

# Is the Ricardian Equivalence Proposition an “Aerie Fairy” Theory for Europe?\*

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## Abstract

Using a theoretical model based on dynamic optimizing agents, we test empirically the Ricardian Equivalence Proposition (REP) for the EU-15 countries. The theoretical setting allows us to obtain estimates of the structural parameters of the model and directly test the hypothesis implied by the REP. Using recently developed end-of-sample cointegration breakdown tests, we find evidence of a change in the fiscal behaviour of individuals during the last decade for most countries in the sample. The results concerning the direction of change are mixed, with more evidence of “Ricardianity” in the end of the sample for some countries, and less evidence for others.

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“The Ricardian theory [...] has been described as aerie fairy theory [by Robert J. Gordon] in the New York Times. What does [that] mean?” Exam question of Robert Barro for his students.

“Aerie fairy means in la la land, out of touch with the indisputable, hard facts of the world.” One of Barro’s students on the very exam question.<sup>1</sup>

## 1 Introduction

The discussion concerning the size of the fiscal multiplier and the effect of fiscal policy on private consumption (and hence economic activity) has become more of interest in academic as well as political circles following the “expansionary fiscal contractions” in Denmark and Ireland, that apparently contradicted conventional macroeconomic theory according to which a decrease in the budget balance has a contractionary effect on real GDP growth. Giavazzi and Pagano (1990) attribute the high GDP growth rates which came together with a fiscal contraction to the fact that during these episodes the size of the consolidation changed consumers’ expectations about future fiscal policy and hence about their net lifetime income which, in turn, led to an increase in private consumption.

These days, three views prevail in this discussion: The first – traditional Keynesian – view hypothesizes that an expansionary fiscal policy is effective in stimulating aggregate demand and hence GDP growth. The second view, based on the Ricardian equivalence proposition (REP henceforward), concludes that such a type of policy has no effect since rational individuals – being aware of the intertemporal government budget constraint – base their consumption decisions on permanent (not actual) income and will hence anticipate a future increase in taxes by saving the amount of, say, a tax cut to make up for the loss of income in the future. The third view, the non-Keynesian view, emphasizes the importance of current fiscal policy – specifically the level of debt – in shaping consumers’ expectations about the future. Thus an expansionary fiscal policy today which comes together with a high debt to GDP ratio or a large budget deficit, may have a contractionary effect on private consumption.

Advocates against the REP point out that the theory is based on relatively strong assumptions such as rational and forward-looking individuals, lump-sum taxes, perfect capital markets and infinite lives of consumers all of which may render the REPs practical relevance – at least in its perfect form – questionable. However, as Hemming et al. (2002) note, it

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<sup>1</sup>Quotes taken from Barro (1996).

could still be the case that under certain circumstances a Ricardian type of response of the consumers is more likely. For instance, if a government is bound by a fiscal rule which requires a reversal of a fiscal expansion, then even households with comparatively short time horizons might change their consumption behaviour, e.g., to prepare for income losses as a consequence of higher taxes in the future.<sup>2</sup> This idea may be particularly accurate for the European Monetary Union (EMU) due to the 3%-deficit fiscal rule of the Stability Pact (see Cotis et al., 1998).<sup>3</sup>

The importance of the REP in Europe these days can be easily documented by the fact that official publications by international institutions such as the OECD, the European Commission (EC) or the IMF often contain references as to the potential relevance of the REP.<sup>4</sup> A good example why the validity of the REP is essential as an argument is the fiscal policy discussion carried out during the present cycle: Here the EC repeatedly emphasized the importance of staying below the 3% deficit threshold. Since some economies displayed very moderate GDP growth rates<sup>5</sup> this implied to follow procyclical fiscal policies, which, in terms of traditional (Keynesian) theory, would hardly be recommended. However, if (at least a less stringent form of) the REP were to hold, the rationale of the EC would actually make sense since consumers of an excessive deficit country would anticipate a future tax increase following to the tax cut and hence not raise consumption but instead save more.

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<sup>2</sup>Kopits and Symanski (1998) define a fiscal rule as “a permanent constraint on fiscal policy, expressed in terms of a summary indicator of fiscal performance, such as the government budget deficit, borrowing, debt, or a major component thereof”. According to a narrower definition of the European Commission (2003), a fiscal rule should have two specific characteristics, namely being ‘permanent’ and defined through an ‘indicator’ that can be easily monitored.

<sup>3</sup>One has to note that the suspension of the excessive deficit procedures against Germany and France in 2003 severely undermined the credibility of the Stability Pact. Some observers even suggested that this might be the end of the present fiscal framework in Europe. We will however disregard these developments since we deal with data only up to 2002, where the 3% rule was firmly in place.

