (1998), von Hagen et al (2002) and Briotti (2004)), and is by now accepted as received wisdom. Tsibouris (2006) and Kumar (2007) provide excellent overviews of the literature on this topic.

12. More recently Larch and Turrini (2008) have found that, over time, the composition of adjustment (in terms of the revenue increases and current and capital expenditure cuts) appears to have lost some of its discriminatory power between success and failure over the past decade. Successful consolidations still remain more based on expenditure control and less on revenue enhancement than unsuccessful episodes of fiscal consolidation. However,

the differences have narrowed. As a result, other factors have become more decisive, such as fiscal governance and structural reforms. The channels through which structural reforms help fiscal consolidation are twofold: directly by capping or flattening existing expenditure trends, and indirectly by spurring economic activity.

13. At the same time the current global economic environment has highlighted the role of initial conditions in assessing the impact of fiscal policy. Moreover, as Giavazzi, Jappelli and Pagano (2000) note, a common finding of the empirical studies on non-Keynesian effects of fiscal policy is that the response of private sector demand may be non-linear: both the magnitude and the sign of the response appear to change depending on the conditions under which the impulse occurs and on its characteristics. However, there has been relatively little empirical work looking directly at, if and how, the marginal propensity to consume out of income varies non-linearly with the ratio of government debt to household income, or if it has any relationship to the size of the government spending.

III. THE THEORETICAL MODEL

14. It is assumed that the country is populated by a large number of finitely lived agents. As in Sutherland (1997), the overlapping generation's structure proposed by Blanchard (1985) is adopted whereby each individual agent faces a Poisson death rate λ. The population is assumed to be stationary.

15. Each representative consumer in the economy is assumed to maximize expected lifetime utility as of period t:

$$\mathrm{Max}_{C_t^P}\, E_t \sum_{t=0}^{\infty} U(C_t^P, G_t) e^{-(r+\lambda)t} \qquad (1)$$

where E_t is the expectational operator conditional on time t information;

C^P_t denotes private real consumption at time t;

G_t denotes government consumption spending per capita; and

r is the consumer's rate of time preference, and also the real interest on bonds (both assumed to be constant).

16. The standard household budget constaint is given by

$$A_{t+1} - A_t = (Y_t - T_t) - C^P_t + (r+\lambda) A_t \quad (2)$$

where A_t is the financial assets (nonhuman wealth) of the consumer in period t;

Y_t is the gross labor income of the consumer in period t; and

T_t is the taxes paid by the consumer in period t.

17. The rate of return on bonds is $(r+\lambda)$, where λ is the 'premium' received from the insurance company which legally acquires the consumer's assets when he/she dies.

18. Let $U(C^P_t, G_t)$ be an intertemporally separable quadratic utility function given by

$$U(C^P_t, G_t) = \alpha (\text{Log}(C^P_t)) + \theta(\text{Log}(G_t)) - \beta (\text{Log}(C^P_t)) + \theta(\text{Log}(G_t))^2 \quad (3)$$

19. A negative value for θ implies that an increase in government consumption raises the marginal utility of private consumption (i.e. the two are complements), whereas a positive θ would suggest that an increase in government consumption diminishes the marginal utility of private consumption (i.e. the two are substitutes).

20. Evolution of government debt per capita, D_t, is given by

$$D_{t+1} - D_t = rD_t + G_t - T_t \quad (4)$$

21. We further assume for the sake of simplicity that government consumption spending is fixed in per capita terms:

$$G_t = G^* \quad (5)$$

and that taxes are a non-linear function of (labor) income and government debt given by

$$T_t = \tau Y_t + \gamma(D_t - Y_t)^2 + \sigma(D_t/Y_t)\,\Delta z$$

$$= \tau Y_t + \gamma(D_t^2 + Y_t^2 - 2\sigma D_t Y_t) + \sigma(D_t/Y_t)\,\Delta z \quad (6)$$

where Δz is the increment of a Weiner process and $\sigma(D_t/Y_t)$ is a scaling parameter that varies positively with the government debt to gross household income ratio. The idea is that the higher the level of government debt relative to household income, the greater the uncertainty about future taxes and also the higher the likelihood that taxes on households would have to be raised sooner rather than later in order for the government's inter-temporal budget constraint

$$\sum_{t=0}^{\infty} T_t = \sum_{t=0}^{\infty} G_t + D_{t,t=0} \quad (7)$$

to be met.

22. Applying the Bellman Equation and Ito's Lemma it can be shown that, with a value function given by

$$V(A_t,D_t) = -2\beta\gamma\,(A_t/C^P_t)\,\mathrm{Log}(Y_t) + 2\beta(r+\lambda)\,(1+\sigma(D_t/Y_t))(A_t/C^P_t)D_t \quad (8)$$

the following consumption function can be derived (see Appendix I for further technical details):

$$\mathrm{Log}\,(C^P_t) = (\alpha/2\beta) - \theta\,\mathrm{Log}(G^*) + \gamma\,\mathrm{Log}(Y_t) - (r+\lambda)^* [\,(1+\sigma(D_t/Y_t))D_t + G^*\,\{1+\sigma'(D_t/Y_t)^*D_t/Y_t + \sigma(D_t/Y_t)\}\,] \quad (9)$$

23. The intuition behind the non-linear relationship between private consumption and government debt implied in Equation (9) is as follows. At low or moderate levels of government debt per capita fiscal policy has the usual Keynesian effects and consumers behave in a non-Ricardian manner: the positive income effects of a higher fiscal deficit outweigh any possible negative effects through downward revisions to expected permanent income, in part because consumers discount future taxes since they may not be alive when taxes have to be raised to meet the government's inter-temporal budget constraint. But when government debt per capita reaches very high (perhaps unsustainable) levels, consumers face a higher probability that the burden of extra taxes to finance higher government debt will fall on them. Moreover, a debt stabilization program or a government default may be imminent, which could have serious negative real effects on the economy. The implication for households is a reduction in their expected permanent disposable income, and so they reduce their current consumption. Consequently their behavior becomes more Ricardian.

IV. The Empirical Results

24. Equation (9) is difficult to estimate, given the very general form of the non-linear consumption function. The approach taken in this paper is to use a standard econometric technique for estimating coefficients that vary over time – the Kalman Filter - to derive time-varying estimates of the marginal propensity to consume out of gross disposable income. We then go on to see if there is a non-linear relationship between the estimated marginal propensity to consume and government debt per capita. The key elements of the Kalman Filter approach, applied to Equation (9) above, are as follows:

***Measurement equation*:**

$$\text{Log } C^{P}_{t} = Z_t\alpha_t + \xi_t \quad (10)$$

$$\xi_t \sim N(0, \upsilon^2) \quad (11)$$

where

Log C^{P}_{t}, the dependent variable, is the log of private consumption per capita in period t, and

Z_t consists of two independent variables—a constant term, and the log of gross household income per capita in period t.

