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An Exploration of the Private Sector Response to Changes in Government Saving Across OECD Countries

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An Exploration of the Private Sector Response to Changes in Government Saving Across OECD Countries

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Abstract

Several recent papers have examined the response of national saving to changes in fiscal policy. This paper uses knowledge about the intergenerational fiscal position of a country to determine whether this information helps to explain cross country differences in the nature of the response. Using OECD data the paper finds that in countries in intergenerational fiscal balance, the private sector completely offsets fiscal policy changes whereas in other countries the private sector offset is only partial. Moreover, in countries with large intergenerational fiscal imbalances, strong fiscal consolidation packages reduce the impact of changes in fiscal policy on national saving.

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I. INTRODUCTION

Fiscal policy is a tool that is often used for demand management purposes, especially in economies where the monetary authority is targeting the exchange rate and is therefore constrained in responding to cyclical movements in output. For many years, Norway and Denmark have assigned the role of demand management to fiscal policy to facilitate the monetary policy objective of exchange rate targeting. The usefulness of fiscal policy in this role is currently heavily debated in the context of the introduction of the euro because, in adopting the single currency, countries have had to relinquish their own monetary policy frameworks and therefore the question has been posed whether fiscal policy should play a more active role in moderating cyclical imbalances in Europe.

Fiscal policy has a number of drawbacks in its role in moderating cyclical impulses. First, long lags are involved in terms of policy formulation and implementation. Second, the private sector may offset a large portion of the change in government saving if it expects the change to be temporary or to affect the long-run budgetary position of the economy significantly. Third, in open economies, fiscal multipliers are hypothesized to be small because of the leakage of demand through imports. This paper focuses on the second issue and attempts to parameterize the degree of private sector offset to changes in government finances across OECD countries and offer an explanation for the cross-country differences.

II. EQUATION SPECIFICATION

There are two schools of thought on the strength of the relationship between government and private saving depending on whether or not the economy is perceived to be characterized as having Ricardian or Keynesian features. In a Ricardian world a cut in taxes (holding the permanent level of public spending constant) or an increase in expenditures (holding permanent taxes constant) would result in a equivalent rise in private saving because individuals would expect an equivalent discounted tax increase in the future. Under these conditions, fiscal policy is unable to directly affect national saving. This view, articulated by Barro (1974), assumes that individuals' consumption choices fit a life-cycle model of consumption, they are forward looking and effectively "infinitely lived" through a bequest motive inspired by each generation's concern about the welfare of the next generation. Once the generational linkage breaks down, however, there is not a complete offset. Moreover, even in the presence of bequest motives, Ricardian equivalence may not hold if some individuals are liquidity constrained or if markets are incomplete. [2]

The separate effects of changes in taxes and expenditures on private saving differ between models with Ricardian and Keynesian features. The two effects are identical in a Ricardian world, whereas expenditure changes have larger effects in a pure Keynesian world

[2] See the survey paper by Seater (1993) for a detailed discussion of these issues.

bc ıse individuals adjust private saving less than for changes in taxes. In practice, actual economic behavior lies between these two polar views.

Although there is an extensive empirical literature testing the validity of the arguments presented above, the results provide support for both Ricardian and Keynesian features. Studies have tested the Ricardian equivalence hypothesis in two ways. First, private consumption functions derived from first principles have been estimated to test for specific departures from Ricardian equivalence. Research papers generally fail to reject the infinite horizon assumption embodied in the proposition (Haque (1988), Haque and Montiel (1989), and Khalid (1996)). However, several papers reject the permanent income hypothesis underpinning the proposition because they find that a significant proportion of consumers have binding borrowing constraints (Campbell and Mankiw (1991), Corbo and Schmidt-Hebbel (1991), and Evans and Karras (1996)) or have a strong precautionary saving motive. These effects are manifest in the finding that consumption is more sensitive to fluctuations in current income than predicted by the permanent income models (Muellbauer (1983), Flavin (1985), and Bayoumi (1990)). The second group of studies tests for Ricardian equivalence through general reduced-form equations for consumption or saving which provide estimates of the offset coefficients for private-public saving. Based on papers with a cross-country dimension, the general finding is that the impact on national saving of an increase in public saving is not complete but varies between 0.3 and 0.7 (Masson, Bayoumi, and Samiei (1995), Edwards (1995), Loyoza, Schmidt-Hebbel and Serven (2000)).

The standard test of Ricardian equivalence using cross-country data generally imposes coefficient restrictions across countries but Haque, Pesaran, Sharma (HPS, 1999) have recently criticized this method because it fails to allow for heterogeneity across countries and ignores dynamics. To take account of this critique this paper estimates a regression for the change in the ratio of gross national saving to potential GDP, separating short and long run effects and allowing short-run effects to differ by country. HPS indicate that fixed effect estimators are inconsistent in dynamic models because of a non-zero correlation between the error term and the regressors associated with autocorrelated errors. For this reason they propose estimating a dynamic panel using the mean group estimator. This paper initially uses 3SLS and then tests for the presence of autocorrelation to determine whether a mean group estimator is needed.

Among the array of variables highlighted in the empirical literature on the determinants of the gross national saving rate, this paper has chosen to isolate the cyclical position of the economy, the real interest rate, changes in the nominal exchange rate, and the ratios of government revenues and expenditures to potential GDP as determinants (variable definitions are provided in appendix 1). The cyclical position of the economy controls for movements over the cycle, the real interest rate captures the attractiveness of saving, and the exchange rate captures the association between current account movements and domestic saving. Both the level and the change in the government revenue and expenditure ratios are included to separate short and long term effects. The tradition of defining revenues and expenditures net of transfers is retained in the present study. Since both the short run and long run sensitivity of national saving to changes in government revenues and expenditures is

sought, the estimated equation must be specified in a non-linear fashion in order to infer statistical significance on the long run variables:

$$\Delta NS_{it} = \beta 0_i + \beta 1_i.\Delta NS_{i(t-1)} + \beta 2_i.gap_{it} + \beta 3_i.r_{it} + \beta 4_i \Delta nex_t + \beta 5_i.\Delta grev_{it}$$
$$+ \beta 6_i.\Delta gex_{it} + \beta 7.NS_{t-1}(1 - \beta 8.(grev_{t-1} / NS_{t-1}) - \beta 9.(gex_{t-1} / NS_{t-1})) + \varepsilon_t(1)$$

In the long run all the delta terms are zero and therefore $\beta 8.grev + \beta 9.gex = NS$ so that the long run sensitivity of national saving to changes in government revenues and expenditures is β8 and β9 respectively. Moreover β7 represents the speed of adjustment to the long run relationship.

