INSTITUTO UNIVERSITARIO
de Análisis Económico y Social

Universidad de Alcalá

www.iaes.es

Sustainability of external imbalances in the OECD countries

Oscar Bajo-Rubio, Carmen Díaz-Roldán y Vicente Esteve

SERIE DOCUMENTOS DE TRABAJO
10/2013

SUSTAINABILITY OF EXTERNAL IMBALANCES IN THE OECD COUNTRIES*

ABSTRACT

In this paper, we provide a test of the sustainability of external imbalances in the OECD countries over the years 1970-2007, i.e., before the beginning of the international financial crisis. Specifically, we deal with the case of those countries that have experienced current account deficits in more than half of the years throughout the period of analysis, and address the recent critique of Bohn (2007) on unit root and cointegration tests of the intertemporal budget constraint.

Key words: External imbalances, Sustainability, Current account.

RESUMEN

En este artículo, ofrecemos un test de la sostenibilidad de los desequilibrios exteriores en los países de la OCDE durante los años 1970-2007, es decir, antes del inicio de la crisis financiera internacional. En concreto, nos ocupamos del caso de aquellos países que han experimentado un déficit por cuenta corriente en más de la mitad de los años de todo el período de análisis, y abordar la reciente crítica de Bohn (2007) sobre la raíz unitaria y tests de cointegración de la restricción presupuestaria intertemporal.

Palabras clave: Desequilibrios externos, sostenibilidad, cuenta corriente.

*The authors wish to thank three anonymous referees for helpful comments to a previous version. Financial support from the Spanish Institute for Fiscal Studies, the Spanish Ministry of Economy and Competitiveness (Projects ECO2011-29314-C02-02–O. Bajo-Rubio and C. Díaz-Roldán– and ECO2011-30260-C03-01–V. Esteve–), and the Department of Education and Science of the regional government of Castilla-La Mancha (Project PEII09-0072-7392), is also gratefully acknowledged. V. Esteve also acknowledges support from the Generalitat Valenciana (Project GVPROMETEO2009-098).

AUTORES

OSCAR BAJO RUBIO OSCAR BAJO RUBIO es Master of Arts en Economía por la University of Warwick y Catedrático de Fundamentos del Análisis Económico en la Universidad de Castilla-La Mancha. Sus áreas de investigación son Macroeconomía, Economía internacional e Integración económica. Ha realizado estancias de investigación en las universidades de Harvard, Warwick, Wrocław University of Economics, Oxford y London School of Economics, entre otras. Ha publicado artículos en revistas como Economics Letters, Economic Modelling, European Economic Review, Regional Studies, Journal of Policy Modeling, Journal of Macroeconomics, European Journal of Political Economy y Explorations in Economic History, entre otras. Miembro fundador y presidente de la Asociación Española de Economía y Finanzas Internacionales entre 2009 y 2013. Es miembro del Consejo de Asesores de la revista Investigaciones Regionales.

CARMEN DÍAZ ROLDÁN es Doctora en Economía por la Universidad Pública de Navarra y Profesora Titular del Departamento de Análisis Económico y Finanzas en la Universidad de Castilla-La Mancha. Sus áreas de interés son Política Fiscal, Macroeconomía y Economía Internacional. Ha realizado estancias de investigación en la Universidad de Oxford, London School of Economics y Suffolk University (Boston). Actualmente es la presidenta de la Asociación Española de Economía y Finanzas Internacionales y tiene artículos publicados en revistas como Regional Studies, European Planning Studies, Journal of Macroeconomics, Journal of Policy Modelling, Applied Economics, Economics Letters, European Journal of Political Economy y Post-Communist Economies, entre otras.

VICENTE ESTEVE es Doctor en Ciencias Económicas y Catedrático de Economía Aplicada en la Universidad de Valencia, e Investigador Asociado del IAES de la Universidad de Alcalá. Sus áreas de investigación son: Macroeconomía, Economía y Finanzas Internacionales, Finanzas Públicas y Econometría Aplicada. Tiene artículos publicados en revistas nacionales e internacionales como International Review of Economics and Finance, Energy Economics, Economic Modelling, Journal of Applied Economics, European Journal of Political Economy, Journal of Policy Modeling, Journal of Macroeconomics, Economics Letters, entre otras.

ÍNDEX

1. INTRODUCTION

Global external imbalances seem nowadays to be quite different as compared to those prevailing in the past. First, they mostly affect to rich countries, both the US and within the euro area. In addition, they are primarily driven by private saving and investment decisions, rather than by government deficits. Moreover, these imbalances are financed in a more orthodox way (i.e., through either direct or portfolio investment), rather than through bank lending. Accordingly, these imbalances are a matter of concern for such countries, requiring an adequate policy answer (Blanchard, 2007).

The problem of global external disequilibria relates in turn to the current international financial crisis, as discussed at length in Obstfeld and Rogoff (2010). Regarding the case of the European Union (EU), those countries with the highest current account disequilibria are those that have experienced a greater fall in their levels of domestic demand (Lane, 2010). Moreover, it has been argued that for these countries, usually the eurozone members with lower income levels, borrowing in international markets would have become easier before the beginning of the crisis. In fact, the greater financial integration, together with the adoption of the euro, would have meant a reduction in the cost of capital and the disappearance of exchange rate risk. As a result, this would have translated into both a decrease in saving and an increase in investment, and hence into a deterioration of the current account balance (Blanchard and Giavazzi, 2002). Even more, the prospects of convergence as regards the richer countries would have favour growth expectations in those countries, which contributed additionally to greater deficits; see Lane (2010). However, unlike the case of the US, where the size of the external deficit has led to a wide academic debate [see, e.g., Mann (2002), Blanchard, Giavazzi and Sa (2005), Edwards (2005) or Obstfeld and Rogoff (2007)], this has not been the norm in the European case, with a predominance of descriptive studies of a limited analytical content.