α_t is the state variable and is assumed to follow the transition path specified below:

***Transition equation*:**

$$\alpha_t = \alpha_{t-1} + \eta_t \quad (12)$$

$$\eta_t = N(0, \upsilon^2 Q) \quad (13)$$

The error terms in both the transition and measurement equations are non-zero.

Initial conditions:

$$\alpha_0 \sim N(a_0, \upsilon^2 P_0) \quad (14)$$

25. The vector of prior coefficients was taken from the coefficients from an OLS regression over the entire sample period estimated separately for each individual country. The variance of the constant term in Equation (10) was set equal to zero, while the variance of the coefficient on gross household income per capita was set equal to the OLS estimate of the variance of the estimated coefficient for each individual country.

26. The above state-space model was estimated using a Kalman Filter for eighteen OECD countries—Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Korea, New Zealand, Norway, Spain, Switzerland, United Kingdom and United States. All the data for the estimation came from the OECD Analytical Database. These particular countries were chosen on the basis of data availability over a sufficiently long period of time. Gross household income here is defined as household disposable income plus direct taxes paid by households plus total transfers paid by households less total transfers received by households. The data for government net debt (the net financial liabilities of government) includes all financial liabilities less all financial assets, as defined by the system of National Accounts (where data availability permits), and covers the general government sector (which is a consolidation of central government, state and local governments, and the social security sector).

27. Two sets of Kalman Filter estimates are presented in Table 1 below. They are the average values of the coefficients over the sample period for each country that was obtained after smoothing (see Harvey (1981)). The first set of results, KF1, is based on constant price data in local currency, and the estimated marginal propensities to consume are plotted in Figures 1a-18a. The second set of results, KF2, is based on OECD volume measures of the relevant variables, and the estimated marginal propensities to consume from KF2 are plotted in Figures 1b-18b. The results are very similar for both sets of data. What is striking, however, is the wide variation in coefficient estimates across countries, with the estimated marginal propensity to consume varying from 0.33 (Spain) to 1.24 (New Zealand) for KF1, and from 0.31 (Ireland) to 1.39 (New Zealand) for KF2. One possible explanation could be that we are measuring the marginal propensity to consume out of *gross* household income rather than *net* household income. Since the former does not take into account direct taxes as well as government spending on transfers and subsidies to households, which vary considerably by country in terms of their size and importance to the economy, it is plausible to suppose that there is less cross-country variation in the marginal propensities to consume out of net household incomes.

28. Figures 1a-18b indicate that, at least for a few countries, the estimated marginal propensities to consume tends to vary in a non-linear fashion with the ratios of government net debt to gross household income.

29. For most of the countries the estimated MPCs moved in the same direction as the government net debt to gross household income ratios, at least during the early part of the estimation periods. At the same time, for several countries there is evidence of a structural break in the relationship between these two variables. In Korea, for example, there appears to have been a clear upward shift in the MPC over the period 1998-2002, even though the government net debt ratio continued to decline. After 2002 the estimated MPC and government net debt ratio move in the same direction. In the United States, the MPC and the government net debt ratio moved in opposite directions over the period 1993-2000, but since then have moved again in tandem with each other, as in earlier decades. Our empirical results also suggest that the MPC started moving in the opposite trend direction to the government net debt ratio from the mid-1990s in Australia and Canada, and from the late 1990s/early 2000s in Belgium, Denmark, and Spain. The most likely explanation for these observed structural shifts were domestic financial sector reforms. Together with the introduction of new financial instruments and an era of relatively cheap money and laxer financial regulation for most of the past decade in some, but not all, of these countries, these reforms for the most part served to alleviate liquidity constraints on households.

Table 1. Kalman Filter Estimates
(period averages)

	Constant term	Coefficient on gross household income[3] (Standard Error)
Australia: 1960–2008		
KF1[4]	0.689	0.688***
		(0.003)
KF2[5]	-0.361	0.753***
		(0.008)
Austria: 1964–2008		
KF1	-4.649	1.209***
		(0.009)
KF2	-5.130026	1.268***
		(0.010)
Belgium: 1985–2008		
KF1	0.078	0.594***
		(0.003)
KF2	0.196	0.581***
		(0.003)
Canada: 1965–2008		
KF1	1.874	0.465***
		(0.006)
KF2	1.787	0.479***
		(0.005)
Denmark: 1985–2008		
KF1	0.528	0.891***
		(0.002)
KF2	-0.944	1.091***
		(0.002)
Finland: 1960–2009		
KF1	4.477	0.664***
		(0.011)
KF2	4.548	0.656***
		(0.010)

[3] ***Significant at 1 percent level. ** Significant at 5 percent level.

[4] KF1: Kalman filter estimates based on value measures deflated to get a constant price series.

[5] KF2: Kalman Filter estimates based on volume measures.

Table 1. Kalman Filter Estimates (continued)
(period averages)

	Constant term	Coefficient on gross household income[6] (Standard Error)
France: 1960–2008		
KF1[7]	-0.058	0.758***
		(0.005)
KF2[8]	2.215	0.767***
		(0.006)
Germany: 1991–2008		
KF1	-1.103	0.844***
		(0.003)
KF2	-2.845	1.235***
		(0.004)
Ireland: 1990–2008		
KF1	7.419	0.334***
		(0.011)
KF2	7.615	0.309***
		(0.010)
Italy: 1961–2008		
KF1	1.927	0.832***
		(0.011)
KF2	2.285	0.725***
		(0.010)
Japan: 1980–2008		
KF1	1.572	0.410***
		(0.005)
KF2	1.67	0.397***
		(0.006)
Korea: 1980–2008		
KF1	-0.048	0.885***
		(0.010)
KF2	0.527	0.779***
		(0.008)

[6] ***Significant at 1% level. ** Significant at 5% level.

[7] KF1: Kalman filter estimates based on value measures deflated to get a constant price series.

[8] KF2: Kalman Filter estimates based on volume measures.

Table 1. Kalman Filter Estimates (continued)
(period averages)

	Constant term	Coefficient on gross household income[9] (Standard Error)
New Zealand: 1986–2008		
KF1[10]	-7.00	1.243***
		(0.003)
KF2[11]	-3.81	1.389***
		(0.003)
Norway: 1975–2008		
KF1	1.157	0.651***
		(0.008)
KF2	3.332	0.671***
		(0.007)
Spain: 1964–2008		
KF1	2.243	0.328***
		(0.005)
KF2	2.251	0.326***
		(0.004)
Switzerland: 1965–2007		
KF1	1.198	0.528***
		(0.002)
KF2	1.234	0.524***
		(0.002)
United Kingdom: 1963–2008		
KF1	-0.621	1.101***
		(0.004)
KF2	-0.200	1.017***
		(0.004)
United States: 1960–2008		
KF1	-1.161	0.656***
		(0.007)
KF2	0.551	0.829***
		(0.010)

[9] ***Significant at 1% level. ** Significant at 5% level.