Before estimating equation (1) it is necessary to consider the stationarity of the data to determine whether cointegration analysis is required. The stationarity test was conducted by pooling the data across countries in order to improve the power of the tests. The data period covered 1980-1999 and the analysis was limited to the following OECD countries to obtain a consistent panel over this time period: Belgium, Canada, Finland, France, Germany, Iceland, Ireland, Italy, Japan, the Netherlands, Spain, Sweden, the UK, and the US.

When individual/country specific intercepts are introduced into pooled regressions the t-statistic for a single time series has a non-zero mean and therefore the regression estimator converges to a normal distribution with a mean shift. Levin and Lin (1992) have shown that in such cases the following relationship holds:

$\sqrt{(1.25)}.t_p + \sqrt{(1.875)}. \Rightarrow N(0,1)$ where t_p is the standard t statistic for significance.

Therefore, in testing for significance the standard t statistic must be transformed as shown above (see Oh 1996 for a discussion of this issue).

Taking account of the Levin and Lin correction, the adjusted t statistic at the 90 percent confidence level is 6.9. Table 1 presents the corresponding Augmented Dickey-Fuller statistics and indicates that, with the exception of the structural balance, all variables are stationary at the 90 percent confidence level. Since the structural balance is stationary by construction, these results are taken to imply that the system is stationary. Figure 1 show the national saving rates for all of the countries included in the present study and indicate that all the saving rates are fairly stable over time. Japan stands out as having a national saving rate above all others although the difference between Japan and the other countries has declined in recent years associated with the expansionary fiscal policies that the country has adopted to stimulate growth. The saving rates in the UK, US, and Iceland are generally below those of the other countries and about half the magnitude of Japan's saving rate. With the exception of Belgium and Ireland, the saving rates have remained fairly stable over the 1980-99 period.

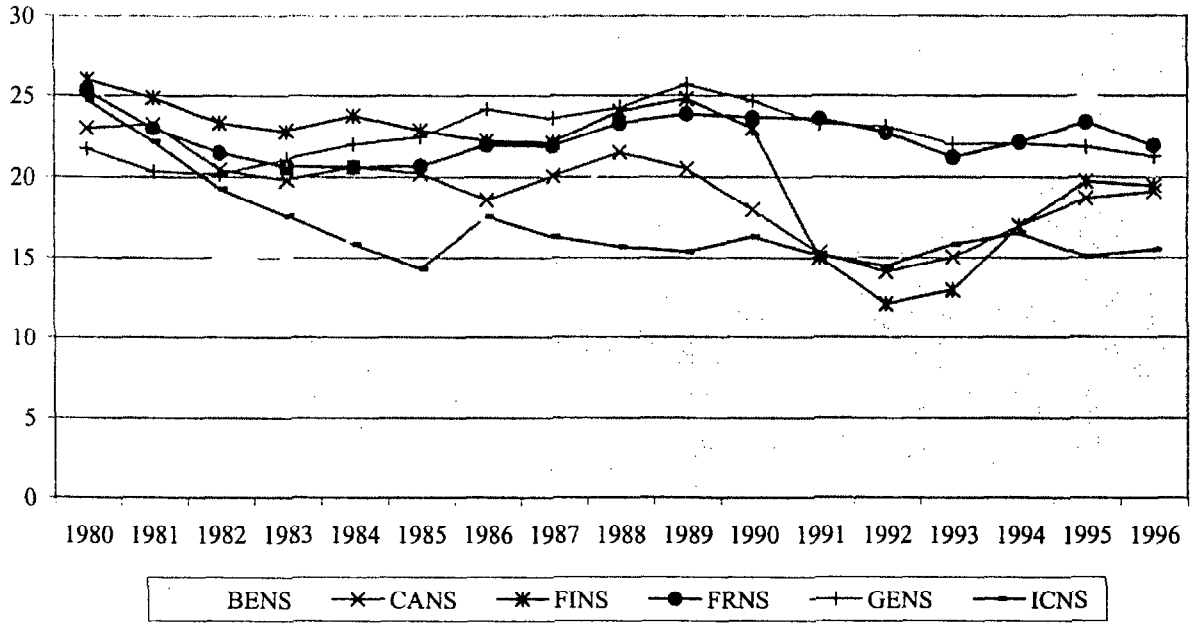
A common problem in conducting this type of analysis is endogeneity. Since national saving and government revenues and expenditures are affected by similar economic shocks, true causality among the variables is difficult to determine. To limit this problem, the