<sup>4</sup>These references are typically of the following form: “A strong and credible commitment to fiscal rigor is necessary to prevent that rational households save part of their tax cut in anticipation of future tax increases [...] considered necessary to re-establish long-run fiscal sustainability” (OECD 2003), “A high tax burden stifled incentives to work and invest, while the incomplete fiscal consolidation process raised concerns about the future tax burden” (IMF 2003), “Cases have been documented of EU countries in which tax increases or expenditure cuts have been followed by accelerated growth in the short run” (EC 2002).

<sup>5</sup>As of the end of 2004 (realized budgets to 2003 and projections for 2004), Germany (with an average growth rate of 0.5% from 2001 to 2003) as well as France would have missed the target for the third time in a row, Portugal twice, in 2001 and 2004.

Since the seminal study by Barro (1974), numerous studies have (directly or indirectly) empirically tested the relevance of the REP. The evidence is very mixed and no clear-cut conclusions about the existence of Ricardian equivalence have emerged. The diversity of the results in the literature can partly be attributed to the application of reduced-form models with no theoretical framework, whose empirical counterpart may suffer from misspecification, omitted variable bias or endogeneity. The literature has tested the REP by, e.g., using an aggregate consumption function (usually either reduced-form consumption functions or Euler-equation type of specifications), or simply quantifying the effect of deficits on interest rates. As to country-specific studies, Feldstein (1982), Seater and Mariano (1985) and Bernheim (1997) investigate the REP for the US, where the first two reject the REP whereas the latter finds a stimulative effect of fiscal policy on private consumption; Within a cross-country setting, Masson et al. (1995) find similar results as Bernheim (1997) for a panel of advanced economies whereas Giavazzi et al. (2000) reject the REP for a panel of 21 OECD-countries as does Evans (1993) for 19 advanced economies. Most studies have investigated the REP for the US or a panel of states. For Europe, the empirical evidence is relatively scarce. The only study that we are aware of is by Brunila (1997), concluding that the REP cannot be rejected for six out of ten European countries.

This piece of research contributes to the economic policy discussion outlined above and to the empirical literature in several aspects. We test for the relevance of the REP for all EU-15 countries by using the structural model by Leiderman and Razin (1988), as modified by Khalid (1996). Furthermore, we explicitly investigate the existence of a structural break in the behavioural parameters of the model in the 1990s. The results will help us to evaluate the stability of the structural parameters (and thus the relevance of the REP) during the last decade, where the effects of the Stability Pact (if any) should have taken place. In other words, we will be able to verify whether the introduction of a fiscal rule such as the one implied by the Stability Pact does induce consumers to act (more) Ricardian. to the knowledge of the authors The notion that the introduction of such a fiscal rule could lead to Ricardian behaviour is new when assessing the REP empirically. Given the small amount of observations after the potential break, the new method proposed by Andrews and Kim (2003) in order to assess end-of-sample cointegration breakdown will be used to investigate the existence of a structural break in the parameters of the model. The paper is organized as follows: Section two introduces the theoretical model which will be the baseline for our empirical analysis. Section three presents the econometric methodology and the empirical

implementation of the theoretical specification as well as the cointegration-breakdown test results. Section four concludes.

## 2 The theoretical model

The basic theoretical setting to the empirical study is given by the model proposed by Khalid (1996) which is an extension of the one put forward by Leiderman and Razin (1988). The advantage of the model is that it offers a theoretical structure and an empirically tractable solution. Furthermore it provides a setting to test for the stability of the behavioural parameters of the theoretical model.

The expected life-time utility of the liquidity-unconstrained representative consumer at time  $t$  is given by:

$$E_t \sum_{\tau=0}^{\infty} (\gamma\delta)^\tau U(c_{t+\tau}^{u*}) \quad (1)$$

where  $E_t$  is the conditional expectations operator in period  $t$ ,  $c_t^{u*}$  denotes effective consumption of individuals facing no liquidity constraints in period  $t$ ,  $\gamma$  the probability of survival from one period to the next<sup>6</sup> and  $\delta$  is the subjective discount factor. Suppose further that  $c_t^{u*}$  is a combination of public consumption  $g_t$  and private consumption  $c_t$  ( $c_t^{u*} = c_t + \sigma g_t$ , where  $\sigma$  indicates the degree of substitutability between private and public consumption). The individual maximizes (1) subject to the following lifetime budget constraint

$$c_t^{u*} = b_t^u + y_t^u - \left(\frac{R}{\gamma}\right) b_{t-1}^u + \sigma g_t \quad (2)$$

where  $b_t$  is a real one period bond issued to unconstrained individuals in period  $t$ ,  $y_t$  is real income net of taxes in period  $t$  of unconstrained individuals,  $R = 1 + r$  where  $r$  is the (risk-free) real interest rate (assumed constant) and  $(R/\gamma)$  is the effective interest rate due to life-time uncertainty.