[10] KF1: Kalman filter estimates based on value measures deflated to get a constant price series.

[11] KF2: Kalman Filter estimates based on volume measures.

Figures 1a–18b. Estimated MPCs and Government Debt-to-Household Income Ratios

Figure 1a: Australia

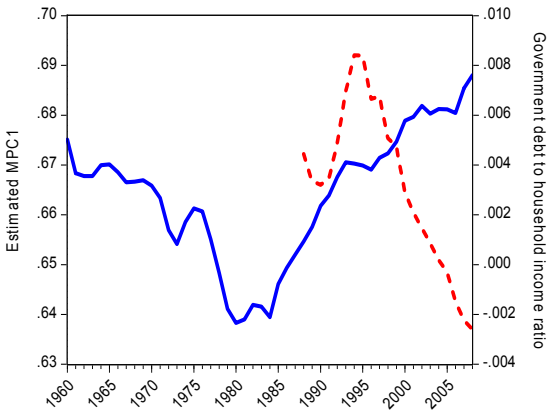


Figure 1b: Australia

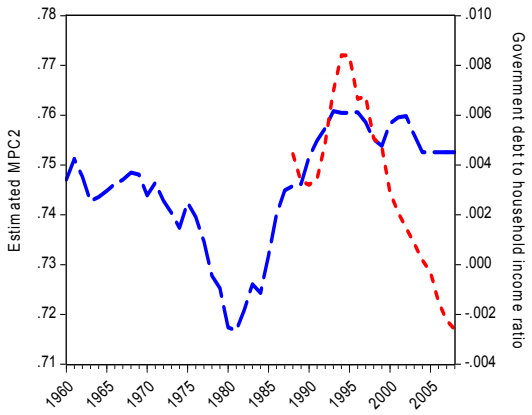


Figure 2a: Austria

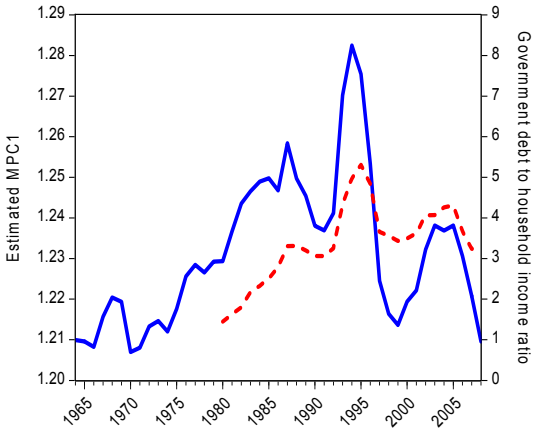


Figure 2b: Austria

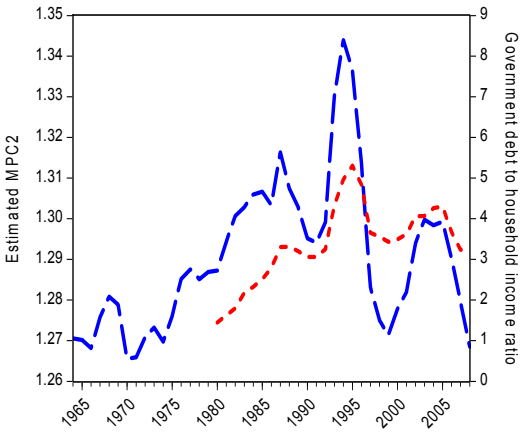


Figure 3a: Belgium

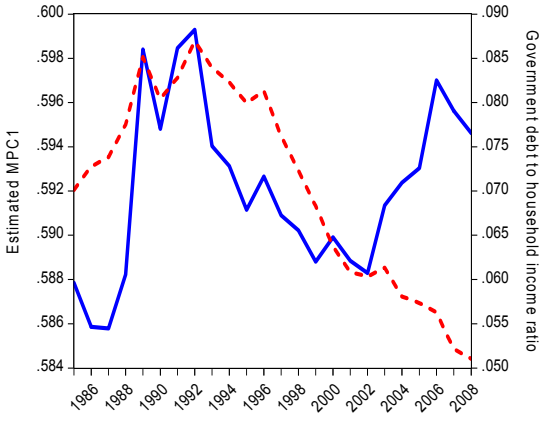
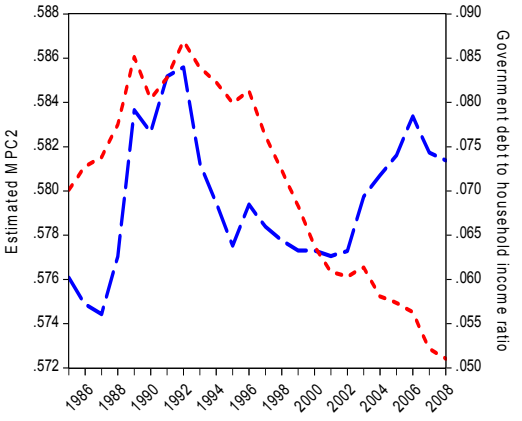


Figure 3b: Belgium



Source: OECD database

Estimated MPC1, first column, left axis

Estimated MPC2, second column, left axis

Government debt to household income ratio, right axis

Figures 1a–18b. Estimated MPCs and Government Debt-to-Household Income Ratios (continued)