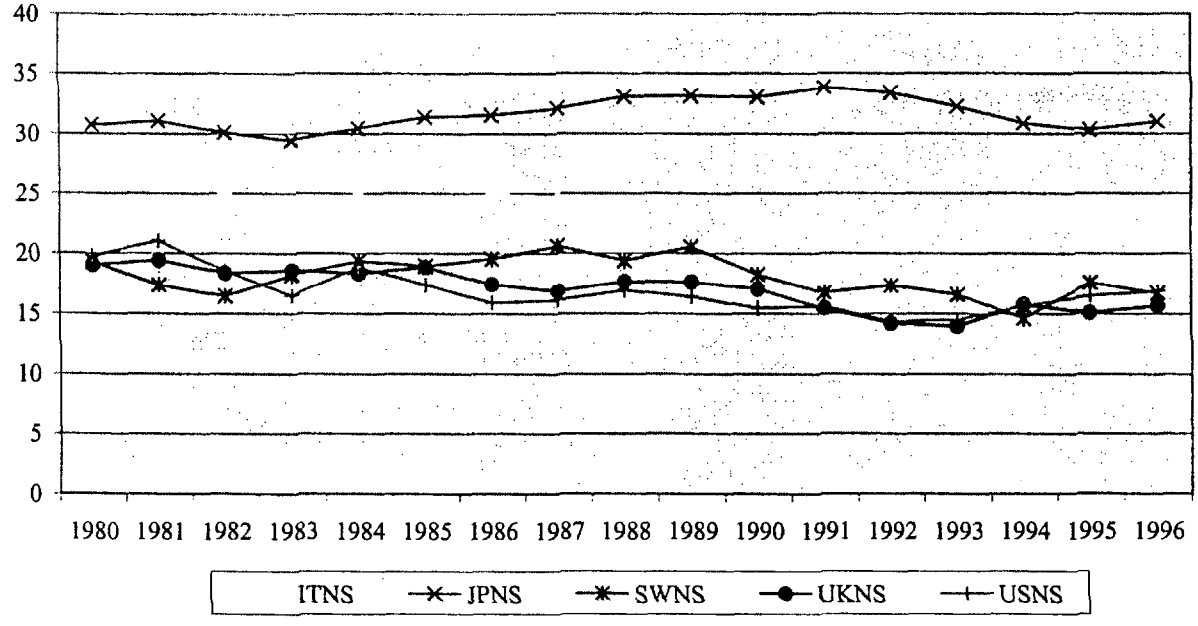
Table 1. Stationarity Tests Using the Augmented Dickey-Fuller Test on Panel Data

Variable	DF Stat
NS	-10.7**
GREV	-14.9**
GEX	-7.4**
OGAP	-13.6**
RINT	-17.5**
SB	-6.8**

** indicates significance at the 10 percent level

Figure 1. National Saving Rates
(in percent of GDP)





Source:OECD National Accounts

relationship was estimated using three stage least squares with instruments comprised of two lags of the output gap, the real interest rate, the real exchange rate, the government revenue and expenditure ratios and the contemporaneous and first lag of the structural fiscal surplus. To minimize problems of heteroscedasticity, consistent standard errors based on White's adjustment were calculated.

While using instruments in the estimation process helps to address the endogeneity problem, uncertainties remain about the causality between changes in government saving and private saving. In particular, it could be argued that the rise in private saving preceded the deterioration in public saving in Japan during the late 1980 and 1990s whereas the opposite occurred in Iceland following financial liberalization in the mid-1990s. To address this issue Granger causality tests were conducted between the change in private saving and the change in the government balance for each country. The basic equations involved regressing the private saving rate (government saving rate) on two of its own lags and on two lags of the government saving rate (private saving rate). The results indicate that changes in government saving Granger cause changes in the private saving rate in France, Japan, the Netherlands, and the United States, although the opposite result holds for Finland (Table 2). For the other countries there was either no effect or both variables Granger caused each other over the historical period. While one cannot be unequivocal on the issue, especially given that there are many omitted variables, it appears that changes in government saving drive movements in national saving rather than vice versa.

Turning to the estimation results, Table 3 presents country specific estimates of the effects of changes in government revenues and expenditures on the national saving rate and long-run level coefficients for these variables with cross-country restrictions imposed. The diagnostic tests indicate the absence of serial correlation (insignificant Q statistics) implying that 3SLS is an appropriate estimation technique and obviates the need to use HPS's mean group estimator which corrects for the correlation between the error term and the lagged independent variables. In terms of coefficient estimates, the table indicates that short-run changes in taxes have significant positive effects on changes in the national saving rate in Belgium, Finland, Germany, Sweden, the United Kingdom and the United States. For all countries the effect is significantly less than unity, suggesting a partial private sector offset of tax-induced changes in public saving. On expenditures, the short term effect is significant for Canada, Finland, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, and the United States and is at least unity for all countries except for Italy, Japan, and Sweden. There are no short run effects for Belgium, Iceland, and the United Kingdom. For Ireland, the effects go in the opposite direction in that increases in taxes lower domestic saving and increases in expenditure raise domestic saving.

The specification includes a long-run relationship between the national saving rate and the government revenue and expenditure ratios, with the coefficients assumed to be equal across countries to conserve degrees of freedom. The coefficients indicate that changes in the revenue ratio have no effect on national saving in the long-run whereas a 1 percentage point increase in the expenditure ratio leads to a decline in the national saving rate by about 0.5

Table 2. Granger Causality Tests

	Significance of government savings in private savings rate equation		Significance of private savings in government savings rate equation	
	F stat	Significance	F stat	Significance
Belgium	0.12		0.48	
Canada	0.2		0.33	
Finland	2.4		5.6	*
France	2.6	*	1.2	
Germany	0.2		0.7	
Iceland	0.1		2.1	
Ireland	2.4		0.8	
Italy	0.2		1.3	
Japan	5.6	*	2.3	
Netherlands	2.7	*	0.9	
Spain	2.7	*	4.3	*
Sweden	0.5		0.4	
UK	0.6		0.5	
US	6.9	*	1.2	

Notes: * denotes significance at the 10 percent level

Table 3. Country Specific Determinants of Gross National Savings

	β4	β5	β6	β7	β8
Belgium	0.45 *	-0.33			
Canada	-0.41 *	-1.73 *			
Finland	0.77 *	-1.09 *			
France	0.18	-1.85 *			
Germany	0.22 *	-1.22 *			
Iceland	-0.20 *	0.03			
Ireland	-0.35 *	0.66 *			
Italy	-0.09	-0.26 *			
Japan	-0.24 *	-0.63 *			
Netherlands	0.07	-1.50 *			
Spain	-0.81 *	-1.38 *			
Sweden	0.27 *	-0.73 *			
UK	0.49 *	-0.31			
US	0.34 *	-1.60 *			
			-0.39 *	-0.03	0.54 *
Diagnostic Statistics:					
R squared	0.7				
Q stat(1)	0.2				
Q stat(2)	1.4				

percentage points, within the range identified by other researchers based on the government saving rate.