Subject to a no-Ponzi-game-rule ( $E_t \lim_{t \rightarrow \infty} \left(\frac{\gamma}{R}\right) b_t^u = 0$ ), the intertemporal budget constraint of the liquidity-unconstrained individual can be stated as follows:

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<sup>6</sup>For simplicity, this probability is assumed to be independent of age. Thus the probability that the individual survives at  $\tau$  periods is  $(\gamma)^\tau$ .

$$E_t \sum_{\tau=0}^{\infty} \left(\frac{\gamma}{R}\right)^{\tau} c_t^{u*} = E_t \sum_{\tau=0}^{\infty} \left(\frac{\gamma}{R}\right)^{\tau} [y_{t+\tau}^u + \sigma g_{t+\tau}^u] - \left(\frac{R}{\gamma}\right) b_{t-1}^u \equiv E_t w_t^{u*} \quad (3)$$

where  $E_t w_t^{u*}$  denotes a (specific definition of) expected wealth. According to equation (3) the present discounted value of real consumption equals the present discounted value of real income net of taxes plus the contribution of public consumption to effective consumption less the real interest paid on the last period's debt commitment.

Assuming a quadratic utility function<sup>7</sup>,

$$U(c_t) = \alpha c_t - \frac{1}{2} c_t^2$$

it can be shown that the solution to the maximization problem takes the form:

$$c_t^{u*} = \beta_0 + \beta_1 E_t w_t^{u*} \quad (4)$$

with:

$$\beta_0 = \frac{\alpha \gamma (1 - \delta R)}{\delta R (R - \gamma)} \quad \text{and} \quad \beta_1 = 1 - \left(\frac{\gamma}{\delta R^2}\right)$$

We will further assume that a fraction of the population is liquidity-constrained. The liquidity constrained group of individuals receives a fixed proportion ( $\theta$ ) of total labor income and they spend their entire income on consumption, whereas the unconstrained group which gets  $(1 + \theta)$  of total income behaves as in equation (4). It can then be easily shown that aggregate consumption,  $C_t$  – defined as the sum of consumption of the liquidity-constrained and the liquidity-unconstrained group – is given by:

$$\begin{aligned} C_t = & (1 - R) \beta_0 + (1 - \beta_1) R C_{t-1} + (1 - \gamma)(1 - \theta) \beta_1 E_{t-1} \sum_{\tau=0}^{\infty} \left(\frac{\gamma}{R}\right)^{\tau} (1 - \theta) Y_{t+\tau} + (5) \\ & + (1 - \gamma) \beta_1 E_{t-1} \sum_{\tau=0}^{\infty} \left(\frac{\gamma}{R}\right)^{\tau} \sigma G_{t+\tau} + \theta Y_t - \sigma G_t + (1 - \beta_1) (R \theta Y_{t-1} - \sigma G_{t-1}) \\ & (\beta_1 \gamma [e_t^y + \sigma e_t^g]) \end{aligned}$$

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<sup>7</sup>Even though the use of a quadratic utility function has some drawbacks (it implies that consumers have increasing absolute risk aversion, for instance), its use is very common. The reason is that a quadratic utility function can be translated into a linear Euler equation which can easily be combined with the linear budget constraint to derive a closed-form solution to the consumption problem.

where,  $e_t^y$  and  $e_t^g$  are the expectation errors for income and government consumption made by individuals. We will further assume that government expenditure and income follow an ARIMA (1, 1, 0) process, so that:

$$\Delta Y_t = \rho_1 \Delta Y_{t-1} + \eta_t^Y \quad \text{and} \quad \Delta G_t = \rho_2 \Delta G_{t-1} + \eta_t^G$$

where  $\eta_t^Y$  and  $\eta_t^G$  are *iid* errors, independent from each other. Now, using the above processes and substituting values of  $\beta_0$  and  $\beta_1$ , yields:

$$C_t = \lambda_0 + \lambda_1 C_{t-1} + \lambda_2 Y_{t-1} + \lambda_3 Y_{t-2} + \lambda_4 G_{t-1} + \lambda_5 G_{t-2} + v_t \quad (6)$$

where  $v_t$  is the error term, assumed to be *iid* normal. Equation (6) states that private consumption is determined by an ARDL (1, 2, 2) process without contemporaneous effects of government spending and income.  $\lambda_0$  to  $\lambda_5$  are the structural parameters, given by:

$$\lambda_0 = \frac{\alpha\gamma(1-R)(1-\delta R)}{\delta R(R-\gamma)} \quad (7)$$

$$\lambda_1 = \frac{\gamma}{\delta R} \quad (8)$$

$$\lambda_2 = \left[ \theta \left( 1 + \rho_1 - \frac{\gamma}{\delta R} \right) + (1-\theta)(1-\gamma) \left( 1 - \frac{\gamma}{\delta R^2} \right) \left( \frac{R^2(1+\rho_1) - R\gamma\rho_1}{(R-\gamma)(R-\gamma\rho_1)} \right) \right] \quad (9)$$