Figure 4a: Canada

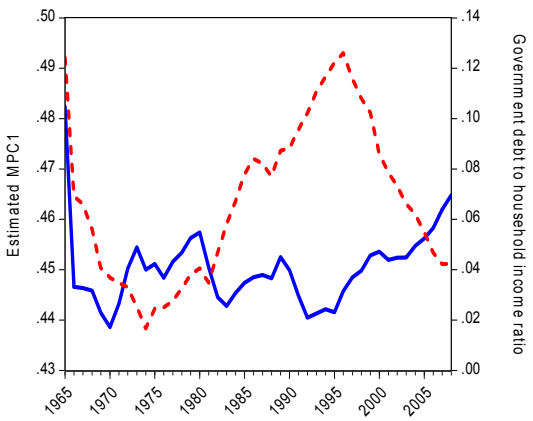


Figure 4b: Canada

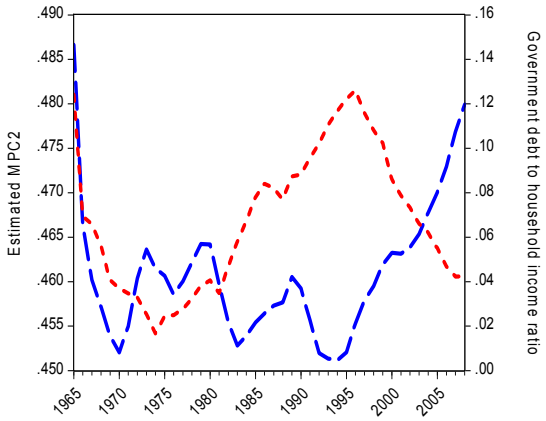


Figure 5a: Denmark

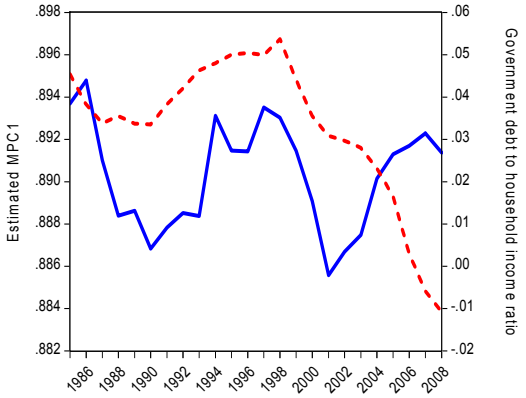


Figure 5b: Denmark

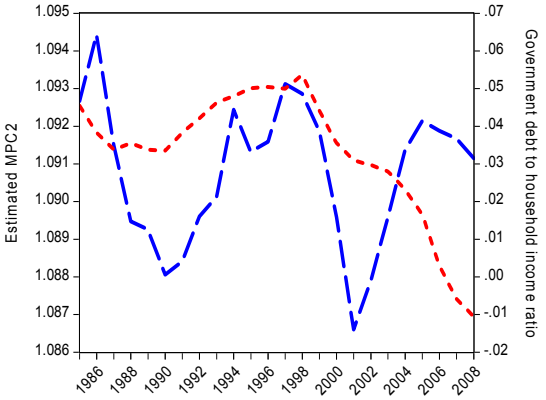


Figure 6a: Finland

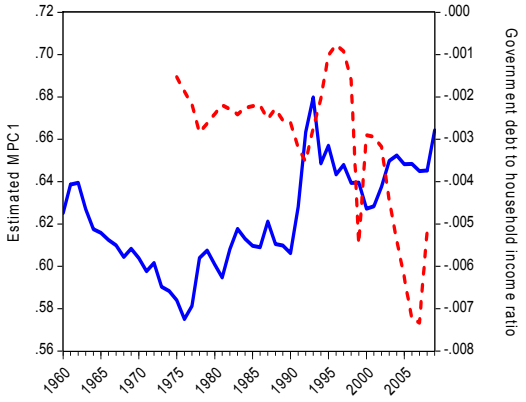
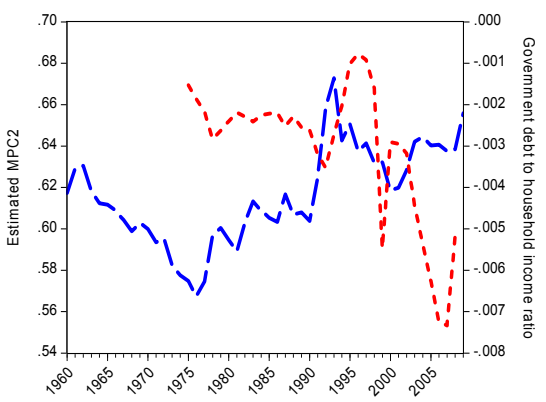


Figure 6b: Finland



Source: OECD database

Estimated MPC1, first column, left axis

Estimated MPC2, second column, left axis

Government debt to household income ratio, right axis

Figures 1a–18b. Estimated MPCs and Government Debt-to-Household Income Ratios (continued)