The results from the estimation appear to reject the Ricardian view of the world ($\beta5=\beta6=0$) in favor of the Keynesian view ($\beta5>0$, $\beta6<0$) since short-run revenue and expenditure changes are significant for half of the countries and a significant long run relationship between expenditures and national saving is identified. Moreover, Keynesian models can rationalize the sizeable difference between the effects on national saving of changes in expenditure versus changes in revenue as follows. Tax changes are immediately reflected in changes in private sector incomes, some of which are saved, whereas the private sector is not expected to offset the change in government expenditures except for permanent changes which improve the sustainability of the fiscal position in countries with high debt ratios or in countries in intergenerational balance (see below).

III. Searching for an Explanation for Differences Across Countries

Explanations for the differences in behavior across countries were sought by distinguishing countries with varying degrees of intergenerational financial stability and openness and periods during which the private sector might offset fiscal policy actions (large fiscal adjustments).

A. Differences Based on Measures of Fiscal Sustainability

An economy with a sustainable long-run fiscal position comes closest to satisfying Ricardian features because increases in taxes and expenditures are unlikely to affect the long-run intergenerational balance unless they are sustained for a very long time. Rational individuals would therefore respond to an increase in taxes (expenditures) by reducing (raising) their saving to maintain their consumption profile. Calculations of the long-run fiscal position have been motivated by the future aging of the population and the prospective decline in the participation of working-age men in work because these developments are likely to put a heavy strain on the public finances of the industrialized countries. Auerbach et al. (1999) have used generational accounting to estimate the likely cost of these developments, measured as the unfunded liability of the government. They document that the pension liability is most pronounced for Germany, Italy and Japan while Belgium, France, and the United States have moderately large liabilities, and Canada and Sweden are in generational balance (Table 4). Raffelhüschen et al. (1999) have conducted a similar study on other European countries and they find that the intergenerational liability is large for Finland, Germany, Italy, and Spain, moderate in France and the Netherlands, and is absent in Ireland. Auerbach et al. assume that benefits grow in line with GDP per capita whereas Raffelhüschen et al. assume that benefits grow at the rate of productivity growth. Over the medium term these assumptions are very similar because the employment/population ratio is broadly constant. Cardarelli, Sefton, and Kotlikoff (1999) have estimated generational accounts for the United Kingdom based on the assumption that benefits are indexed by the

Table 4. Generational Accounting Liability
(in percent of GDP)

	Kotlikoff et al. estimates	Raffeluschen et al. estimates
Australia	12.6	
Belgium	20.2	18.8
Canada	0.1	
Finland		253.2
France	26.5	81.3
Germany	51.6	136
Iceland 1/	8.6	
Ireland		-4.3
Italy	77.4	107.3
Japan	59.3	
Netherlands		75.9
Spain		151.9
Sweden	-14.5	
UK 2/	33.0	
US	16.9	

1/ Benediktsson et al (2000)
2/ Cardarelli, Sefton, and Kotlikoff (1999)

CPI and health care expenditures per inhabitant decline over time (this is a proxy of the government's current intentions). [3]Under these assumptions they document the existence of a small intergenerational liability for the United Kingdom. Benediktsson et al. (2000) have estimated generational accounts for Iceland based on the assumption that benefits are indexed by labor productivity growth. In contrast to most other studies which categorize all government investments that do not provide revenue as consumption, they only include the depreciation of these assets as consumption. Under these assumptions they find that the intergenerational liability is small in Iceland.

Not only can countries in intergenerational balance demonstrate Ricardian features, but any country can manifest such features over isolated periods of time if fiscal measures adopted by a particular country lead to a significant revaluation of its long run fiscal position. Following the recent experiences of Ireland and Denmark in which large fiscal consolidations resulted in booming economies, a number of researchers have begun to emphasize the role of expectations in understanding the relationship between movements in the government budgetary position and total saving. In an intertemporal model of consumption behavior, Bertola and Drazen (1993) argue that the effects of current fiscal policy depend on the expectations it generates for the course of future fiscal policy. If a sizeable fiscal contraction signifies the intent for future fiscal consolidations, the private sector may take this into account and offset a large fraction of it. Similarly, Giavazzi and Pagano (1996) argue that large fiscal consolidations can be expansionary precisely because they signal a permanent and decisive change in the stance of fiscal policy, while small adjustments may have the opposite effect for the opposite reason. Blanchard (1990) emphasizes the non-Keynesian effects of fiscal policy contractions at high levels of debt by postulating the existence of a trigger point beyond which tax increases result in declines in output because of tax distortions. Countries undertaking fiscal consolidation with high debt levels will experience an extra output boost if the debt level falls below the trigger point because of the accompanying reduction in tax distortions. The private sector anticipates this prospective output boost and offsets the contractionary effects of fiscal policy through declines in private saving. Perotti (1999) endogenizes this effect and shows that aggregate consumption is negatively influenced by positive shocks to government expenditure in countries with large intergenerational liabilities. Individuals expect tax increases following increases in expenditure and this expectation causes a bigger fall in their wealth and consumption the larger the initial distortions. Since the tax distortion is a positive function of the intergenerational balance, the effect carries through for the level of the intergenerational balance.

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[3] It must be recognized however, that the intergenerational fiscal balance is sensitive to assumptions. Assuming that benefits are indexed to wages and that health expenditures per inhabitant remain constant in real terms, the intergenerational liability in the UK would rise to over 180 percent of GDP.