$$\lambda_3 = \left[ (1-\theta)(\gamma-1) \left( 1 - \frac{\gamma}{\delta R^2} \right) \left( \frac{R^2\rho_1}{(R-\gamma)(R-\gamma\rho_1)} \right) - \theta\rho_1 \right] \quad (10)$$

$$\lambda_4 = \left[ \left( \frac{\gamma}{\delta R} - 1 - \rho_2 \right) + (1-\gamma) \left( 1 - \frac{\gamma}{\delta R^2} \right) \left( \frac{R^2(1+\rho_2) - R\gamma\rho_2}{(R-\gamma)(R-\gamma\rho_2)} \right) \right] \sigma \quad (11)$$

$$\lambda_5 = \left[ \rho_2 + (\gamma-1) \left( 1 - \frac{\gamma}{\delta R^2} \right) \left( \frac{R^2(1+\rho_2) - R\gamma\rho_2}{(R-\gamma)(R-\gamma\rho_2)} \right) \right] \sigma \quad (12)$$

The constraints implied by the REP are that of infinite horizon ( $\gamma = 1$ ) and no liquidity constraints ( $\theta = 0$ ). If these conditions are fulfilled, the lags of disposable income have no effect on current consumption. Furthermore, if the degree of substitutability between the private and public consumption spending is zero ( $\sigma = 0$ ), the equilibrium interest rate of the model implies that consumption follows a random walk.<sup>8</sup> If individuals have finite lives ( $\gamma < 1$ ) and/or a strictly positive proportion of income is owned by liquidity-constrained

<sup>8</sup>This alternative corresponds to Hall's model of consumption (Hall, 1978).

agents ( $\theta > 0$ ), fiscal policy measures will have an effect on expected income and private consumption.

### 3 Econometric Methodology

#### 3.1 Ricardian equivalence in Europe: Full sample results

The aim of the first part of the empirical analysis is to obtain estimates of the structural parameters for the EU-15 countries. We use yearly data on private consumption ( $C_t$ ), government consumption ( $G_t$ ) and disposable income ( $Y_t$ ) for the period 1960-2002. Given the complex set of parameter restrictions implied by (7)-(12), we will exogenously set the value of some parameters of the model. The parameter corresponding to the risk-free real interest rate,  $R$ , was calculated as the average long-term real interest rate in the period 1960-2002.<sup>9</sup> The parameters corresponding to the ARIMA representation of  $Y_t$  and  $G_t$  ( $\rho_1$  and  $\rho_2$ ) are obtained by estimating the univariate models on  $Y_t$  and  $G_t$  using all available observations. After imposing these parameters, the original model (7)-(12) is left with five structural parameters to be estimated ( $\alpha, \gamma, \delta, \theta$  and  $\sigma$ ). The variables involved in the model present nonstationary features.<sup>10</sup> Equation (6) can thus be rewritten in form of an error correction model,

$$\Delta C_t = -\phi(C_{t-1} - \theta_0 - \theta_1 Y_{t-1} - \theta_2 G_{t-1}) + \xi \Delta Y_{t-1} + \kappa \Delta G_{t-1} + v_t, \quad (13)$$

where the parameters that specify the long-run equilibrium ( $\theta_0, \theta_1$  and  $\theta_2$ ), the adjustment parameter ( $\phi$ ) and the short run parameters corresponding to the first differences of income and government spending are functions of the coefficients in (6). Table 1 presents the results of the OLS estimation of (6), together with the augmented Dickey-Fuller (ADF) test results for the deviations from the long-run equilibrium in (13).<sup>11</sup> The long run elasticities were computed using the Bewley transformation (Bewley, 1979).

Insert Table 1 around here

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<sup>9</sup>All data used in the paper were obtained from the European Commission's Ameco database.

<sup>10</sup>Results from different unit root tests giving evidence of this claim are available from the authors upon request.

<sup>11</sup>The significance of the test statistics was assessed using the critical values in Davidson and MacKinnon (1993).



The results indicate that the model renders stationary deviations from the long-run equilibrium only for three countries in the sample: Ireland, Spain and Denmark. The null of no cointegration (i.e. a unit root in the residuals of the long run relationship) cannot be rejected for any of the other countries. Notice, however, that this model does not consider the possibility of a break in the cointegration relationship, which could have caused the full-sample cointegration residuals to behave in a nonstationary fashion. The estimates of the unrestricted model (6) for the countries where there is evidence of a stable cointegration relationship in the whole sample reveal substantial differences: The first lag of consumption is statistically insignificant for Spain, while for Denmark the point estimate of the parameter is highly significant and equal to 0.7. No other parameter is individually significant for the Danish case, and for Spain only the first lag of disposable income appears significant in the ARDL specification. A first tentative evaluation could lead us to think that the random walk model for consumption is more suitable for the Danish economy than for Spain. However, in order to be able to assess directly the structural parameters of the model, the specification given by (7)-(12) was estimated for the whole sample (see Table 2).<sup>12</sup>