Figure7a: France

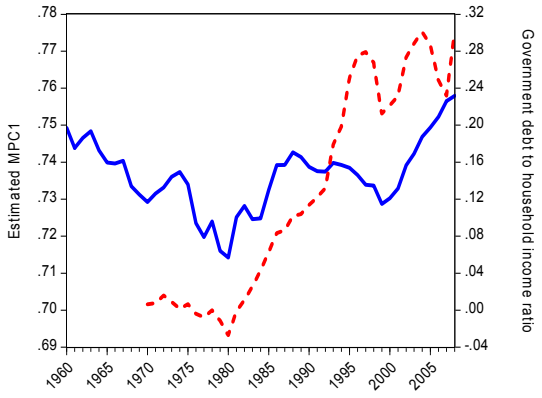


Figure 7b: France

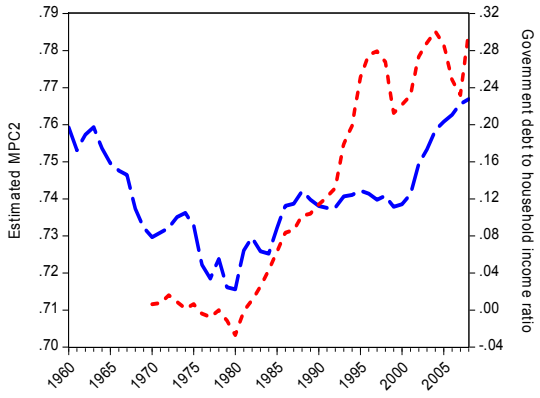


Figure 8a: Germany

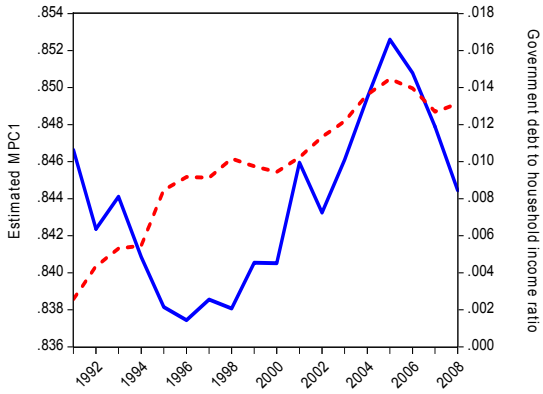


Figure 8b: Germany

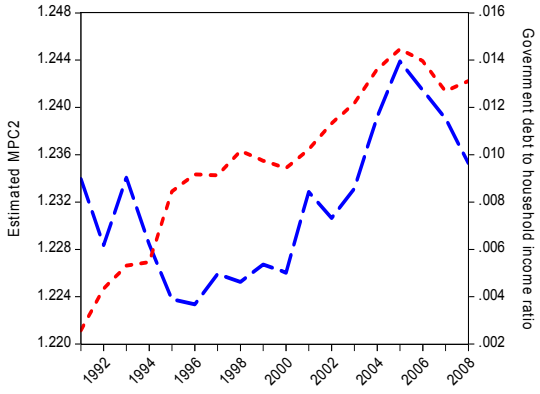


Figure 9a: Ireland

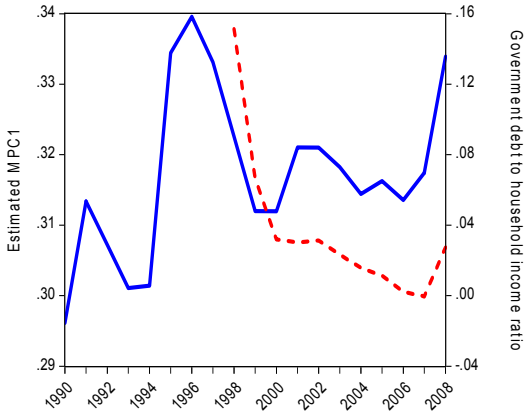
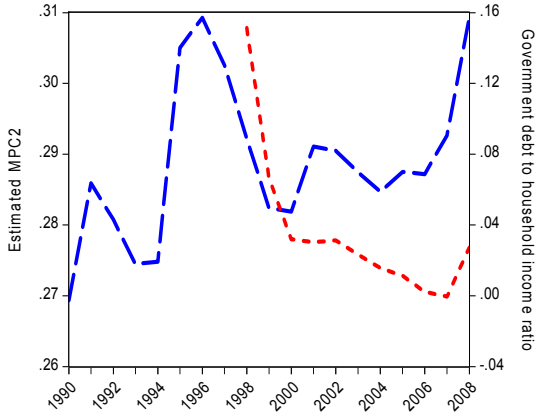


Figure 9b: Ireland



Source: OECD database

Estimated MPC1, first column, left axis

Estimated MPC2, second column, left axis

Government debt to household income ratio, right axis

Figures 1a–18b. Estimated MPCs and Government Debt-to-Household Income Ratios (continued)

Figure 10a: Italy

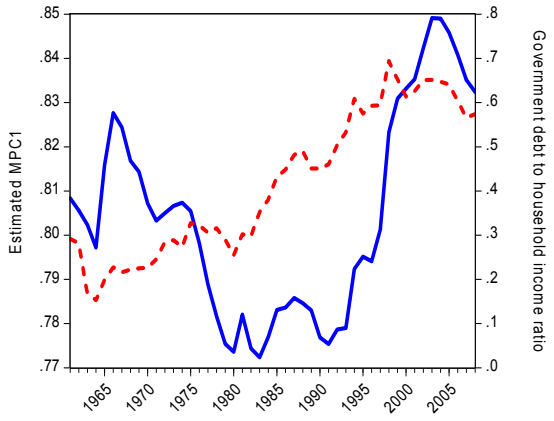


Figure 10b: Italy

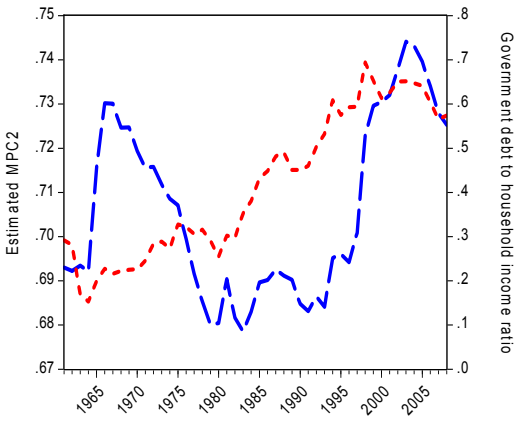


Figure 11a: Japan

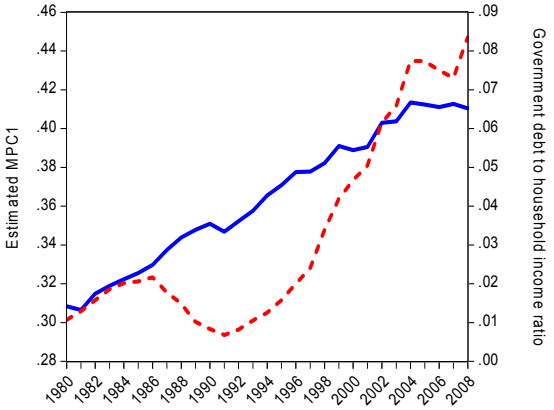


Figure 11b: Japan

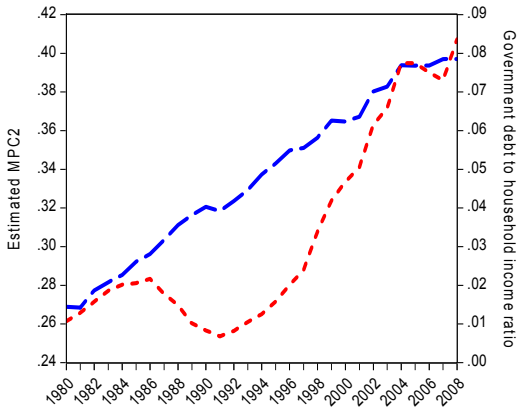


Figure 12a: Korea

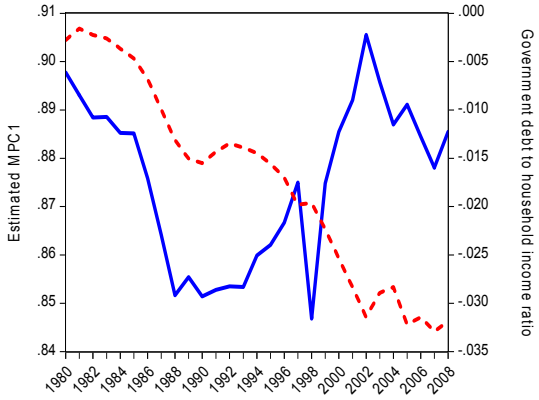
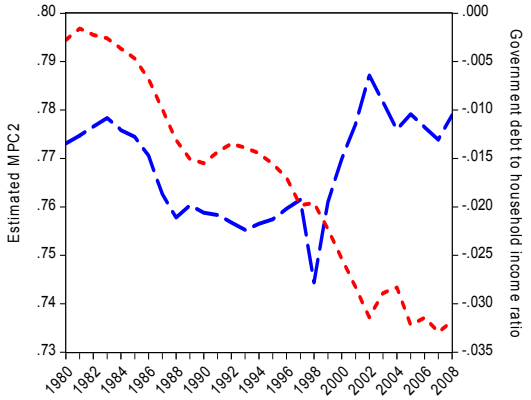


Figure 12b: Korea



Source: OECD database

Estimated MPC1, first column, left axis

Estimated MPC2, second column, left axis

Government debt to household income ratio, right axis

Figures 1a–18b. Estimated MPCs and Government Debt-to-Household Income Ratios (continued)