Alesina and Perotti (1997) have considered the relationship between fiscal policy and economic activity in identifying successful fiscal adjustments among OECD countries and comparing macroeconomic developments following successful and unsuccessful fiscal adjustments. They identify a successful fiscal adjustment if one of the two following conditions holds three years after the adoption of a tight fiscal stance: (1) the ratio of the cyclically adjusted primary deficit to GDP is at least 2 percentage points below the level observed in the last year of the fiscal contraction or (2) the ratio of debt to GDP is 5 percent of GDP below the level observed in the last year of the fiscal contraction. They find that following the adoption of a successful fiscal adjustment, a country's growth profile is significantly higher than the industrial country average, fuelled by strong investment.

Tests were conducted to determine the effects of the intergenerational budget position and sizeable fiscal adjustments as follows. The importance of the intergenerational budget balance was identified by dropping the country specific revenue and expenditure coefficients from equation (1) and adding to it the interaction between the change in government revenues and expenditures and a dummy variable with the value of unity for countries with no estimated intergenerational fiscal liability (Canada, Iceland, Ireland, and Sweden). The long-run level relationship between revenues, expenditures and national saving was also assumed to differ between countries in and out of intertemporal fiscal balance.

The temporary effects of large fiscal adjustments were captured by interacting changes in government revenues and expenditures with a dummy representing periods when fiscal contractions/ expansions were large (defined as periods when the structural fiscal balance changed by more than 1 percentage point in either direction, see appendix 2) in countries which are not in intergenerational balance. Separate variables were added for countries with sizeable intergenerational imbalances to capture non-linear effects resulting from the distortionary effects of taxation.

The ranking of countries based on the size of the intergenerational liability is comparable between the Auerbach et al. and Raffelhüschen et al. studies although the actual estimates differ considerably. Germany and Italy are estimated to have large liabilities in both studies and therefore these countries are included in the high debt category in our analysis. Japan and Spain are also included in this category because their liabilities are high relative to those of other countries in their respective sample groups. While the findings of the Raffelhüschen et al. study would suggest that Finland should also be in this category, Finland is currently running fiscal surpluses at about 4 percent of GDP and the decision to set aside these surpluses to pay future pensions has improved its intergenerational fiscal position immensely. For this reason Finland is excluded from the sample of high debt countries in the analysis which follows.

The estimated equation is as follows:

$$\Delta NS_{it} = \beta 0_i + \beta 1_i.\Delta NS_{i(t-1)} + \beta 2_i \Delta gap_{it} + \beta 3_i.\Delta r_{it} + \beta 4.\Delta nex_{i(t-1)} + \beta 5 \Delta grev_{it} + \beta 6.\Delta gex_{it}$$
$$+ \beta 7.\Delta grevl_{dt} + \beta 8.\Delta gexl_{dt} + \beta 9.\Delta grev_{hdt} + \beta 10.\Delta gex_{hdt} + \beta 11 \Delta grev_{ibt} + \beta 12 \Delta grex_{ibt}$$
$$+ \beta 15.NS_{t-1}(1 - \beta 16.(grev_{t-1} / NS_{t-1}) - \beta 17.(gex_{t-1} / NS_{t-1})$$
$$- \beta 20.(grev_{ib(t-1)} / NS_{t-1}) - \beta 21.(gex_{ib(t-1)} / NS_{t-1})) + \varepsilon_t (2)$$

where the subscript ld/hd identifies countries with modest and large intergenerational imbalances and subscript ib identifies countries in intergenerational balance.

The estimated coefficients of this regression are presented in column 1 of Table 5. The coefficient estimate on the change in government revenues is significantly positive but small for the sample as a whole (β5) whereas the coefficient on the change in government expenditures is significantly negative and considerably larger in magnitude (β6). This confirms the earlier result that Keynesian features are present in these economies. While the small revenue coefficient in the whole sample (β5) does not get offset by the revenue coefficient of the countries with sustainable long-run fiscal positions(β11), the expenditure coefficient (β6) gets completely offset (β12), evident in the insignificant Chi squared statistic. These results are partially supported by the long-run coefficients. In the long-run the relationship between government revenues and national saving is insignificant for all countries in the sample whereas, a significantly negative long-run relationship is identified between expenditures and national saving with a coefficient of about a half. Surprisingly, the expenditure coefficient is comparable for countries in or out of intergenerational balance whereas one would have thought that the expenditure coefficient would be insignificant for countries in intergenerational balance. On the other hand, eliminating the long-run revenue and expenditure variables for countries in intergenerational balance strengthened the short-run offset effects with the coefficient on revenues significantly negative and partially offsetting the positive effect for the whole sample (equation [2]). These results suggest that, in general, countries in intergenerational balance exhibit Ricardian features.

Turning to the effects of significant fiscal consolidations, the coefficient on the change in government revenues is significantly positive for countries with small intergenerational imbalances (β7) but insignificant for countries with large intergenerational imbalances (β9). This suggests that in countries with small imbalances changes in government revenues have bigger impacts on total saving when fiscal adjustment is large. Moreover, while the effect on national saving of large expenditure adjustments gets accentuated for countries with modest intergenerational imbalances (β8<0), it gets attenuated for countries with large intertemporal fiscal imbalances (β10 >0). Since the sum of β6 and β8 is greater than one, the private sector accommodates sizable changes in the fiscal position in countries with modest intergenerational imbalances which is surprising. On the other hand the more modest impact on national saving of expenditure changes in countries with large intertemporal fiscal imbalances is consistent with Perotti (1999) and provides support for the presence of expectation effects related to fiscal actions and/or large tax distortions. Moreover, the behavioral difference in countries with large imbalances manifests itself in response to expenditure rather than revenue changes. This is consistent with the fact that