Insert Table 2 around here

Insert Table 2a around here

The estimation of (7)-(12) was performed using full information maximum likelihood. The last column of Table 2 presents the likelihood ratio test statistic for the premises implied by the REP, namely infinite horizon and no liquidity constraints, which is equivalent to setting  $\gamma = 1$  and  $\theta = 0$ . The results render  $\gamma$  highly significant and close to one for practically all countries in our sample. The estimates of  $\theta$  are significantly different from zero for France, Germany, Netherlands and Sweden at the 5% significance level or lower, and for the UK at the 10% significance level. It implies that in these countries a model where a fraction of the population is liquidity constrained obtains more evidence from the data that the model based exclusively on unconstrained individuals.<sup>13</sup> The parameter estimate for  $\sigma$  is positive and significant only in Spain, implying a certain degree of substitutability of private and public consumption. Belgium and Luxemburg, on the other hand, present evidence of

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<sup>12</sup>Due to lack of comparability, the estimates of the utility function parameter  $\alpha$  are not reported in the table, but are available from the authors upon request.

<sup>13</sup>The only country which is both in our sample and in that used by Khalid (1996) is Portugal. Our results are consistent with those by Khalid (1996), notwithstanding the fact that his sample runs only until 1988.

complementarity between public and private consumption. The last column of Table 2 presents the likelihood ratio test statistic for the null hypothesis of the REP. The likelihood ratio test indicates significant deviations from the REP for Belgium, Finland, France, Italy, Netherlands, Portugal, Sweden and the UK. For the remaining seven countries, the null of  $\gamma = 1$  and  $\theta = 0$  cannot be rejected at standard levels of significance. For comparison purposes, the structural parameters for other selected OECD-countries were also estimated: Australia, Canada, Japan and the USA (see Table 2a). While, as mentioned before, the results are mixed for the EU-15 countries, there is no evidence of Ricardianity for any of the other OECD countries reported.

### 3.2 A structural break in the structural parameters?

The results presented in Table 1 indicate that the deviations from the long run equilibrium implied by (13) are not stationary for the majority of EU countries. As outlined in the introduction, if the transparency in the path of fiscal policy induced by the Maastricht criteria and the SGP has indeed caused a change in the behaviour of economic agents, the lack of evidence concerning the attractor properties of the cointegration relationship could be due to a structural break happening at the end of the sample. In this subsection we will investigate this hypothesis using the test for end-of-sample cointegration breakdown proposed by Andrews and Kim (2003). This test is asymptotically valid also for the case of a fixed post-break subsample length (as opposed to the usual Chow-type tests, which are only useful if the amount of observations before and after the break is large enough).

Andrews and Kim (2003) propose using as a test statistic the post-break sum of squared residuals computed with an estimator of the cointegration parameters for data up to the break. The critical values of this test statistic can then be approximated using parametric subsampling. Given that the date of occurrence of the break is not determined a priori, we report in Figure 1 the  $p$ -values for the null of no break in the cointegration relationship for all countries and all years ranging from 1992 to 2001. The  $p$ -values in Figure 1 correspond to the test statistic  $P_b$  in Andrews and Kim (2003), which corrects for the over-rejection rate of the simple sum of post-break squared residuals in small samples (this latter alternative corresponds to the  $P_a$  test statistic in Andrews and Kim, 2003).<sup>14</sup>

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<sup>14</sup>We are not directly interested in obtaining an exact estimate of the breakpoint, but in evaluating whether there is evidence of a breakpoint in the interval described for some EU countries. In principle, the adequate estimator of the breakpoint for each country would be given by the period corresponding to a maximum

Insert Figure 1 around here

In concordance with the results of the cointegration tests in Table 1, Denmark and Spain present no evidence of a structural break in the cointegration relationship for the period 1992-2001. All other countries reject the null of no cointegration breakdown at least in one year of the subsample analyzed. The pattern of rejections is relatively heterogeneous: While France rejects strongly the null hypothesis of a stable cointegration relationship exclusively for 1993 and Greece just for 2001, the rest of the countries have at least two years with strong evidence of cointegration breakdown. In order to assess the effect that the structural change had in the fiscal behaviour of individuals (in the sense of a change in the parameters governing Ricardianity), we reestimated the structural model given by (7)-(12) replacing the  $\gamma$  and  $\theta$  parameters by

$$\gamma = \gamma_1 + \gamma_2 \mathcal{I}(t > T^*)$$

and

$$\theta = \theta_1 + \theta_2 \mathcal{I}(t > T^*)$$

where  $T^*$  will be set equal to the first year for which the  $P_b$  test rejects stability at a 5% significance level and  $\mathcal{I}(\cdot)$  is the Heavyside function, taking value one if the argument is true, and zero otherwise. Significant values of  $\gamma_2$  and/or  $\theta_2$  indicate a change in the parameters that govern Ricardianity in the last decade.