Figure 13a: New Zealand

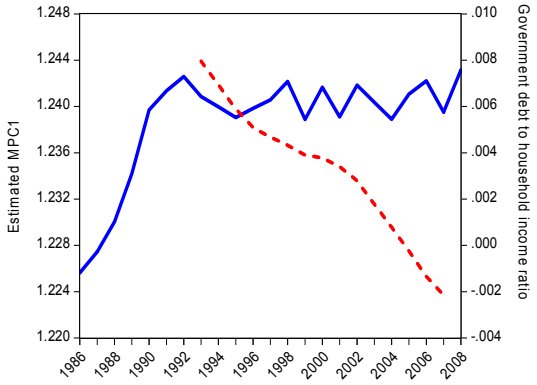


Figure 13b: New Zealand

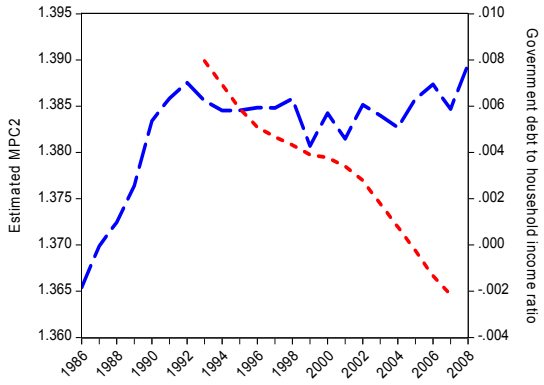


Figure 14a: Norway

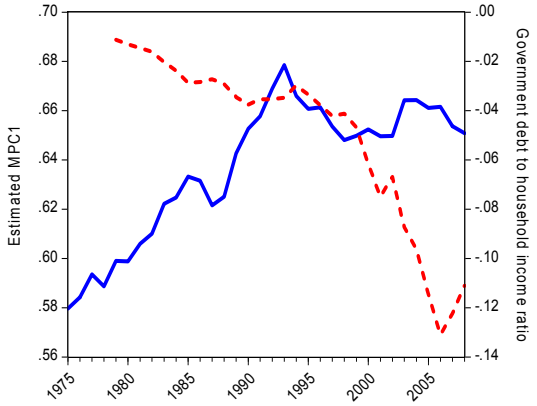


Figure 14b: Norway

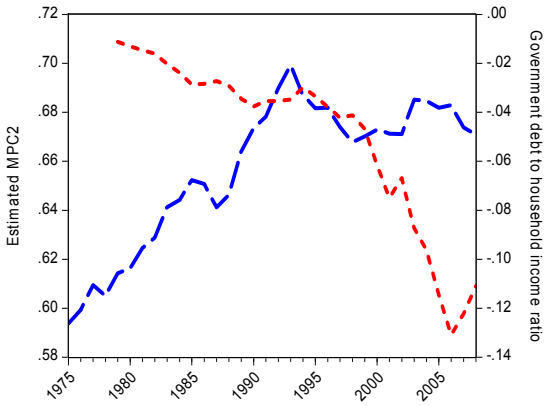


Figure 15a: Spain

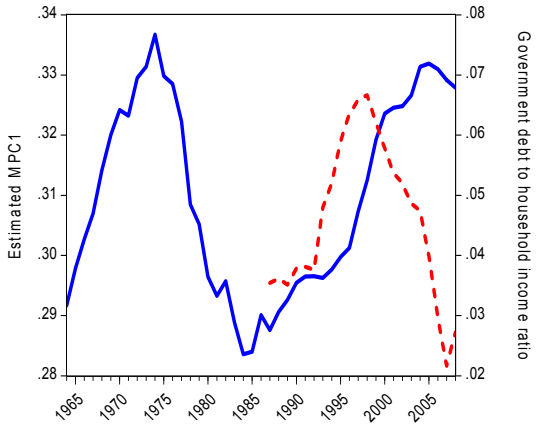
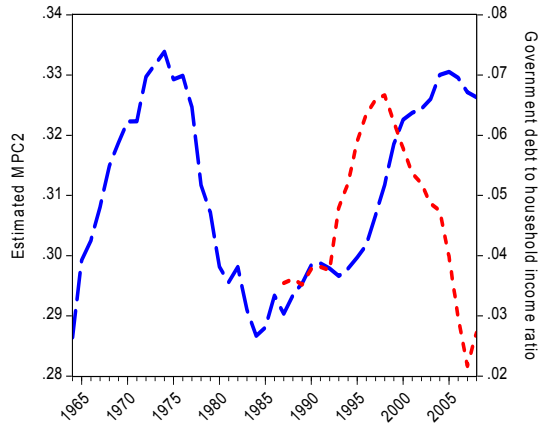


Figure 15b: Spain



Source: OECD database

Estimated MPC1, first column, left axis

Estimated MPC2, second column, left axis

Government debt to household income ratio, right axis

Figures 1a–18b. Estimated MPCs and Government Debt-to-Household Income Ratios (continued)