Table 5. Determinants of Gross National Savings

Variable	[1]		[2]		[3]		[4]		[5]	
β5	0.12	*	0.17	*	0.13	*	0.18	*	-0.04	
β6	-0.7	*	-0.72	*	-0.64	*	-0.7	*	-0.63	*
β7	0.36	*	0.3	*	0.25	*	0.19	*	0.06	
β8	-0.42	*	-0.41	*	-0.67	*	-0.61	*	-0.48	*
β9	-0.06		-0.12	*	-0.04		-0.07		-0.05	*
β10	0.16	*	0.15	*	0.28	*	0.31	*	0.27	*
β11	-0.07		-0.09	*	-0.09		-0.1		0.15	
β12	0.65	*	0.75	*	0.56	*	0.72		0.66	*
β13									0.45	*
β14									-0.3	*
β15	-0.41	*	-0.36	*	-0.44	*	-0.39	*	-0.44	*
β16	0.1		0.09		0.05		0.06		-0.08	
β17	-0.59	*	-0.59	*	-0.56	*	-0.55	*	-0.35	*
β18									0.33	*
β19									-0.51	*
β20	0.06				0.03					
β21	-0.37	*			-0.4	*				
Diagnostic Statistics:										
R squared	0.59		0.59		0.62		0.61		0.61	
Q stat(1)	3.4		3.4		4.6		4.9		4.6	
Q stat(2)	3.8		4		6		6.2		5.6	
Hypothesis Tests										
	Ho:β12=-β6		Ho:β11=-β5						Ho:β12=-β6	
	Chi Sq(1)=1.6		Chi Sq(1)=8.8	*					Chi Sq(1)=0.7	
	Ho:β17=β21		Ho:β12=-β6							
	Chi Sq(1)=0.7		Chi Sq(1)=0.7							

fiscal consolidations achieved through changes in revenue are thought to be less durable than those achieved through changes in expenditure because they are more easily reversed.

The empirical literature has focused on current government obligations in defining countries with high debt levels whereas this paper has used the intertemporal definition, which arguably is closer in spirit to the Ricardian hypothesis.[4] It could be claimed, however, that the findings are sensitive to changes in the definition of countries with high debt. To test for this, high debt countries were defined as those with large ratios of government obligations to GDP. According to this definition, Belgium is categorized as a high debt country and Germany and Spain are categorized as countries with moderate debts (see Table 6). Consistent with our previous finding, in countries with high debt ratios, the private sector offsets government expenditure changes rather than revenue changes ($\beta 9 \sim 0$, $\beta 10 > 0$) during periods of large fiscal adjustments. For every 1 percentage point increase in expenditures, national saving declines by 0.36 percentage points in countries with high debt ratios whereas it declines by over 1 percentage point in countries with moderate imbalances. This difference is larger than under the alternative definition of countries with high debt and the explanatory power of the equation is higher.

This paper's approach in determining Ricardian effects has a number of similarities with the analysis of Giavazzi and Pagano (GP, 2000). One major difference however is that GP ignore the distinction between countries in and out of intergenerational balance. While they find small revenue and large expenditure offset coefficients, similar to this study, they also find that large fiscal adjustments moderate the impact of changes in government incomes on national saving for all countries, and that the impact of revenue/expenditure changes on national saving is independent of the level of government debt. A potential explanation for the different results is that GP do not isolate periods with large fiscal adjustments when interacting government revenues and expenditures with dummies for countries with high debt ratios. It is quite likely that the impact of the high debt burden is greatest during these periods because they suggest a significant break in the debt profile.

B. Differences Based on the Degree of Openness

The strong relationship between changes in government revenues and expenditures and total saving indicates the presence of Keynesian features in these economies. In such economies the extent to which fiscal policy can impact the economy depends on the degree of openness since expenditures leak out of the economy via imports. This effect is clear from the national income identity:

$$Sp + Sg \equiv Ip(r) + Ig(r) + CA$$

[4] Perotti's (1999) analysis is also based on the present discounted value of debt although he only calculates it five years into the future.

Table 6. Average Import and Gross Debt Levels 1980-99
(in percent of GDP)

	Import Ratio	Gross Debt Ratio
BELGIUM	67.8	119.2
CANADA	29.0	78.6
FINLAND	28.0	30.3
FRANCE	22.1	38.2
GERMANY	26.0	46.3
ICELAND	34.7	39.7
IRELAND	57.2	86.0
ITALY	21.2	95.7
JAPAN	9.7	77.4
NETHERLANDS	54.8	70.6
SPAIN	20.9	45.8
SWEDEN	31.8	62.7
UNITED KINGDOM	26.7	46.8
UNITED STATES	11.0	62.0

where S_p is the gross private saving rate, S_g is the gross saving position of the government, Ip is the private investment rate, Ig is the public investment rate, and CA is the current account. In open economies, changes in government saving generate significant movements in the current account and hence in national saving although the output effects are moderated because of the expenditure leakage into imports.

To capture the effects of openness to trade, a proxy variable was introduced, defined as the ratio of imports of goods and services to GDP. Based on this definition, Belgium is the most open economy in the sample with an average import ratio of over 67 percent of GDP over the 1980-99 period (Table 6). The import ratios for Ireland and the Netherlands are also high at over 50 percent. Most of the other import ratios are grouped in two country categories, one between 25 and 35 percent of GDP (Iceland, Sweden, Canada, Finland, the UK, and Germany) and the other between 20 and 22 percent of GDP (France, Italy, and Spain) with Japan and the United States taking up the rear. Countries with a high level of import penetration were defined as those with an import ratio above 25 percent of GDP and extra short and long-run revenue and expenditure coefficients were included for countries with this characteristic.[5] The revised equation is as follows:

$$\begin{aligned}\Delta NS_{it} &= \beta 0_i + \beta 1_i.\Delta NS_{i(t-1)} + \beta 2_i \Delta gap_{it} + \beta 3_i.\Delta r_{it} + \beta 4.\Delta nex_{i(t-1)} + \beta 5 \Delta grev_{it} \\ &+ \beta 6.\Delta gex_{it} + \beta 7.\Delta grev_{ldt} + \beta 8.\Delta gex_{ldt} + \beta 9.\Delta grev_{hdt} + \beta 10.\Delta gex_{hdt} + \beta 11.\Delta grev_{ibt} \\ &+ \beta 12.\Delta gex_{ibt} + \beta 13.\Delta grev_{ot} + \beta 14.\Delta gex_{ot} + \beta 15.NS_{t-1}(1 - \beta 16.(grev_{t-1}/NS_{t-1}) \\ &- \beta 17.(gex_{t-1}/NS_{t-1}) - \beta 18.(grev_{o(t-1)}/NS_{t-1}) - \beta 19.(gex_{o(t-1)}/NS_{t-1})) + \varepsilon_t \quad (3)\end{aligned}$$

where the subscript o denotes variables which have been multiplied by a dummy associated with countries with large import ratios.

In this specification the coefficients on changes in government revenues and expenditures interacted with dummies for intergenerational balance and significant fiscal adjustments are comparable to the previous specification (column 5 in Table 5) with the exception that government revenue changes are insignificant in the short run.[6] Of the new variables of interest, the degree of openness affects the spillage of government revenues and expenditures into the current account (significant coefficients on β13 and β14) with stronger effects for revenues than expenditures. This could be associated with the fact that government expenditures are generally spent on home goods so the initial spillage into

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[5] Separate long run coefficients were added for countries with high import penetration because, even in the long run, these countries should experience larger expenditure leakages (and hence lower private sector offsets) through the current account, holding all other factors constant.

[6] In this specification, countries with high debt ratios are defined as those with high government debt levels.

imports is likely to be less. Turning to the long-run coefficients, a 1 percentage point increase in revenues has no effect on national saving in closed economies but results in a 0.33 percentage point increase in open economies. On expenditures, a 1 percentage point increase in expenditure leads, in the long-run, to a 0.35 percentage point decline in national saving in closed economies and a 0.50 percentage point decline in open economies.

The finding that countries in intergenerational balance demonstrate Ricardian features has considerable intuitive appeal. However, the extent to which this finding is robust is debatable. Apart from the works already cited there are few studies on Ricardian equivalence which focus on Canada, Iceland, Ireland, and Sweden. However, those that do so generally find that Sweden, Iceland and Ireland manifest these features although the Canadian case is more uncertain. Carroll and Summers (1987) compare saving rates in Canada and the United States and, controlling for other determinants, find that the difference in the saving rates can be explained assuming that the Canadian economy has Ricardian features. Evans and Hasan (1994) find that the lagged level of real per capita net worth is unable to explain changes in private consumption in Canada, consistent with the view that the planning horizon for private sector consumption decisions is infinite. However, in a more recent paper Evans and Karras (1996) find that changes in current income have a significant effect on changes in consumption for most countries, including Canada, suggesting that liquidity constraints are present in these economies. For Iceland, Einarrsson (1990) estimates an empirical model of the Icelandic economy and simulates its response to a temporary tax cut. He finds very little change in the current account following this tax cut and argues that this is suggestive of strong Ricardian effects. Evans and Karras' findings for Ireland and Sweden indicate that changes in current income have no effect on current consumption. This finding on Sweden is supported by Brunila (1997) who estimates Euler equations for a number of European countries and finds that current income has no effect on current consumption in the Netherlands, Finland, and Sweden but has a significant effect in Austria, Belgium, France, Germany, Greece, Italy, and the UK.

IV. CONCLUSION

This paper has considered the extent to which the private sector offsets changes in government finances among OECD countries and finds that the difference in responses is considerable. The importance of revenue changes in affecting total saving differs between a negative effect for Canada, Iceland, Ireland, and Spain and a significant positive effect for Belgium, France, Germany, Sweden, the United Kingdom and the United States. Similarly the importance of expenditure changes in affecting saving differs from zero for Belgium, Iceland, and the United Kingdom to more than unity for Canada, Finland, France, Germany, the Netherlands, Spain and the United States.

Explanations for these different effects were sought in terms of the intergenerational fiscal position, the size of the fiscal adjustment, and the degree of openness. The analysis found that the private sector is likely to offset any fiscal adjustment in countries which are in intertemporal balance and offset about half of the magnitude of large expenditure adjustments in countries with high public debt levels. Moreover, open economies are likely

to have a smaller private sector offset to changes in government revenue and expenditure because of the sizeable spillage of these income flows into the current account.

For countries in intergenerational balance, this analysis suggests that the impact on output of fiscal policy actions is likely to be limited. Therefore, in Ireland and Sweden's case tax cuts may not have much of an inflationary impact because of the potential for tax cuts to yield a comparable increase in private saving. For Iceland, faced with a large current account deficit, the ability of fiscal policy to address this imbalance is also likely to be limited especially in view of the fact that the rise in the deficit is largely the result of financial imbalances in the private sector.

Turning to the Euro-area countries, changes in taxes are unlikely to generate much of a total saving response unless the economy is very open. Moreover, even for open economies the output response to fiscal adjustments is likely to be limited because of the strong leakage into imports. In contrast, the short-run effects on national saving of changes in government expenditures are considerably stronger at above unity for significant fiscal adjustments except for those undertaken in high debt countries such as Belgium and Italy. For the latter two countries the effect of a 1 percentage point reduction in expenditures would lead to an increase in national saving of about a third of a percentage point.

The above considerations demonstrate the limits of fiscal policy in affecting cyclical swings, particularly in countries in intergenerational balance. For the Euro-area countries the paper suggests that changes in government expenditures would provide the most durable way of influencing national saving and hence affecting output.

Variable Definitions

NS: national savings/potential GDP

Gap: (GDP-potential GDP)/potential GDP

R: 3-month T-bill rate minus the 12 month change in the CPI

Nex: Nominal exchange rate index

Grev: (general government gross saving plus government consumption)/potential GDP

Gex: (government consumption plus government investment)/potential GDP

Sbal: budget balance corrected for cyclical movements

Periods During Which Significant Fiscal Consolidation Took Place[7]

Country	Time period
Belgium	1982, 1984, 1987, 1989, 1993-96
Canada	1981, 1984-87,1996
Finland	1982-83, 1987-88, 1991-92
France	1981-82, 1987, 1996
Germany	
Iceland	1983-86, 1989-90, 1992, 1995
Ireland	1983-85, 1987-91, 1993, 1995-96
Italy	1981-83, 1985, 1990-93
Japan	1984-85, 1987, 1993-96
Netherlands	1985-86, 1988-91, 1993, 1996
Spain	1982, 1985-88, 1990, 1992, 1995-97
Sweden	1983, 1986-92, 1995-96
United Kingdom	1981-84, 1992-93, 1996
United States	1980, 1993-94

[7] A significant fiscal consolidation is defined as a change in the cyclically adjusted budget position measured at or above 1 percent of potential output.

References

Alesina, A. and R. Perotti, 1997, "Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects," *Staff Papers*, International Monetary Fund, Vol. 44, pp.210 – 48.

Auerbach A. and L. Kotlikoff, 1999, *Generational Accounting Around the World*, (Chicago: University of Chicago Press).

Barro, R., 1974, "Are Government Bonds Net Wealth?" *Journal of Political Economy*, Vol. 82, pp. 1095-1117.

Bertola, G. and A. Drazen, 1993, "Trigger Points and Budget Cuts: Explaining the Effects of Fiscal Austerity," *American Economic Review*, Vol. 83, pp.1170-88.

Blanchard, O., 1990, "Comment," NBER Macroeconomics Annual No. 5 (Cambridge, Massachusetts: National Bureau of Economic Research).

Brunila, A., 1997, "Current Income and Private Consumption-Saving Decisions: Testing the Finite Horizon Model," Bank of Finland Discussion Papers No. 6 ([City: publisher]).

Campbell, J. and G. Mankiw, (1991) "The Response of Consumption to Income: A Cross-Country Investigation," *European Economic Review*, Vol. 35, pp. 723-67.

Cardarelli, R., J. Sefton, and L. Kotlikoff, 1999, "Generational Accounting in the UK," mimeo, National Institute of Economic Research, London.

Carroll, C. and L. Summers, 1987, "Why have private saving rates in the United States and Canada diverged?" *Journal of Monetary Economics*, September.

Corbo, V. and K. Schmidt-Hebel, 1991, "Public Policies and Saving in Developing Countries," *Journal of Development Economics*, Vol. 36, pp. 89-115.

Edwards, S., 1996, "Why are Latin America's Saving Rates so Low? An International Comparative Analysis," *Journal of Development Economics*, Vol. 51, pp. 5 - 44.

Einarsson, T., 1990, "Ricardian Equivalence under labor income taxes," University of Iceland Working Paper No. 1990/12.

Evans, P. and I. Hasan, 1994, "Are Consumers Ricardian? Evidence from Canada," *Quarterly Journal of Economics and Finance*, Vol. 34, pp. 25 - 40.

Evans, P. and G. Karras, (1996) "Private and Government Consumption with Liquidity Constraints," *Journal of International Money and Finance*, Vol.15, pp. 255 - 66.

Flavin, M., 1985, "Excess Sensitivity of Consumption to Current Income: Liquidity Constraints or Myopia?" *Canadian Journal of Economics,* Vol. 18, No. 1.

Giavazzi, F. and M. Pagano, 1996, "Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience," *Swedish Economic Policy Review*, May, pp. 75 - 111.

Giavazzi, M., T. Jappelli, and M. Pagano, 2000, "Searching for Non-linear effects of fiscal policy: evidence from industrial and developing countries," NBER Working Paper No. 7460 (Cambridge, Massachusetts: National Bureau of Economic Research).

Haque, N. and P. Montiel (1989) "Consumption in Developing Countries: Tests for Liquidity Constraints and Finite Horizons," *Review of Economic Studies*, Vol. 71, pp. 408 - 415.

Haque, N., H. Pesaran, and S. Sharma, 1999, "Neglected Heterogeneity in Cross-Country Savings Regressions," IMF Working Paper No. 99/128 (Washington: International Monetary Fund).

Khalid, A., 1996, "Ricardian Equivalence: Empirical Evidence from Developing Countries," *Journal of Development Economics,* Vol. 51, pp. 413 - 32.

Loyoza, N., K. Schmidt-Hebbel, and L. Serven, 2000, "What Drives Saving Across the World?" *Review of Economics and Statistics,* Vol.82, pp. 226 - 238.

Masson, P., T. Bayoumi, and H. Samiei, 1998, "International Evidence on the Determinants of Private Saving," *World Bank Economic Review*, Vol. 12 (Washington: The World Bank).

Oh, K., 1996, "Purchasing Power Parity and the Unit Root Test using Panel Data," *Journal of International Money and Finance,* Vol. 15, pp. 405- 418.

Perotti, R., 1999, "Fiscal Policy When Things are Going Badly," *Quarterly Journal of Economics*, Vol. 4, November, pp. 1399 - 1436.

Raffelhüschen, et al., 1999, *Generational Accounting in Europe*, European Economy Reports and Studies No. 6 (City: publisher/organization)

Seater, J., 1993, "Ricardian Equivalence", *Journal of Economic Literature*, Vol. 31, pp. 142 – 190.

Sutherland, A., 1997, "Fiscal Crises and Aggregate Demand: Can High Public Debt Reverse the Effects of Fiscal Policy?" *Journal of Public Economics,* Vol. 65, pp. 147 - 162.