Insert Table 3 around here

Table 3 presents the results of the likelihood ratio test for Ricardianity using the pre- and post-breakdown parameters. If there is evidence for the hypothesis that individuals have become more Ricardian due to the introduction of a fiscal rule, there should be a tendency towards finding that the REP holds for the post-breakdown results (notwithstanding the degree of accuracy of change in the post-breakdown parameter estimates, for which a very small amount of data are available). The results presented in Table 3 show a very heterogeneous picture of the change in the fiscal behaviour of individuals in EU-15 countries. The experience in France and the Netherlands seems to reflect perfectly the idea mentioned

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value of  $P_b$  in the subsample considered, but this test statistic should be evaluated against the distribution corresponding to the test statistic  $P_{b,\max} = \max P_b$ , instead of the distribution of  $P_b$ .

before: The REP cannot be rejected for the data after the break, while before the break it was strongly rejected. These two cases are particularly interesting, as one would reach the conclusion that there is no evidence of fulfillment of the REP requirements if the whole sample was used, while explicitly modelling the structural break in the nineties reveals a significant change in the fiscal behaviour of economic agents. On the other hand, there is evidence of the opposite change in the parameter constellation for Austria and Ireland, and no conclusive results (possibly pointing at structural breaks in other parameters different from the ones implied in the REP).

An obvious question is why the two key parameters of the model,  $\gamma$  and  $\theta$ , should have changed due to the introduction of the SGP. Whereas the reasoning in the case of  $\gamma$  – which indicates the time-horizon of consumers – is straightforward, since due to the introduction of a fiscal rule people should behave with more foresight, the story is less clear in the case of  $\theta$ . In the literature the excess sensitivity of consumption (i.e. current disposable income determines current consumption) is generally explained with liquidity constraints and myopia (Flavin, 1985). Hence, as in the case for  $\gamma$ , one could argue, for instance, that the introduction of a fiscal rule should have reduced the consumers' myopia. Another line of reasoning – which may be more appropriate for our case – is that the incidence of liquidity constraints and the degree of myopia may be affected by the government debt ratio. The reason is that high or rising government debt ratios imply an increase in households' future liabilities: Banks or other lenders may then reduce the amounts they lend, thereby raising the incidence of liquidity constraints and excess sensitivity of private consumption. In a recent paper Pozzi et al. (2003) find that a higher government debt implies tighter credit conditions and hence leads to more excess sensitivity. One could thus argue that the introduction of the SGP by binding countries to reduce debt has also reduced excess sensitivity and hence  $\theta$  should have also become smaller.

## 4 Conclusions

This piece of research presents evidence concerning the validity of the REP for 15 EU-member states in the last four decades. We hypothesized that in these countries consumers may have become more Ricardian due to the introduction of the Stability Pact in 1992. We investigate this idea using the model proposed by Leiderman and Razin (1988) and Khalid (1996), taking into account the possibility of a break after to the introduction of the Sta-

bility Pact. Evidence from the baseline model for the time period 1960-2002 leads to the conclusion that the REP holds for 8 out of 15 countries, but the existence of a cointegration relationship justifying the use of the model is only clear in three of the EU-15 countries.

When we test for a breakdown of the cointegration relationship, we find that for all countries except for Spain and Denmark the relationship breaks down (at some specific date) during the nineties. In general, our results imply that the effect of the enforcement of the Stability Pact on the behaviour of individuals is quite heterogeneous across EU-countries: For some countries, it seems as if consumers would indeed behave (more) Ricardian after 1993 (France and Netherlands) but we also find the opposite effect, with some economies changing from Ricardianity to non-Ricardianity (Austria, Ireland).

Our results suggest that it may indeed be the case that the introduction of a fiscal rule leads to a more Ricardian behaviour of consumers. To put it in the context of the comment by Hemming et al. (2003), a fiscal rule such as the one implied by the Stability Pact could induce individuals with comparatively short time horizons to adjust their consumption behaviour. That would imply that those countries for which the REP holds should refrain from running expansionary fiscal policies when they are over the 3% deficit threshold since in that case the fiscal multiplier would be zero.

However, if we review the policy recommendations of international institutions concerning the validity of the REP *for all countries* of the EU with respect to national fiscal policies one should point out that according to our results a uniform conclusion may show a distorted picture. One should be aware of the fact that fiscal policy may have different effects *in different economies* which depend on particular circumstances (such as, e.g. the existence of a high debt to GDP ratio). Thus it may be better to formulate country-specific recommendations with regard to fiscal policy when putting it in the context of the REP.