Figure 16a: Switzerland

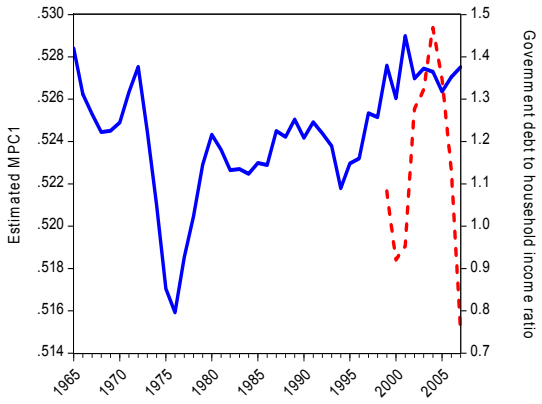


Figure 16b: Switzerland

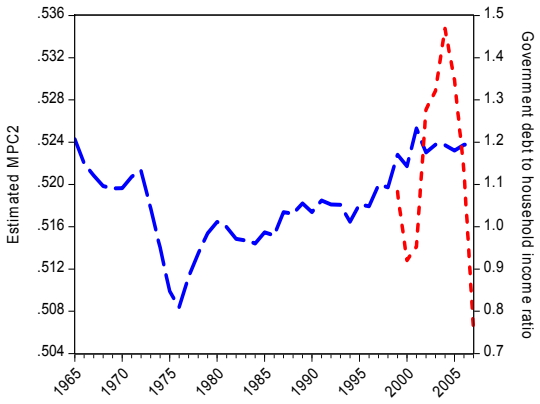


Figure 17a: United Kingdom

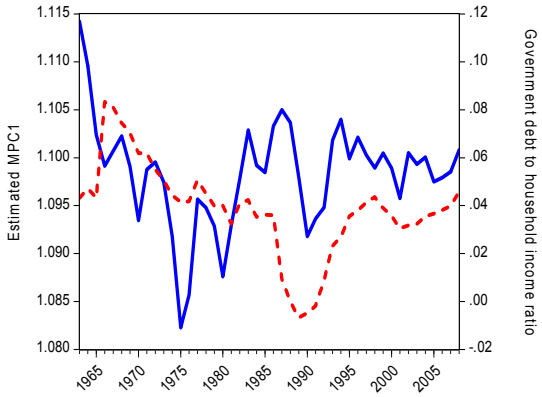


Figure 17b: United Kingdom

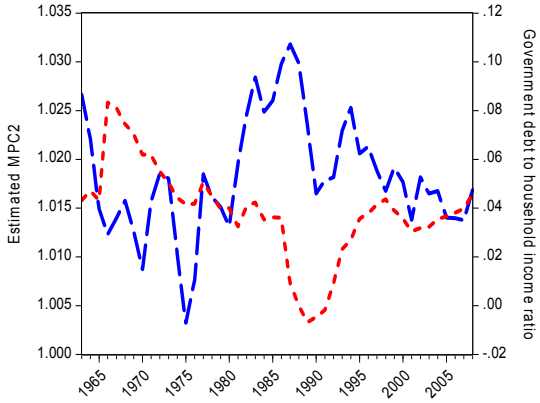


Figure 18a: United States

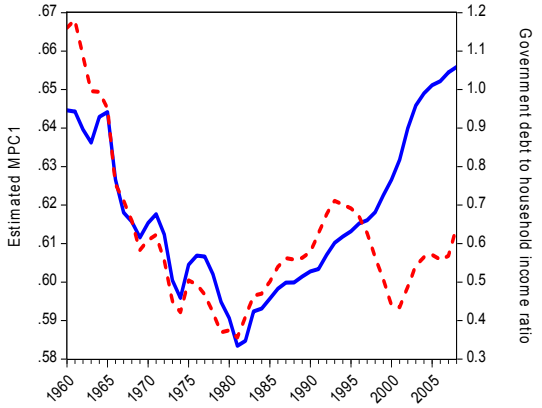
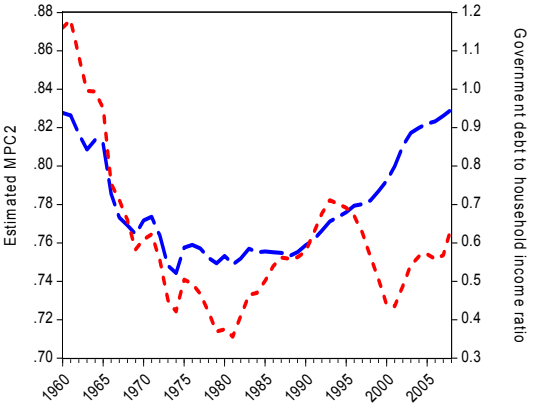


Figure 18b: United States



Source: OECD database

Estimated MPC1, first column, left axis

Estimated MPC2, second column, left axis

Government debt to household income ratio, right axis

30. The next step in the empirical analysis is to see if there is a relationship between the estimated marginal propensities to consume and government net debt GND as a ratio of gross household income GHY.[12] Panel data analysis was used to regress the estimated marginal propensities to consume (MPC1 and MPC2) from KF1 and KF2 respectively against a constant, government net debt as a ratio of gross household income (GNDGHY), government net debt squared as a ratio of gross household income (GND2GHY), and government consumption as a ratio to GDP (GCON). Both government net debt and gross household income are measured in real per capita terms. Government consumption and GDP are defined in real terms. The results are presented in Table 2.[13]

31. Both the "Fixed effects" and "Random effects" results yield statistically significant coefficients on GNDGHY and GND2GHY at the 1 percent significance level, for both sets of estimates of the marginal propensity to consume, although the size of the coefficients are very small. The coefficient on GCON is negative and statistically significant at the 1 percent level in both cases: thus the larger the share of the public sector in the economy, the lower the propensity to consume out of gross household income, indicating that private consumption and government consumption are substitutes in the household utility function. Moreover, the Hausman specification tests do not reject at the 1 percent level the null hypothesis that the individual country intercept terms are uncorrelated with the independent explanatory variables, implying that the random effects estimates are consistent.

32. In short, the empirical results from our panel data analysis provide support for the hypothesis that households move from non-Ricardian to Ricardian behavior as government indebtedness reaches high levels and as uncertainty about future taxes increases, resulting in a non-linear relationship between private consumption and government indebtedness. It is important to note here, however, that this does not necessarily imply causation from government debt ratios to private consumption behavior.

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[12] Note that, even though η_t is assumed to follow a random walk, this does not mean that the estimated coefficients from the measurement equation cannot have a significant relationship with the *current* values of some explanatory variables; the assumption only implies that *past* values of these variables cannot be used to predict movements in the coefficients.

[13] Note that, if the marginal propensity to consume MPC, $\delta(\log C^P) / \delta(\log Y)$, has the following nonlinear relationship with government net debt GND

$$MPC = a_0 + a_1 GCON + a_2 GNDGHY + a_3 GND2GHY$$

we have that $\delta MPC / \delta GND < 0$ (non-Keynesian effects) if $GND > a_2 / 2a_3$.

Table 2. Panel Data Estimation Results

	Dependent Variable MPC1	**Dependent Variable** MPC2
Fixed Effects:		
GNDGHY	0.0569*** (0.00646)	0.0644*** (0.00685)
GND2GHY	-3.56e-06*** (4.55e-07)	-3.92e-06*** (4.83e-07)
GCON	-0.00323*** (0.00118)	-0.00303** (0.00125)
Random Effects:		
Constant	0.726*** (0.0682)	0.0645*** (0.00684)
GNDGHY	0.0570*** (0.00645)	0.0645*** (0.00684)
GND2GHY	-3.56e-06*** (4.55e-07)	-3.92e-06*** (4.82e-07)
GCON	-0.00308*** (0.00117)	-0.00293** (0.00124)
Hausman test of H0: Random Effects Vs. H1: Fixed effects	Chi-squared: 1.33 P-value: 0.5130	Chi-squared: 0.53 P-value: 0.7679
Number of observations	521	521

Standard errors are in parenthesis. *** Significant at 1 percent level, ** Significant at 5 percent level.

33. What is also striking is that in Australia, Belgium, Canada, and Spain the estimated marginal propensities to consume of households show a trend rise over the past decade at the same time that the government net debt to gross household income ratio fell. This further indicates that the relationship between these two variables can become negative during periods of high government indebtedness once economic agents are convinced about the authorities' commitment to fiscal consolidation. The policy implication, at least for these countries, is that the direct negative impact of fiscal consolidation measures on aggregate demand and output may be offset, at least in part, by increases in private consumption. The same may be true for other highly indebted countries that have witnessed large increases in public debt in the period since the onset of the global financial crisis in 2008, such as the

United Kingdom and the United States. However, in these countries the offsetting impact of higher private consumption could be somewhat muted due to the current high levels of debt of households relative to their disposable incomes.