The usual way to analyzing current account imbalances makes use of the intertemporal approach to the current account (Sachs, 1981; Obstfeld and Rogoff, 1995; Razin, 1995). According to this approach, given that, from the perspective of the national accounts, the current account equals the difference between savings and investment, and, because savings and investment decisions are based on intertemporal factors (such as life-cycle features, the expected returns of investment projects, and the like) the current account is necessarily an intertemporal phenomenon.

In an important contribution, Milesi-Ferretti and Razin (1996) discuss the usual notion of sustainability in relation to the country's intertemporal solvency, that is, when the present discounted value of

future trade surpluses equals current external indebtedness. Put in other words, current account sustainability would be defined as the ability of an economy of satisfying its intertemporal constraint in the long run, in absence of a drastic change either in the behaviour of the private sector or in economic policy (Taylor, 2002). In general, a current account deficit in excess of 5% of GDP is regarded as unsustainable, so that above this threshold the adjustment process of the current account usually begins (Freund, 2005).

Traditional analyses of current account sustainability are based on unit root and cointegration tests of the intertemporal budget constraint. A first contribution was Trehan and Walsh (1991), who tested for the stationarity of the external investment position of the United States during 1946-1987 to find it was stationary, so that US external imbalances would have been sustainable. However, Husted (1992) obtained no cointegration between the US exports and imports series along the period 1967-1989; the external deficit had been sustainable only after considering a structural change at the end of 1983. By focusing instead on the trade balance and foreign indebtedness (rather than exports and imports), Wickens and Uctum (1993) found sustainability of the US external imbalances for the period 1970-1988. Wu, Fountas and Chen (1996) analyzed cointegration between exports and imports for the US and Canada throughout 1973-1994, and concluded there was no sustainability. On the contrary, Apergis, Katrakilidis and Tabakis (2000) found that the current account had been sustainable in the case of Greece, along the period 1960-1994. In turn, Liu and Tanner (1996) performed stationarity tests on the current accounts of 7 industrialized countries between 1970-1990, finding sustainability in two cases (France and Italy), but not for the other five (US, Germany, Japan, UK and Canada); however, when a discrete break in the current account process was included, sustainability appeared for the US, Germany and Japan.

Other more recent contributions apply the unit root and cointegration tests in a panel data context. Wu (2000) performed panel unit root tests on the current accounts of 10 OECD countries between 1977 and 1997, and found sustainability of their external imbalances. Also, using panel cointegration tests on exports and imports, Wu, Chen and Lee (2001) found external sustainability for 7 industrialized countries from 1973 to 1998. However, following this methodology but identifying which members from within the panel exhibit current account sustainability for a sample of 11 OECD countries and the period 1980-2002, Holmes (2006) was able to distinguish between six countries that exhibited sustainability (Australia, Belgium, Canada, Japan, the UK and the US), and five others that did not offer evidence in favour of sustainability (France, Germany, Italy, Norway and Spain). Finally, in a recent study for a group of 23 OECD countries over the period 1970-2012, Camarero, Carrion-i-Silvestre and Tamarit (2013) tested for external sustainability using several types of cointegration and multicointegration tests. Their results pointed to the existence of weak

sustainability for all the countries in the sample when considering the traditional flow approach to the external intertemporal budget constraint. However, when applying a stock-flow approach, some degree of strong sustainability was found for up to six countries, namely, Japan, New Zealand, Austria, the Netherlands, Portugal and Spain.

As can be seen, the available results on the sustainability of external imbalances are not always clear-cut, which can be due to differences on methodology, the country data set, and the time period under analysis. However, traditional analyses of sustainability (for either the public deficit or the external deficit) have been recently criticized by Bohn (2007). According to this author, these tests, based on unit root and cointegration tests of the (government's or nation's) intertemporal budget constraint, are incapable of rejecting the existence of sustainability. In place of the traditional method, Bohn proposes an alternative approach, based on the existence of an arbitrarily high order of integration of the variables involved, and on error-correction-type policy reaction functions. Moreover, this previous literature (with the only exception of Camarero et al., 2013) neglects the role of capital gains or losses on net foreign asset positions. According to Gourinchas and Rey (2007), for a country facing an external disequilibrium, adjustment through future trade surpluses (the so called "trade channel", i.e., that stressed by the intertemporal approach to the current account) will be complemented by changes in the returns on domestic assets held by foreigners relative to the return on foreign assets held by domestic residents. The latter effect (the so called "valuation channel") may occur in turn via a depreciation of the domestic currency.

Notice that Bohn's (2007) methodology has been already applied by Durdu, Mendoza and Terrones (2013) to a panel of 50 countries (21 industrial and 29 emerging) over the period 1970-2006. Unlike these authors, in this paper we will only analyze developed countries experiencing external deficits, and on a country-by-country basis; see below for details.

Therefore, in this paper we will use Bohn's approach to assess the sustainability of external imbalances in those OECD countries experiencing current account deficits in more than half of the years along the period 1970-2007, i.e., before the beginning of the crisis, allowing for the valuation effects emphasized by Gourinchas and Rey. The paper is organized as follows. In section 2, we describe the underlying theoretical framework. Next, in section 3 we introduce the empirical methodology, and discuss the data and the empirical results. The main conclusions are summarized in section 4.

2. THEORETICAL FRAMEWORK

The sustainability of external deficits is a matter of concern for governments, and is related to the issue of long-run solvency. A current account deficit is regarded as sustainable when, if maintained in the indefinite future, it does not violate the nation's solvency constraint; and a nation is said to be solvent if the present-value budget constraint, i.e., its intertemporal budget constraint (IBC) holds. In other words, a deficit can be sustainable if the country can borrow. However, if the interest rate on the external debt exceeds the growth rate of the economy, debt dynamics would lead to an ever-increasing ratio of debt to GDP. The dynamics of debt accumulation could be stopped only if the ratio of the external deficit to GDP would turn to be a surplus.