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**Table 1: Parameter estimates for the unrestricted model**

Country	$\lambda_1$	$\lambda_2$	$\lambda_3$	$\lambda_4$	$\lambda_5$	$LL$	$ADF$
Austria	0.77 *** (0.17)	0.13 (0.11)	-0.01 (0.09)	0.21 (0.42)	-0.14 (0.41)	-57.71	-2.41
Belgium	0.78 *** (0.17)	0.16 * (0.08)	-0.06 (0.08)	0.15 (0.30)	-0.09 (0.31)	-62.56	-2.36
Denmark	0.70 *** (0.20)	0.15 (0.14)	-0.07 (0.12)	-0.13 (0.46)	0.25 (0.39)	-69.40	-3.68 ***
Spain	0.14 (0.23)	0.66 *** (0.08)	-0.07 (0.12)	-0.46 (0.41)	0.14 (0.42)	-95.69	-3.45 *
Finland	0.81 *** (0.15)	0.32 *** (0.06)	-0.27 *** (0.07)	-0.20 (0.38)	0.33 (0.30)	-51.04	-2.81
France	0.84 *** (0.09)	0.19 ** (0.09)	-0.11 (0.10)	-0.26 (0.42)	0.23 (0.37)	-128.72	-1.73
Germany	0.78 (0.61)	0.47 (0.32)	-0.29 (0.19)	-1.34 (0.86)	1.12 (0.80)	-191.38	-1.87
UK	1.02 *** (0.13)	0.17 (0.14)	-0.13 (0.12)	-0.57 (0.50)	0.46 (0.47)	-144.16	-2.36
Greece	0.99 *** (0.06)	0.09 (0.08)	-0.08 (0.08)	0.26 (0.37)	-0.23 (0.35)	-57.22	-1.20
Ireland	0.60 *** (0.13)	0.44 *** (0.09)	-0.14 (0.11)	-1.51*** (0.37)	1.25*** (0.31)	-22.29	-3.54 *
Italy	0.62 *** (0.18)	0.33 *** (0.12)	-0.11 (0.11)	0.55 * (0.32)	-0.42 (0.29)	-129.16	-0.46
Luxemburg	0.09 (0.08)	0.92 *** (0.06)	-0.05 (0.07)	0.90 ** (0.38)	-0.68 (0.43)	-40.81	-0.32
Netherlands	0.88 *** (0.16)	0.24 *** (0.08)	-0.15 * (0.08)	0.06 (0.48)	-0.21 (0.33)	-86.79	-1.46
Portugal	0.81 *** (0.10)	0.35 *** (0.08)	-0.27 *** (0.08)	0.24 (0.41)	-0.11 (0.43)	-47.74	-1.89
Sweden	0.66 *** (0.12)	0.27 *** (0.06)	-0.13 (0.08)	0.14 (0.27)	-0.14 (0.24)	-67.31	-1.11

The dependent variable is private consumption in all specifications. Time period: 1960-2002. Standard errors in parenthesis. \*\*\*(\*\*)[\*] stands for 1% (5%) [10%] significant, LL is the value of the log-likelihood function.



**Table 2: Parameter estimates for the restricted model**

Country	$\gamma$	$\delta$	$\theta$	$\sigma$	$\sigma$ restr	<i>LRT</i>
Austria	1.03 *** (0.40)	0.96 *** (0.28)	0.08 (0.24)	-0.49 (0.48)	0.51 (0.48)	1.47
Belgium	1.03 ** (0.55)	0.96 *** (0.35)	0.19 (0.22)	-0.43 * (0.26)	-0.41 (0.27)	5.77**
Denmark	1.03 *** (0.21)	0.96 *** (0.04)	0.09 (0.31)	0.23 (0.59)	0.34 (0.49)	0.38
Spain	0.91 *** (0.06)	0.96 *** (0.07)	0.13 (0.31)	1.54 * (0.94)	0.43 (0.79)	2.47
Finland	0.99 *** (0.03)	0.99 *** (0.06)	0.30 (0.29)	0.65 (0.54)	0.74** (0.36)	23.78***
France	1.02 *** (0.01)	0.97 *** (0.00)	0.31 *** (0.08)	0.17 (0.33)	0.49 (0.39)	14.28***
Germany	1.01 *** (0.01)	1.53 *** (2.62)	0.94 *** (0.16)	0.34 (2.10)	0.05 (3.15)	0.74
UK	1.03 *** (0.01)	0.96 *** (0.02)	0.20 * (0.12)	0.54 (0.71)	0.66 (0.70)	6.73**
Greece	0.99 *** (0.04)	1.02 *** (0.02)	0.11 (0.16)	-1.07 (1.63)	-1.16 (1.54)	1.49
Ireland	1.02 *** (0.12)	0.97 *** (0.18)	0.39 (0.38)	1.30 (1.09)	0.51 (0.51)	1.91
Italy	1.02 *** (0.62)	0.98 *** (0.37)	0.30 (0.27)	-0.81 (0.59)	-0.90 (0.61)	5.08**
Luxemburg	0.98 *** (0.00)	1.02 *** (0.11)	-0.22 (0.18)	-1.24 *** (0.49)	-1.41*** (0.49)	4.30
Netherlands	1.00 *** (0.02)	0.97 *** (0.11)	0.35 ** (0.16)	-0.34 (0.49)	-0.54 (0.42)	6.23**
Portugal	0.97 *** (0.02)	1.16 *** (0.10)	0.04 (0.48)	-0.54 (0.44)	-1.50*** (0.52)	6.99**
Sweden	1.00 *** (0.02)	0.97 *** (0.12)	0.37 *** (0.12)	-0.18 (0.40)	-0.20 (0.35)	10.69***