V. CONCLUSIONS

34. Achieving and maintaining prudent public debt levels over the medium-term will require a major and sustained fiscal adjustment in most advanced economies. Of course the precise magnitude of primary balance adjustment required is quite sensitive to assumptions, for example on interest rates and growth rates. Nevertheless, the scale of the fiscal problem is large for various reasonable sets of parameter values. Baseline simulations were carried out by IMF staff to determine the improvement required in the structural primary balance in advanced economies to either achieve a debt-to-GDP ratio of 60 percent by 2030, or to stabilize the debt-to-GDP ratio at the end-2012 level for those countries where the ratio is below 60 percent (see Abbas et al (2010) for further details). These simulations suggest that the required adjustment in the structural primary balance amounts to 8 percentage points of GDP over the period 2011 to 2020. That is, the average structural primary balance has to improve from a projected deficit of 4⅓ percent of GDP in 2010 to a surplus of almost 3⅔ percent of GDP in 2020, implying a fiscal effort of ¾ percentage points of GDP per year. There is also considerable diversity across countries, with fiscal consolidation needs ranging from just under ½ percentage point of GDP for Switzerland to over 13 percentage points of GDP for Japan, Ireland and Greece.

35. Fiscal austerity is unlikely to trigger faster growth in the short-term, as argued forcefully in IMF (2010). However, the empirical (panel data) analysis presented in this paper suggests that the contractionary impact of fiscal consolidation in heavily indebted advanced economies may be offset, at least in part, by higher private consumption. Our empirical results lend support to the hypothesis that households move from non-Ricardian to Ricardian behavior as government indebtedness reaches high levels and as uncertainty about future taxes increases. In particular, our panel data estimation results provide evidence of a non-linear relationship between the marginal propensity to consume on the one hand and government indebtedness on the other. These results are consistent with the implications of our theoretical model (a modification of Sutherland (1997)) which shows how the power of fiscal policy to affect private consumption can vary in a nonlinear fashion with the level of public debt. It is important to note here, however, that our empirical results do not necessarily imply causation from government debt ratios to private consumption behavior. To the best of our knowledge, empirical evidence from cross-country data in support of a non-linear relationship between the marginal propensity to consume and the ratio of government debt-to-household income has not been reported in the academic literature to date.

36. More specifically, in Australia, Belgium, Canada, and Spain our estimated private marginal propensity to consume show a trend rise over the past decade at the same time that the government net debt to gross household income ratio fell. This further indicates that the relationship between these two variables can become negative during periods of high government indebtedness once economic agents are convinced about the authorities' commitment to fiscal consolidation. The policy implication, at least for these countries, is that the direct negative impact of fiscal consolidation measures on aggregate demand and output may be offset, at least in part, by increases in private consumption. The same may be true for other highly indebted countries that have witnessed large increases in public debt in the period since the onset of the global financial crisis in 2008, such as the United Kingdom and the United States. However, in these countries the offsetting impact of higher private consumption could be somewhat muted due to the current high levels of debt of households relative to their disposable incomes.

37. Our empirical results also suggest that private consumption and government consumption are substitutes in the household utility function. Thus, in the current global context the negative direct effects on aggregate demand arising from cuts in public consumption as governments in advanced countries pursue fiscal consolidation measures are likely to be offset, at least in part, by positive indirect effects on private consumption.

APPENDIX

The Modified Sutherland Model

38. The consumer's optimization problem at time t=0 is given by

$$\text{Max}_{C_t^P} \; E_t \; \sum_{t=0}^{\infty} U(C_t^P, G_t) e^{-(r+\lambda)t} \tag{A1}$$

where $U(C^P_t,G_t)$ is an inter-temporally separable quadratic utility function given by

$$U(C^P_t,G_t) = \alpha (\log(C^P_t) + \theta \log(G_t)) - \beta (\log(C^P_t) + \theta \log(G_t))^2 \tag{A2}$$

subject to

$$\begin{aligned} \Delta A_t &= A_{t+1} - A_t \\ &= (Y_t - T_t) - C^P_t + (r+\lambda)A_t \\ &= [(1-\tau)Y - C^P + (r+\lambda)A - \gamma(D_t - Y_t)^2] \Delta t - \sigma(D_t/Y_t) \Delta z \end{aligned} \tag{A3}$$

and

$$\begin{aligned} \Delta D_t &= D_{t+1} - D_t \\ &= rD_t + G_t - T_t \\ &= [\, rD - \tau Y - \gamma(D_t - Y_t)^2 \,] \Delta t + G^* - \sigma(D_t/Y_t) \Delta z \end{aligned} \tag{A4}$$

and the transversality condition given by

$$\lim_{t\to\infty} \quad E_0 [\, A_t e^{-(r+\lambda)t}] = 0 \tag{A5}$$

39. The associated Bellman Equation is given by

$$V(A_t,D_t) =$$

$$\text{Max}_{C^P_t} \; [\, \alpha(\text{Log}(C^P_t) + \theta\text{Log}(G_t) - \beta(\text{Log}(C^P_t) + \theta\text{Log}(G_t))^2 + e^{-(r+\lambda)\Delta t} E_t V(A_{t+1},D_{t+1}) \,] =$$

$$\text{Max}_{C^P_t} \; [\, \alpha(\text{Log}(C^P_t) + \theta\text{Log}(G_t) - \beta(\text{Log}(C^P_t) + \theta\text{Log}(G_t))^2 +$$

$$+ (1 - (r+\lambda)\Delta t)^* E_t \{ V(A_t,D_t) + \Delta V(A,D) \} \,] \tag{A6}$$

40. By Ito's Lemma

$$\Delta V(A,D) = E_t\, V(A_{t+1},D_{t+1}) - V(A_t,D_t)$$

$$= V_A(A,D)\Delta A_t + V_D(A,D))\Delta D_t + \tfrac{1}{2}\, V_{AA}(A,D)\,)\Delta A_t^2$$

$$+ \tfrac{1}{2}\, V_{DD}(A,D)\,)\Delta D_t^2 + V_{AD}(A,D)\Delta A_t \Delta D_t \qquad (A7)$$

41. Substituting (A7) into (A6); using (A3) and (A4) to derive ΔA_t^2, ΔD_t^2 and $\Delta A_t \Delta D_t$; noting that G_t is by assumption constant at G^*; and differentiating with respect to Log (C^P_t) we get the first order condition

$$\text{Log}\,(C^P_t) = (1/2\beta) * [\alpha - 2\beta\theta\, \text{Log}(G^*) - V_A(A,D)\, C^P_t - G^* V_{AD}(A,D)\, C^P_t] \qquad (A8)$$

42. Specifying a value function given by

$$V(A_t,D_t) = -2\beta\gamma\, (A_t/C^P_t)\, \text{Log}(Y_t) + 2\beta(r+\lambda)\, (1+\sigma(D_t/Y_t))(A_t/C^P_t)D_t \qquad (A9)$$

we can use (A8) to derive the following consumption function:

$$\text{Log}\,(C^P_t) = (\alpha/2\beta) - \theta\, \text{Log}(G^*) + \gamma\, \text{Log}(Y_t) - (r+\lambda)*$$

$$[\ (1+\sigma(D_t/Y_t))D_t + G^*\ \{1+\sigma'(D_t/Y_t)*D_t/Y_t + \sigma(D_t/Y_t)\}\ ] \qquad (A10)$$

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