The customary approach for analyzing external imbalances is based on the intertemporal approach to the current account. Under this approach, the current account (i.e., changes in a country's net indebtedness) is considered as an intertemporal issue, since decisions on indebtedness imply changes in future consumption possibilities and these are based on expectations of the entire future path of a number of variables. The intertemporal model of the current account originates in the work of, among others, Sachs (1981, 1982), Obstfeld (1982), and Svensson and Razin (1983); some overviews are provided in Obstfeld and Rogoff (1995) and Razin (1995).

We start with some accounting identities. In period *t*, the current account, i.e., the change in net foreign assets vis-à-vis the rest of the world, equals net exports of goods and services plus net factor payments from abroad[1]:

$$\Delta NFA_t = CA_t = NX_t + rNFA_{t-1} \quad (1)$$

where *CA*, *NFA* and *NX* stand for the current account, net foreign assets and net exports, respectively, all of them in real terms, and *r* is a (constant) real interest rate. Notice that when *NFA* > 0 the country is a net creditor, and when *NFA* < 0 the country is a net debtor. Alternatively:

$$\Delta NFA_t = CA_t = Q_t + rNFA_{t-1} - (C + I) = S - I \quad (2)$$

where *Q* is gross domestic product (GDP, so $Q + rNFA_{-1}$ is gross national product), and *C*, *S* and *I* denote total (i.e., private plus public) consumption, saving and investment, respectively. As can be seen,

[1] Notice that we are omitting here unilateral transfers, usually a small item in the balance of payments. Alternatively, net exports could be assumed net of transfers.

equation (2) links the current account balance with decisions on saving and investment.
Since (1) holds every period, solving for NFA_t and iterating forward over an infinite horizon yields the nation's IBC, written in terms of GDP shares:

$$nfa_t = -\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^{j+1} E_t nx_{t+j+1} + \lim_{j\to\infty}\left(\frac{1+g}{1+r}\right)^{j+1} E_t nfa_{t+j+1}$$

(3)

where *nfa* and *nx* denote, respectively, net foreign assets and net exports, both as ratios to GDP; *E* is the expectations operator; and *g* stands for the rate of growth of real GDP, assumed (as the real interest rate) to be constant for simplicity. The condition for current account sustainability is:

$$\lim_{j\to\infty}\left(\frac{1+g}{1+r}\right)^{j+1} E_t nfa_{t+j+1} = 0$$

(4)

i.e., the transversality condition; or, equivalently:

$$nfa_t = -\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^{j+1} E_t nx_{t+j+1}$$

(5)

By multiplying both sides of (5) by −1, so that the country is a net debtor, we can see that solvency requires that the country must run expected future trade surpluses equal, in present-value terms, to the current value of its outstanding net liabilities vis-à-vis the rest of the world.

The standard approach to test for sustainability of the current account consists of estimating a cointegration relationship between net exports and the (lagged) level of net foreign assets, both as ratios to GDP:

$$nx_t = \alpha + \beta nfa_{t-1} + v_t$$

(6)

where v_t denotes an error term. In this equation, a negative and significant estimate of β would be a sufficient condition for solvency, indicating that the nation satisfies its present-value budget constraint.

Testing whether $\beta < 0$ from the estimation of (6) or, alternatively, whether $\beta' = 1$ from the estimation of a cointegration relationship such as:

$$exp_t = \alpha' + \beta' imp_t + \varepsilon_t$$

(7)

where exp_t and imp_t denote, respectively, the GDP ratios of the exports of goods and services, and the imports of goods and services plus net interest payments and net transfer payments, and ε_t is an error term, are customary approaches to test for the sustainability of external imbalances.

However, this kind of assessments of external sustainability based on unit root and cointegration tests have been recently criticized by Bohn (2007), on the grounds that such tests are incapable of rejecting sustainability. Specifically, Bohn derives the following three propositions, related to the order of integration of net foreign assets, net exports, exports, and imports, in order to verify under which conditions the transversality condition and the IBC hold (see Bohn (2007) for details):

(i) If nfa_t is integrated of order m for any finite $m \geq 0$, then nfa_t satisfies the transversality condition, and nfa_t and nx_t satisfy the IBC.

(ii) If exp_t and imp_t are integrated of order m_X and m_M, respectively, where $\Delta nfa_t = exp_t - imp_t$; then nfa_t is integrated of order m with $m \leq \max(m_X, m_M) + 1$, so the transversality condition and the IBC hold.

(iii) If nfa_t and nx_t follow an error-correction specification of the form $nx_t + \rho nfa_{t-1} = z_t$, and z_t is integrated of order m for some $\rho < 0$ such that $|\rho| \in (0, 1+r]$ where r is a constant interest rate, then nfa_t satisfies the transversality condition and the IBC holds.

Notice, on the other hand, that these are just sufficient conditions, so that a failure of the tests would not mean a rejection of sustainability.

3. DATA AND EMPIRICAL RESULTS

In this section, we provide a test of Bohn's three propositions for the case of the sustainability of current account imbalances in the OECD countries. We use data on net exports and net foreign assets, as well as on exports and imports of goods and services (the latter augmented with net interest payments and net transfer payments), all of them as percentages of GDP, for those OECD countries experiencing current account deficits in more than half of the years along our sample period.

These countries are Australia, Austria, Canada, Greece, Ireland, Italy, New Zealand, Portugal, Spain, the UK, and the US. The data are annual, and have been taken from the International Monetary Fund's *International Financial Statistics*. In turn, the net foreign asset positions come from the updated and extended version of the External Wealth of Nations Mark II database developed by Lane and Milesi-Ferretti (2007), which includes the valuation effects mentioned above. The sample period runs from 1970 to 2007, i.e., the last year before the beginning of the international financial crisis. Notice that using data from 2008 on would tend to bias the results, given that external imbalances have been reduced to a significant extent since the onset of the crisis. This has been especially true in those countries whose pre-crisis current

account balances were in excess of what could be explained by standard economic fundamentals (Lane and Milesi-Ferretti, 2012).

In a related paper, Durdu, Mendoza and Terrones (2013) analyze the sustainability of external imbalances, using a panel of 50 countries (21 industrial and 29 emerging) over the period 1970-2006. In this paper, however, we will focus only on those countries experiencing external deficits, since sustainability should apply to deficits rather than surpluses, for the case of industrial countries. In addition, we will perform the analysis on a country-by-country basis, since panel estimation can hide the different behaviour of specific countries regarding sustainability of their external imbalances.

We begin by testing for the order of integration of the variables nfa_t, exp_t, and imp_t. However, as is well known, misspecification errors due to the non-consideration of structural breaks can bias the analysis under the standard Dickey-Fuller test statistics for a unit root. In order to avoid this pitfall, we will first run a test to assess whether a structural break is present or not in three time series. We have used the Perron and Yabu (2009) test for structural changes in the deterministic components of a univariate time series when it is a priori unknown whether the series is trend-stationary (i.e., the I(0) case) or contains an autoregressive unit root (i.e., the I(1) case). The Perron and Yabu test statistic, called *Exp*-W_{FS}, is based on a quasi-Feasible Generalized Least Squares approach using an autoregression for the noise component, with a truncation to 1 when the sum of the autoregressive coefficients is in some neighbourhood of 1, along with a bias correction. For given break dates, Perron and Yabu (2009) propose an *F*-test for the null hypothesis of no structural change in the deterministic components using the *Exp* functional developed in Andrews and Ploberger (1994).

The specification chosen to test for the presence of a structural break in our three variables is given by Model III in Perron and Yabu (2009), which consider that the structural break may affect both the level and the slope of the time trend. According to the results of the *Exp*-W_{FS} test presented in Table 1, the null hypothesis of absence of a structural break is rejected at the 5% level of statistical significance for some of the variables (namely, exp_t and imp_t for Austria; nfa_t, exp_t and imp_t for Canada; nfa_t and exp_t for Greece and Ireland; nfa_t and imp_t for Spain; and nfa_t for the UK), while it cannot be rejected for the rest of variables. Consequently, the analysis of the order of integration has to consider the presence of structural breaks for the first group of variables, while for the second group we will use standard unit root tests with no structural changes.

Table 1

Perron-Yabu tests for structural changes in deterministic components

Country	Variable	*Exp-W*$_{FS}$
Australia	nfa_t	1.08
	exp_t	1.36
	imp_t	0.77
Austria	nfa_t	1.32
	exp_t	175.7*
	imp_t	5.50*
Canada	nfa_t	435.4*
	exp_t	12.58*
	imp_t	9.50*
Greece	nfa_t	3.84*
	exp_t	6.65*
	imp_t	1.56
Ireland	nfa_t	11.97*
	exp_t	5.56*
	imp_t	1.40
Italy	nfa_t	3.02
	exp_t	0.90
	imp_t	3.03
New Zealand	nfa_t	1.64
	exp_t	2.71
	imp_t	10.24
Portugal	nfa_t	3.07
	exp_t	0.30
	imp_t	0.21
Spain	nfa_t	15.58*
	exp_t	2.47
	imp_t	5.41*
United Kingdom	nfa_t	4.85*
	exp_t	0.50
	imp_t	2.81
United States	nfa_t	2.98
	exp_t	0.64
	imp_t	1.30

Notes:
** denotes significance at the 5% level. The critical values are taken from Perron and Yabu (2009), Table 2.c.*
A trimming parameter ε = 0.15 has been used for the applications.

First, regarding the analysis of the order of integration when structural changes are present, we have used the GLS-based unit root test statistics proposed in Kim and Perron (2009) and extended in Carrion-i-Silvestre, Kim and Perron (2009). This approach allows for multiple breaks at an unknown time under both the null and alternative hypotheses, unlike the previously used tests (e.g., Zivot and Andrews,

1992; Perron and Vogelsang, 1992; or Perron, 1997), which assumed that if a break occurred it did so only under the alternative hypothesis of stationarity. The results of applying the Carrion-i-Silvestre-Kim-Perron tests, allowing up to three breaks, are shown in Table 2; the estimated break dates appear in the last column. In general, the break dates are concentrated in the first 1980s (Austria, Greece, Spain), and at the end of this decade (Canada, Ireland, UK). As can seen, the null hypothesis of a unit root with structural breaks cannot be rejected for all series at the 5% level of significance. Accordingly, we can conclude that the variables in Table 2 are I(1) with a structural break.

Table 2

Carrion-i-Silvestre-Kim-Perron tests for unit roots with structural breaks

Country	Variable	MZ_{α}^{GLS}	MZ_{t}^{GLS}	MSB^{GLS}	MP_{T}^{GLS}	break date
Austria	exp_t	−9.94	−2.21	0.222*	16.68*	1984
	imp_t	−11.00	−2.32	0.211*	15.19*	1979
Canada	nfa_t	−9.41	−2.14	0.225*	16.70*	1988
	exp_t	−12.37	−2.48	0.200*	13.14*	1989
	imp_t	−13.06	−2.52	0.193*	12.03*	1990
Greece	nfa_t	−12.51	−2.49	0.199*	13.33*	1983
	exp_t	−10.31	−2.16	0.210*	16.37*	1985
Ireland	nfa_t	−9.03	−2.11	0.233*	16.56*	1992
	exp_t	−9.23	−1.98	0.215*	17.74*	1986
Spain	nfa_t	−11.07	−2.35	0.212*	14.84*	1982
	imp_t	−12.46	−2.48	0.199*	13.39*	1981
United Kingdom	nfa_t	−10.67	−2.30	0.216*	15.03*	1988

Notes:
* *denotes significance at the 5% level. The critical values were obtained from simulations using 1,000 steps to approximate the Wiener process and 10,000 replications.*
Note that for the MSB and MP_T tests the null hypothesis is rejected in favour of stationarity when the estimated value is smaller than the critical value.

Second, for the analysis of the order of integration when a structural change is not present, we have used a modified version of the tests of Phillips and Perron (1988) proposed by Ng and Perron (2001), which try to solve the main problems present in these conventional tests for unit roots. This method consists of a class of modified tests, called M^{GLS}, originally developed in Stock (1999) as *M*-tests, and computed after detrending the series under analysis using the method of Generalized Least Squares (GLS) as proposed in Elliott, Rothenberg and Stock (1996). Such modifications improve the tests with regard to both size distortions and power. According to the results in Table 3, the null hypothesis of non stationarity cannot be rejected in all cases at the 5%

level of significance, except for the variable imp_t for Australia where it would be rejected at the 10% level. Therefore, with the only possible exception of imp_t for Australia, we can conclude that the variables in Table 3 are I(1) without a structural break.

Table 3

Ng-Perron tests for unit roots

Country	Variable	MZ_α^{GLS}	MZ_t^{GLS}	MSB^{GLS}	MP_T^{GLS}
Australia	nfa_t	−10.57	−2.28	0.215*	8.69*
	exp_t	−12.91	−2.54	0.196*	7.05*
	imp_t	−16.85**	−2.87**	0.170**	5.54*
Austria	nfa_t	−13.32	−2.55	0.192*	7.17*
Greece	imp_t	−6.06	−1.61	0.265*	14.89*
Ireland	imp_t	−7.29	−1.87	0.257*	12.55*
Italy	nfa_t	−10.19	−2.15	0.211*	9.39*
	exp_t	−5.78	−1.65	0.285*	15.65*
	imp_t	−7.83	−1.87	0.239*	11.87*
New Zealand	nfa_t	−5.28	−1.56	0.297*	17.04*
	exp_t	−9.31	−2.07	0.223*	10.09*
	imp_t	−11.91	−2.43	0.204*	7.69*
Portugal	nfa_t	−1.13	−0.49	0.432*	42.21*
	exp_t	−7.00	−1.85	0.265*	13.01*
	imp_t	−11.11	−2.33	0.210*	8.31*
Spain	exp_t	−4.57	−1.50	0.266*	19.85*
United Kingdom	exp_t	−8.19	−2.01	0.246*	11.13*
	imp_t	−11.65	−2.40	0.206*	7.85*
United States	nfa_t	−4.34	−1.47	0.339*	20.97*
	exp_t	−6.13	−1.74	0.284*	14.85*
	imp_t	−11.88	−2.39	0.201*	7.91*

Notes:
** and ** denote significance at the 5% and 10% levels, respectively. The critical values are taken from Ng and Perron (2001), Table I.*
The autoregressive truncation lag has been selected using the modified Akaike information criterion, as proposed by Perron and Ng (1996).

Hence, from the results in tables 1 to 3, and with the only possible exception of imp_t for Australia, the three series would be concluded to be non-stationary (with or without a structural break, depending on each particular case), and the first two propositions of Bohn (2007) would hold.

Next, we estimate, using the method of Non-Linear Least Squares, the error-correction specification analogue to (6):

$$\Delta nx_t = \omega + \delta(L)\Delta nfa_{t-1} + \rho(nx_{t-1} - \alpha - \beta nfa_{t-2}) + \gamma(L)\Delta nx_{t-1} + \eta_t \qquad (8)$$

where η_t is an error term, and the results are shown in Table 4. As can be seen, the error-correction coefficient ρ always shows the expected negative sign, and is significant at the conventional levels in all cases with the only exception of Ireland, where significance only appears at the 15% level. Regarding the long-run coefficient β, we find:

- a negative and statistically significant coefficient for Austria, Canada, Italy, and New Zealand
- a positive and statistically significant coefficient for Australia, Portugal, Spain, and the US
- a non significant coefficient for Greece, Ireland, and the UK

Table 4

Estimation of long-run nonlinear relationships between net exports and net foreign assets

	Long-run coefficient	Error-correction coefficient
Australia	0.02† (4.35)	−0.74† (−4.20)
Austria	−0.40† (−6.26)	−0.50† (−3.54)
Canada	−0.27* (−2.37)	−0.21* (−2.26)
Greece	0.03 (0.58)	−0.20** (−1.70)
Ireland	−0.12 (−0.48)	−0.07 (−1.58)
Italy	−0.15† (−2.65)	−0.44† (−3.68)
New Zealand	−0.05† (−2.85)	−0.76† (−4.46)
Portugal	0.19† (2.44)	−0.14* (−1.97)
Spain	0.11† (3.90)	−0.47† (−3.30)
United Kingdom	0.03 (0.69)	−0.35* (−2.45)
United States	0.13* (2.21)	−0.20* (−2.11)

Notes:
(i) t-statistics in parentheses.
(ii) †, * and ** denote significance at the 1%, 5% and 10% levels, respectively.

Hence, the third proposition of Bohn (2007) would hold, and the current account deficit would be sustainable, only for the cases of Austria, Canada, Italy, and New Zealand. In particular, the adjustment of the net exports-GDP ratio to a given change in the net foreign assets-GDP

ratio would have had an average half-life of about one, three, one, and half a year, respectively[2].

On the contrary, in the cases of Australia, Greece, Ireland, Portugal, Spain, the UK, and the US, Bohn's (2007) third proposition would not hold, so no evidence is found on the fulfilment of the nation's IBC for these countries. Notice, however, that Bohn's approach gives only sufficiency conditions for sustainability to hold; in other words, if the tests yield positive results this means evidence indicating that the IBC holds, but failure of the tests does not reject it.

4. CONCLUSIONS

In this paper, we have tested for the sustainability of external imbalances in the OECD countries over the years 1970-2007 (i.e., before the beginning of the international financial crisis), addressing the recent critique of Bohn (2007) on previous unit root and cointegration tests of the IBC, and allowing for the valuation effects emphasized by Gourinchas and Rey (2007). Unlike Durdu, Mendoza and Terrones (2013), we analyze the case of only those countries undergoing current account deficits in more than half of the years throughout this period, since sustainability should apply to deficits rather than surpluses; and on a country-by-country basis, since panel estimation can hide the different behaviour of specific countries.

Our results show that the three variables net foreign assets, exports of goods and services, and imports of goods and services (augmented with net interest payments and net transfer payments) would be integrated of order one in all the countries analyzed, except for imp_t for Australia (even though at a 10% significance level). Accordingly, the IBC would hold in principle for all of them, with the possible exception of Australia. However, when estimating an error-correction relationship between net exports and net foreign assets, the long-run coefficient had the expected (negative) sign, and was statistically significant, for Austria, Canada, Italy, and New Zealand, so that for these countries the current account deficit would be sustainable. On the contrary, in the cases of Australia, Greece, Ireland, Portugal, Spain, the UK, and the US, no clear-cut results emerge, i.e., the IBC would fail in principle to hold but, since Bohn's approach gives only sufficiency conditions, a failure of the tests does not mean a rejection of sustainability.

Notice that, in the case of the EU countries that joined the Economic and Monetary Union (EMU) after 1999, the disappearance of the exchange rate risk made easier borrowing in international markets, due

[2] Computed as $\log(.5)/\log(|\hat{\rho}|)$, where $\hat{\rho}$ is the estimate of ρ in equation (8), from the second column of Table 4.

to both an increase in the supply of funds available and a decrease in their cost. In other words, the allowable external deficit would be higher in a monetary union (Blanchard and Giavazzi, 2002). Even though such an argument certainly softens the practical significance of the external constraint on growth for a country belonging to a monetary union, this should not mean neglecting the size of the external deficit, however. In fact, for these countries, when a structural break was detected (in the cases of Austria, Greece, Ireland and Spain), it appeared quite before 1999 (see Table 2), so no significant change in the behaviour of external imbalances was detected after EMU. This finding could be rationalized on the grounds that the easier financing of external deficits in a monetary union might be offset by the implications of the impossibility of getting a nominal exchange rate depreciation. That is, current account imbalances, while possibly warranted by fundamentals, can also signal elevated macroeconomic and financial disequilibria (Obstfeld, 2012), which now is no longer possible to offset by means of the depreciation of the nominal exchange rate. In other words, in a monetary union, the external constraint would be still binding, and the financing of current account imbalances would not be without limit[3].

5. REFERENCES

ANDREWS, D. W. K. AND PLOBERGER, W. (1994): "OPTIMAL TESTS WHEN A NUISANCE PARAMETER IS PRESENT ONLY UNDER THE ALTERNATIVE", *ECONOMETRICA* 62, 1383-1414.

APERGIS, N., KATRAKILIDIS, K. P. AND TABAKIS, N. M. (2000): "CURRENT ACCOUNT DEFICIT SUSTAINABILITY: THE CASE OF GREECE", *APPLIED ECONOMICS LETTERS* 7, 599-603.

BLANCHARD, O. (2007): "CURRENT ACCOUNT DEFICITS IN RICH COUNTRIES", *IMF STAFF PAPERS* 54, 191-219.

BLANCHARD, O. AND GIAVAZZI, F. (2002): "CURRENT ACCOUNT DEFICITS IN THE EURO AREA: THE END OF THE FELDSTEIN-HORIOKA PUZZLE?", *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 2, 147-209.

BLANCHARD, O., GIAVAZZI, F. AND SA, F. (2005): "INTERNATIONAL INVESTORS, THE U.S. CURRENT ACCOUNT, AND THE DOLLAR", *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 1, 1-49.

BOHN, H. (2007): "ARE STATIONARITY AND COINTEGRATION RESTRICTIONS REALLY NECESSARY FOR THE INTERTEMPORAL BUDGET CONSTRAINT?", *JOURNAL OF MONETARY ECONOMICS* 54, 1837-1847.

[3] The role of current account imbalances within a monetary union is discussed at length in Catte (1998).

CAMARERO, M., CARRION-I-SILVESTRE, J. LL. AND TAMARIT, C. (2013): "GLOBAL IMBALANCES AND THE INTERTEMPORAL EXTERNAL BUDGET CONSTRAINT: A MULTICOINTEGRATION APPROACH", *JOURNAL OF BANKING & FINANCE,* FORTHCOMING.

CARRION-I-SILVESTRE, J. LL., KIM, D. AND PERRON, P. (2009): "GLS-BASED UNIT ROOT TESTS WITH MULTIPLE STRUCTURAL BREAKS UNDER BOTH THE NULL AND THE ALTERNATIVE HYPOTHESES", *ECONOMETRIC THEORY* 25, 1754-1792.

CATTE, P. (1998): "CURRENT ACCOUNTS: ARE THEY STILL RELEVANT FOR AND WITHIN A MONETARY UNION?", IN *CURRENT ACCOUNT IMBALANCES IN EAST AND WEST: DO THEY MATTER?*, OESTERREICHISCHE NATIONALBANK, VIENNA, 144-168.

DURDU, C. B., MENDOZA, E. G. AND TERRONES, M. E. (2013): "ON THE SOLVENCY OF NATIONS: CROSS-COUNTRY EVIDENCE ON THE DYNAMICS OF EXTERNAL ADJUSTMENT", *JOURNAL OF INTERNATIONAL MONEY AND FINANCE* 32, 762-780.

ELLIOTT, G., ROTHENBERG, T. J. AND STOCK, J. H. (1996): "EFFICIENT TESTS FOR AN AUTOREGRESSIVE UNIT ROOT", *ECONOMETRICA* 64, 813-836.

EDWARDS, S. (2005): "IS THE U.S. CURRENT ACCOUNT DEFICIT SUSTAINABLE? IF NOT, HOW COSTLY IS ADJUSTMENT LIKELY TO BE?", *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 1, 211-288.

FREUND, C. (2005): "CURRENT ACCOUNT ADJUSTMENT IN INDUSTRIAL COUNTRIES", *JOURNAL OF INTERNATIONAL MONEY AND FINANCE* 24, 1278-1298.

GOURINCHAS, P.-O. AND REY, H. (2007): "INTERNATIONAL FINANCIAL ADJUSTMENT", *JOURNAL OF POLITICAL ECONOMY* 115, 665-703.

HOLMES, M. J. (2006): "HOW SUSTAINABLE ARE OECD CURRENT ACCOUNT BALANCES IN THE LONG RUN?", *THE MANCHESTER SCHOOL* 74, 626-643.

HUSTED, S. (1992): "THE EMERGING U.S. CURRENT ACCOUNT DEFICIT IN THE 1980S: A COINTEGRATION ANALYSIS", *REVIEW OF ECONOMICS AND STATISTICS* 74, 159-166.

KIM, D. AND PERRON, P. (2009): "UNIT ROOT TESTS ALLOWING FOR A BREAK IN THE TREND FUNCTION AT AN UNKNOWN TIME UNDER BOTH THE NULL AND ALTERNATIVE HYPOTHESES", *JOURNAL OF ECONOMETRICS* 148, 1-13.

LANE, P. R. (2010): "A EUROPEAN PERSPECTIVE ON EXTERNAL IMBALANCES", REPORT 2010:5, SVENSKA INSTITUTET FOR EUROPAPOLITISKA STUDIER.

LANE, P. R. AND MILESI-FERRETTI, G. M. (2007): "THE EXTERNAL WEALTH OF NATIONS MARK II: REVISED AND EXTENDED ESTIMATES OF FOREIGN ASSETS AND LIABILITIES, 1970-2004", *JOURNAL OF INTERNATIONAL ECONOMICS* 73, 223-250.

LANE, P. R. AND MILESI-FERRETTI, G. M. (2012): "EXTERNAL ADJUSTMENT AND THE GLOBAL CRISIS", *JOURNAL OF INTERNATIONAL ECONOMICS* 88, 252-265.

LIU, P. C. AND TANNER, E. (1996): "INTERNATIONAL INTERTEMPORAL SOLVENCY IN INDUSTRIALIZED COUNTRIES: EVIDENCE AND IMPLICATIONS", *SOUTHERN ECONOMIC JOURNAL* 62, 739-749.

MANN, C. L. (2002): "PERSPECTIVES ON THE U.S. CURRENT ACCOUNT DEFICIT AND SUSTAINABILITY", *JOURNAL OF ECONOMIC PERSPECTIVES* 16, 131-152.

MILESI-FERRETTI, G. M. AND RAZIN, A. (1996): *CURRENT-ACCOUNT SUSTAINABILITY*, PRINCETON STUDIES IN INTERNATIONAL FINANCE 81, PRINCETON UNIVERSITY.

NG, S. AND PERRON, P. (2001): "LAG LENGTH SELECTION AND THE CONSTRUCTION OF UNIT ROOT TESTS WITH GOOD SIZE AND POWER", *ECONOMETRICA* 69, 1529-1554

OBSTFELD, M. (1982): "AGGREGATE SPENDING AND THE TERMS OF TRADE: IS THERE A LAURSEN-METZLER EFFECT?", *QUARTERLY JOURNAL OF ECONOMICS* 97, 251-270.

OBSTFELD, M. (2012): "DOES THE CURRENT ACCOUNT STILL MATTER?", *AMERICAN ECONOMIC REVIEW* 102, 1-23.

OBSTFELD, M. AND ROGOFF, K. (1995): "THE INTERTEMPORAL APPROACH TO THE CURRENT ACCOUNT", IN GROSSMAN, G. AND ROGOFF, K. (EDS.): *HANDBOOK OF INTERNATIONAL ECONOMICS* (VOL. 3), NORTH-HOLLAND, AMSTERDAM, 1731-1799.

OBSTFELD, M. AND ROGOFF, K. (2007): "THE UNSUSTAINABLE U.S. CURRENT ACCOUNT POSITION REVISITED", IN CLARIDA, R. H. (ED.): *G7 CURRENT ACCOUNT IMBALANCES: SUSTAINABILITY AND ADJUSTMENT*, THE UNIVERSITY OF CHICAGO PRESS, CHICAGO, 339-366.

OBSTFELD, M. AND ROGOFF, K. (2010): "GLOBAL IMBALANCES AND THE FINANCIAL CRISIS: PRODUCTS OF COMMON CAUSES", IN GLICK, R. AND SPIEGEL, M. M. (EDS.): *ASIA AND THE GLOBAL FINANCIAL CRISIS*, FEDERAL RESERVE BANK OF SAN FRANCISCO, 131-172.

PERRON, P. (1997): "FURTHER EVIDENCE ON BREAKING TREND FUNCTIONS IN MACROECONOMIC VARIABLES", *JOURNAL OF ECONOMETRICS* 80, 355-385.

PERRON, P. AND NG, S. (1996): "USEFUL MODIFICATIONS TO SOME UNIT ROOT TESTS WITH DEPENDENT ERRORS AND THEIR LOCAL ASYMPTOTIC PROPERTIES", *REVIEW OF ECONOMIC STUDIES* 63, 435-463.

PERRON, P. AND VOGELSANG, T. (1992): "NONSTATIONARITY AND LEVEL SHIFTS WITH AN APPLICATION TO PURCHASING POWER PARITY", *JOURNAL OF BUSINESS & ECONOMIC STATISTICS* 10, 301-320.

PERRON, P. AND YABU, T. (2009): "TESTING FOR SHIFTS IN TREND WITH AN INTEGRATED OR STATIONARY NOISE COMPONENT", *JOURNAL OF BUSINESS & ECONOMIC STATISTICS* 27, 369-396.

PHILLIPS, P. C. B. AND PERRON, P. (1988): "TESTING FOR A UNIT ROOT IN TIME SERIES REGRESSION", *BIOMETRIKA* 75, 335-346.

RAZIN, A. (1995): "THE DYNAMIC-OPTIMIZING APPROACH TO THE CURRENT ACCOUNT: THEORY AND EVIDENCE", IN KENEN, P. B. (ED.): *UNDERSTANDING INTERDEPENDENCE: THE MACROECONOMICS OF THE OPEN ECONOMY*, PRINCETON UNIVERSITY PRESS, PRINCETON, 169-198.

SACHS, J. (1981): "THE CURRENT ACCOUNT AND MACROECONOMIC ADJUSTMENT IN THE 1970'S", *BROOKINGS PAPERS ON ECONOMIC ACTIVITY* 1, 201-268.

SACHS, J. (1982): "THE CURRENT ACCOUNT IN THE MACROECONOMIC ADJUSTMENT PROCESS", *SCANDINAVIAN JOURNAL OF ECONOMICS* 84, 147-159.

STOCK, J. H. (1999): "A CLASS OF TESTS FOR INTEGRATION AND COINTEGRATION", IN ENGLE, R. AND WHITE, H. (EDS.): *COINTEGRATION, CAUSALITY, AND FORECASTING: A FESTSCHRIFT IN HONOUR OF CLIVE W.J. GRANGER*, OXFORD UNIVERSITY PRESS, OXFORD, 135-167.

SVENSSON, L. E. O. AND RAZIN, A. (1983): "THE TERMS OF TRADE AND THE CURRENT ACCOUNT: THE HARBERGER-LAURSEN-METZLER EFFECT", *JOURNAL OF POLITICAL ECONOMY* 91, 97-125.

TAYLOR, A. M. (2002): "A CENTURY OF CURRENT ACCOUNT DYNAMICS", *JOURNAL OF INTERNATIONAL MONEY AND FINANCE* 21, 725-748.

TREHAN, B. AND WALSH, C. (1991): "TESTING INTERTEMPORAL BUDGET CONSTRAINTS: THEORY AND APPLICATIONS TO U.S. FEDERAL BUDGET AND CURRENT ACCOUNT DEFICITS", *JOURNAL OF MONEY, CREDIT, AND BANKING* 23, 206-223.

WICKENS, M. R. AND UCTUM, M. (1993): "THE SUSTAINABILITY OF CURRENT ACCOUNT DEFICITS: A TEST OF THE US INTERTEMPORAL BUDGET CONSTRAINT", *JOURNAL OF ECONOMIC DYNAMICS AND CONTROL* 17, 423-441.

WU, J.-L. (2000): "MEAN REVERSION OF THE CURRENT ACCOUNT: EVIDENCE FROM THE PANEL DATA UNIT-ROOT TEST", *ECONOMICS LETTERS* 66, 215-222.

WU, J.-L., CHEN, S.-L. AND LEE, H.-Y. (2001): "ARE CURRENT ACCOUNT DEFICITS SUSTAINABLE?: EVIDENCE FROM PANEL COINTEGRATION", *ECONOMICS LETTERS* 72, 219-224.

WU, J.-L., FOUNTAS, S. AND CHEN, S.-L. (1996): "TESTING FOR THE SUSTAINABILITY OF THE CURRENT ACCOUNT DEFICIT IN TWO INDUSTRIAL COUNTRIES", *ECONOMICS LETTERS* 52, 193-198.

ZIVOT, E. AND ANDREWS, D. W. K. (1992): "FURTHER EVIDENCE ON THE GREAT CRASH, THE OIL-PRICE SHOCK, AND THE UNIT-ROOT HYPOTHESIS", *JOURNAL OF BUSINESS & ECONOMIC STATISTICS* 10, 251-270.

DOCUMENTOS DE TRABAJO

La serie Documentos de Trabajo que edita el Instituto Universitario de Análisis Económico y Social (IAES), incluye avances y resultados de los trabajos de investigación realizados como parte de los programas y proyectos del Instituto y por colaboradores del mismo.

Los Documentos de Trabajo se encuentran disponibles en internet

http://ideas.repec.org/s/uae/wpaper.html

ISSN: 2172-7856

ÚLTIMOS DOCUMENTOS PUBLICADOS

WP-04/13 THE PRESENT VALUE MODEL OF US STOCK PRICES REVISITED: LONG-RUN EVIDENCE WITH STRUCTURAL BREAKS, 1871-2010
Vicente Esteve, Manuel Navarro-Ibáñez, María A. Prats

WP-05/13 EDUCACIÓN FINANCIERA PARA JÓVENES: UNA VISIÓN INTRODUCTORIA
José M. Domínguez Martínez

WP-06/13 RECENT CYCLICAL MOVEMENTS IN THE SPANISH PRODUCTIVITY. AN AGGREGATE AND SECTORAL ANALYSIS
Andrés Maroto-Sánchez y Juan R. Cuadrado-Roura

WP-07/13 LA FINANCIACIÓN TRADICIONAL DE LAS PYMES EN ESPAÑA: UN ANÁLISIS EN EL MARCO DE LA UNIÓN EUROPEA
Francisco del Olmo García

WP-08/13 A NON PARAMETRIC ANALYSIS OF THE RELATIVE PERFORMANCE AND EFFICIENCY PATTERNS OF SERVICE INDUSTRIES IN THE ADVANCED COUNTRIES
Andrés Maroto-Sánchez

WP-09/13 FROM COMPLEMENTS TO SUBSTITUTES: STRUCTURAL BREAKS IN THE ELASTICITY OF SUBSTITUTION BETWEEN PAID-EMPLOYMENT AND SELF-EMPLOYMENT IN THE US
Emilio Congregado, Vicente Esteve y Antonio A. Golpe

INSTITUTO UNIVERSITARIO de Análisis Económico y Social

Universidad de Alcalá

Plaza de la Victoria, 2. 28802. Alcalá de Henares. Madrid - Telf. (34)918855225
Fax (34)918855211 Email: iaes@uah.es. www.iaes.es

INSTITUTO UNIVERSITARIO DE ANÁLISIS ECONÓMICO Y SOCIAL