The dependent variable is private consumption in all specifications. Time period: 1960-2002. White heteroskedasticity/serial correlation-corrected standard errors in parenthesis. \*\*\*(\*\*)[\*] stands for 1% (5%) [10%] significant, LRT is the likelihood-ratio test with the null of Ricardianity.

**Table 2a: Parameter estimates for the restricted model, benchmark countries**

Country	$\gamma$	$\delta$	$\theta$	$\sigma$	$\sigma$ restr	<i>LRT</i>
Australia	0.83 *** (0.05)	0.99 *** (0.06)	-1.48 (1.26)	0.73 (0.51)	0.41 (0.40)	19.58 ***
Canada	0.93 *** (0.07)	0.98 *** (0.07)	-0.22 (0.75)	0.25 (0.48)	0.25 (0.33)	20.00 ***
Japan	1.02 *** (0.38)	0.97 *** (0.18)	0.27 (0.39)	-0.07 (0.58)	0.39 (0.84)	8.84 **
USA	0.98 *** (0.00)	0.51 *** (0.08)	0.49 (0.05)	-0.34 ** (0.17)	-0.49 (0.74)	336.99***

**Table 3: Summary of results for the LR-test with the null of Ricardianity before and after break**

Country	year	REP pre-break	REP post-break	REP full sample
Austria	1997	0.95	10.74 ***	1.47
Belgium	1993	5.58 *	9.69 ***	5.77 **
Denmark	–	–	–	0.38
Spain	–	–	–	2.47
Finland	1995	5.32 **	11.44 ***	23.78 ***
France	1993	91.08 ***	1.37	14.28 ***
Germany	1993	0.02	0.04	0.74
UK	1992	1.20	0.40	6.73 **
Greece	2001	–	–	1.49
Ireland	1992	2.95	75.63 ***	1.91
Italy	1992	2.34	1.72	5.08 **
Luxemburg	1998			4.30
Netherlands	1995	18.24 ***	0.22	6.23 **
Portugal	1995	5.00 *	7.19 **	6.99 ***
Sweden	1993	572.41 ***	16.97 ***	10.69 ***

Figure 1:  $p$ -values for the null of no break in the cointegration relationship

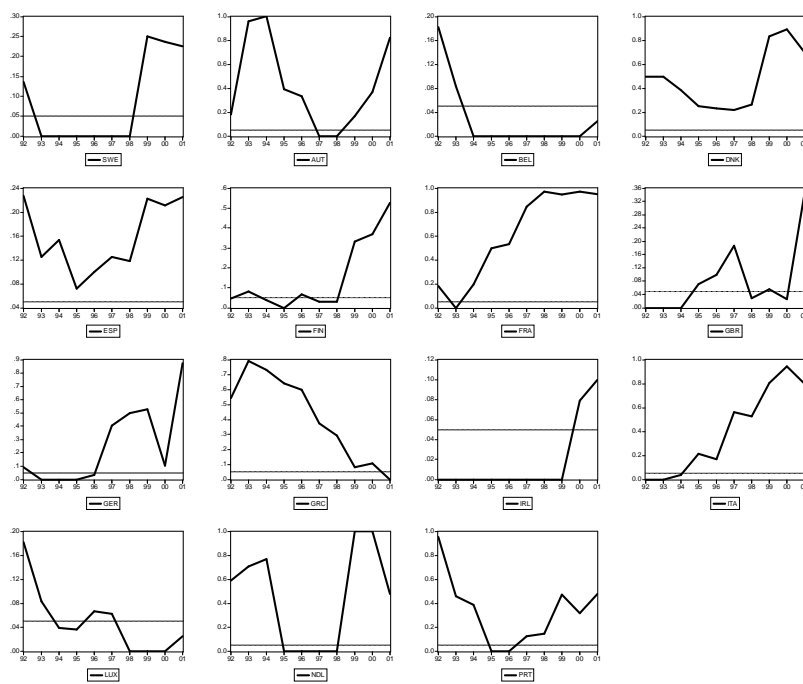


Figure 2: