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How sustainable are OECD current account balances in the long-run?

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Abstract. *The study examines the stationarity and long-run sustainability of OECD current account balances. For this purpose, tests for stationarity and then cointegration between exports and imports are based on recently developed panel data methods that offer increased power over existing time series techniques. Unlike existing panel studies on this topic, this study utilizes techniques that enable the examination of sustainability for individual panel members. The first stage of the investigation relies on a novel approach to unit root testing whereby tests for stationarity are conducted within a seemingly unrelated regression framework. The second stage involves the estimation of the long-run relationship between the exports and imports by a range of recently developed panel data techniques advocated by Pedroni. Using a panel of eleven OECD countries for the study period 1980-2002, the results from these techniques suggest that sustainability is present in six countries at most. Also, sustainability is generally a characteristic of the non-Euro countries. These results can be contrasted with existing group mean unit root and cointegration tests that indicate sustainability for the group as a whole.*

Keywords: OECD, current account, unit root, cointegration, panel data.

1. Introduction

The stationarity and sustainability of OECD current account balances has been the focus of many researchers over a number of years [see, *inter alia*, Trehan and Walsh (1991), Gundlach and Sinn (1992), Otto (1992), Wickens and Uctum (1993), Liu and Tanner (1996), Wu (2000) and Wu *et al.* (2001)]. In these studies, the sustainability of the current account has been of major concern for a number of reasons. First, a sustainable current account is consistent with the sustainability of external debts and might indicate there is no incentive for a country to default. Temporary current account deficits are not necessarily 'bad' as they reflect the reallocation of capital to countries where capital is more productive. However, persistent deficits are more serious. They may lead to increased domestic interest rates to attract foreign capital and, in addition to this, the accumulation of external debt

owing to persistent deficits will imply increasing interest payments that impose an excess burden on future generations. Second, the sustainability of the current account is consistent with the intertemporal model of the current account, and hence supports its validity.¹ The modern intertemporal model of current account determination uses consumption smoothing behaviour to predict that the current account acts as a buffer to smooth consumption in the face of shocks. This implies that exports and imports should be cointegrated with a coefficient of unity.

Earlier studies that investigate the stationarity of the current account deficit have largely concerned OECD countries and include, *inter alia*, Trehan and Walsh (1991) and Wickens and Uctum (1993) who look at the US, Otto (1992) who looks at the US and Canada, Liu and Tanner (1996) who examine the G7 countries, and Gundlach and Sinn (1992) who examine a larger sample of twenty three countries. With the exception of Liu and Tanner, who consider the impact of structural breaks, these studies generally find that current accounts are non-stationary for several major industrialised countries including the US, UK, Canada, Germany and Japan. More recently, Wu (2000) and Wu *et al.* (2001) confirm sustainability of OECD current account deficits using panel data unit root and cointegration tests. Similarly, Coakley *et al.* (1999) look at the case of less developed countries (LDCs) using panel data unit root tests. Compared to the earlier studies, these panel approaches use more observations and exploit the cross-country variations of the data in estimation thereby yielding higher test power than standard cointegration tests such as those advocated by Engle and Granger (1987), Johansen (1991) and Philips and Ouliaris (1990) that fail to incorporate information across countries and this leads to a loss of efficiency in estimation.

¹ See, for example, Husted (1992) and references therein.

The purpose of this study is to examine the long-run sustainability of OECD current account balances using panel data unit root and cointegration tests. The studies by Wu (2000) and Wu *et al.* (2001) employ Im *et al.* (1997) panel data unit root tests along with Pedroni tests for current account stationarity and cointegration between exports and imports in their examination of OECD countries. These procedures are followed here. However, this investigation takes the analysis of sustainability further. Rather than just focus on group-based unit root statistics and estimates of the long-run relationship between exports and imports, we consider which members from within the OECD panel are responsible for accepting or rejecting sustainability. For this purpose, this investigation first conducts ADF unit root tests on OECD current account balances within a seemingly unrelated regression (SUR) framework and second, this study follows Pedroni (2001) and estimates the long-run cointegrating panels using fully modified ordinary least squares (FMOLS) which provides estimates of long-run parameters and facilitates tests of restrictions on individual countries. Unlike the earlier long-run panel data studies, the application of these two techniques enable us to identify which members from within the panel are characterised with current account stationarity and also which members exhibit homogeneity in any long-run relationship between exports and imports.

The paper is set out as follows. The following section discusses the methodology in more detail. The third section discusses the data and results. Although the more familiar group based panel data unit root tests indicate a stationary current account balance for the panel, the SURADF results suggest that more than half the panel nonetheless exhibit non-stationarity. In the case of the Pedroni panel cointegration tests, there is evidence that exports and imports are cointegrated for the panel and unity restrictions on the long-run relationship between exports and imports

are accepted in six out of eleven cases. It is predominately the Euro members who are characterised by non-stationary current accounts. The final section concludes.

2. Methodology

Let us define the current account balance for country i , d_{it} , as

$$d_{it} = X_{it} - M_{it} \quad (1)$$

where X and M are respectively exports and imports expressed as a proportion of GDP, $i = 1, 2, \dots, N$ countries and $t = 1, 2, \dots, T$ time periods. Suppose d_{it} is generated by a first order autoregressive process, $d_{it} = \alpha_i + \rho_i d_{it-1} + \varepsilon_{it}$ which can be transformed into the familiar ADF regression

$$\Delta d_{it} = \alpha_i + \beta_i d_{it-1} + \sum_{j=1}^{k_i} \gamma_{i,j} \Delta d_{it-j} + \varepsilon_{it} \quad (2)$$

where $\beta_i = \rho_i - 1$. Acceptance of the null hypothesis $\beta_i = 0$ ($\rho_i = 1$) means that d_{it} is a non-stationary series whereas rejection of the null means that d_{it} is stationary and therefore the current account balance exhibits long-run sustainability. There exist a range of panel data unit root tests that offer increased power over methods for univariate unit root testing. The early tests proposed by Abuaf and Jorion (1990) and Levin and Lin (1993) offer restrictive joint and null hypotheses where *all* members of the panel series are either non-stationary or stationary with common autoregressive parameters, i.e. ρ 's or β 's. In addition to this, Abuaf and Jorion (1990) set k at zero and do not feature a lag structure. Levin and Lin (1993) on the other hand, incorporate $k \geq 0$ but k is given the same value for all panel members. Papell (1997) allows k to vary across all members but, in common with the earlier panel-based tests, does not allow for contemporaneous cross-correlation of the ε_{it} 's. O'Connell (1998) argues

that panel data unit root tests that presume identically and independently distributed disturbances can have dramatic implications for statistical size and power to the extent that the null may not be correctly accepted or rejected. To allow for correlation across the panel, Im, Pesaran and Shin (1997) assume that

$$\varepsilon_{it} = \theta_t + u_{it} \quad (3)$$

where θ_t is a time-specific common effect that allows for a degree of dependency across the series and u_{it} is an idiosyncratic random effect that is independently distributed across groups. To remove the effect of the common component θ_t , we can subtract the cross-section means from the panel of current account balances. However, this demeaning procedure only partially tackles cross-sectional dependence. O'Connell (1998) controls for contemporaneous correlation directly by estimating the disturbance covariance matrix and so allows for contemporaneous cross correlation but forces the lag structure to be homogeneous. With the exception of Im, Pesaran and Shin (1997) and O'Connell (1998), none of the above tests allow for a mixture of stationary and non-stationary series in the panel because they impose a common value for the autoregressive parameter in the null and alternative hypotheses. Other tests advocated by Maddalla and Wu (1997), Wu and Wu (1998) and Sarno and Taylor (1998) do allow for this mixture. These latter studies address the issue of heterogeneous lag structures and contemporaneous correlation of the residuals, but they still provide a single test statistic that does not allow the researcher to identify how many and which of the series in the panel are in fact stationary.

This paper utilises the alternative test procedure recently advocated by Breuer *et al.* (2002) that exploits the power of panel data analysis without imposing uniformity across the panel under either the null or alternative hypothesis. This test relies on SUR analysis of OECD current account balances with no across panel

restrictions under either hypothesis. While this test offers increased power over univariate ADF tests especially when residual cross-correlations are high, there are three further advantages. First, more information is exploited through knowledge of the cross-equation error covariances to produce efficient estimators and potentially more powerful test statistics. Second, autoregressive processes of varying orders can be incorporated. Third, the researcher can identify which panel members are stationary or non-stationary because, unlike the previous tests, the SURADF test is based on individual rather than joint hypotheses. The SURADF test involves non-standard distributions therefore critical values must be obtained through simulation. These critical values are specific to the estimated covariance matrix, sample size, number of panel members and lag structure.

The second stage of the empirical investigation is to test for cointegration between exports and imports. Husted (1992) provides a simple framework that implies a long-run relationship between exports and imports. For an individual country, the current-period budget constraint is

$$C_t = Y_t + B_t - I_t - (1 + r)B_{t-1} \quad (4)$$

where C , Y , B and I refer to current consumption, income, borrowing and investment, r is the one-period world interest rate and $(1 + r)B_{t-1}$ is the initial debt size. Since equation (4) must hold in every time period, the period-by-period budget constraints can be combined to form the country's intertemporal budget constraint (IBC) which states that the amount a country borrows (lends) in international markets equals the present value of future trade surpluses (deficits). Husted makes a number of further assumptions that include a stationary world interest rate and that exports and imports follow non-stationary processes to derive the following testable equation,

$$X_t = \alpha + \beta M_t + \mu_t \quad (5)$$

where X denotes expenditure on goods and services and M denotes imports of goods and services plus net transfers and net interest payments. Cointegration is a necessary condition for the economy to obey its IBC. However, $\beta < 1$ when trade flows are measured as a proportion of GDP is inconsistent with a finite and sustainable external debt-GDP ratio. For a stationary and sustainable current account deficit, we require $\beta = 1$ and that μ is a stationary process.

For the purpose of testing for cointegration within the panel of OECD countries, we follow Pedroni (1999) who proposes a range of statistics that can be used to determine the presence of cointegration in heterogeneous panels. In each case, the test statistics are constructed using the residuals from the following hypothesized cointegrating regression based on equation (5),

$$X_{it} = \alpha_i + \beta M_{it} + \mu_{it} \quad (6)$$

where α_i allows the cointegrating regression to include country-specific fixed effects. The procedure for computing the test statistics involves estimating the hypothesized cointegration regression described in (6) and using the residuals μ_{it} to estimate the appropriate autoregression. From this, one may compute the *panel ADF* statistic which is a parametric statistic and analogous to the Levin and Lin (1993) panel data unit root test applied to the estimated residuals of cointegrating regression.² This statistic is referred to as a *within-dimension* statistic that effectively pools the autoregressive coefficients across different countries during the unit root test. A common value for the autoregressive coefficient is specified under the alternative hypothesis of cointegration. The second statistic is based on a group mean approach. The *group ADF* statistic is a parametric statistic and analogous to the Im *et al.* (1997)

test for a unit root panel that is applied to the estimated residuals of a cointegrating regression. This statistic is referred to as a *between-dimension* statistic that averages the estimated autoregressive coefficients for each country. Under the alternative hypothesis of cointegration, the autoregressive coefficient is allowed to vary across countries. This allows one to model an additional source of potential heterogeneity across countries. Following an appropriate standardization, both of these statistics will be distributed as standard normal as both N and T grow large. Both of these the statistics diverge to negative infinity under the alternative hypothesis and consequently the left tail of the normal distribution is used to reject the null hypothesis of non-cointegration.

Having tested for cointegration, the next stage of the investigation is to analyse equation (6). Pedroni (2001) describes how FMOLS procedures can be employed to obtain the panel data estimates for β_i . Using a dynamic modelling procedure results in a more powerful test for cointegration as well as giving generally unbiased estimates of the long-run relationship and standard t -statistics. FMOLS amounts to the application of non-parametric adjustment to the OLS estimates of both the long-run parameter β_i and associated t -statistic, on account of any bias due to autocorrelation or endogeneity bias that shows up in the OLS residuals [Phillips and Hansen (1990)].

Following on from (6), let $\xi_{it} = (\hat{\mu}_{it}, \Delta M_{it})'$ be a stationary vector comprising the estimated residuals and the differences in imports. Also, let

² In the case of the *panel ADF* statistic, (6) is also run in first difference form where the estimated residuals η_{it} are saved. The long-run variance of η_{it} is computed and used as a nuisance parameter estimator in the computation of the test statistic.

$\Omega_i = \lim_{T \rightarrow \infty} E \left[T^{-1} \left(\sum_{t=1}^T \xi_{it} \right) \left(\sum_{t=1}^T \xi_{it} \right)' \right]$ be the long-run covariance for this vector

process which can be decomposed into $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i'$ where Ω_i^0 is the contemporaneous covariance and Γ_i is a weighted sum of autocovariances. Pedroni shows that the group mean panel FMOLS estimator is given as

$$\hat{\beta}_{GFM}^* = N^{-1} \sum_{i=1}^N \left(\sum_{t=1}^T (M_{it} - \bar{M}_i)^2 \right)^{-1} \left(\sum_{t=1}^T (M_{it} - \bar{M}_i) X_{it}^* - T \hat{\gamma}_i \right) \quad (7)$$

where $X_{it}^* = (X_{it} - \bar{X}_i) - \frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}} \Delta M_{it}$ and $\hat{\gamma}_i \equiv \hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^0 - \frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}} (\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}^0)$. The

between-dimension estimator is calculated as $\hat{\beta}_{GFM}^* = N^{-1} \sum_{i=1}^N \hat{\beta}_{FM,i}^*$ where $\hat{\beta}_{FM,i}^*$ is the conventional FMOLS estimator applied to the i^{th} member of the panel. The associated t -statistics are calculated as

$$t_{\hat{\beta}_{GFM}^*} = N^{-0.5} \sum_{i=1}^N t_{\hat{\beta}_{FM,i}^*} \quad (8)$$

where $t_{\hat{\beta}_{FM,i}^*} = \left(\hat{\beta}_{FM,i}^* - \beta_0 \right) \left(\hat{\Omega}_{11i}^{-1} \sum_{t=1}^T (M_{it} - \bar{M}_i)^2 \right)^{0.5}$.

In the empirical analysis, we focus on the between-dimension panel FMOLS tests. There are several advantages over the within-dimension approach. First, the between-dimension approach allows for greater flexibility in the presence of heterogeneity across the cointegrating vectors where β_i is allowed to vary. Under the within-dimension approach, β_i would be constrained to be the same value for each country under the alternative hypothesis. Second, the point estimates of the between dimension estimator can be interpreted as the mean value of the cointegrating vectors. This is helpful in the interpreting the results. Third, the between-dimension estimator

suffers from lower small-sample size distortions than is the case with the within-dimension estimator.

3. Results

In line with the data requirements indicated in equation (5), the study employs quarterly data on X , M and d , each expressed as a percentage of nominal GDP, for eleven countries over the study period 1980Q1-2002Q4 inclusive. The countries used are Australia, Belgium, Canada, France, Germany, Italy, Japan, Norway, Spain, UK and the US.³ All data are taken from the *OECD Main Economic Indicators* and are seasonally adjusted.⁴

We first examine the stationarity of OECD current account balances. Table 1 reports univariate Augmented Dickey Fuller (ADF) unit root tests on the OECD current account balances expressed as a proportion of GDP. The choice of lag lengths is based on the Akaike information criterion.⁵ It can be seen that there is only evidence of current account stationarity for Australia and Japan at the 5 and 10% significance levels respectively. In common with the earlier studies that also employ univariate unit root tests, there is general evidence against the sustainability of OECD current account balances. It is possible that the univariate unit root tests are subject to low test power that accounts for the acceptance of the null of non-stationarity in the majority of cases. Table 2 reports the findings from two widely used tests for unit roots in panels. These are the earlier Levin and Lin (1993) and Im *et al.* (1997) tests. Each of these statistics is distributed as standard normal as both N and T grow large and one can see that the null hypothesis of joint non-stationarity of the series in the

³ This range of countries are dictated by OECD data availability with respect to the study period.

⁴ This may be contrasted with Wu (2000) who employs seasonally unadjusted data obtained from the IMF database.

panel is rejected at the 1 and 5% significance levels for the Levin and Lin (1993) and Im *et al.* (1997) tests respectively. However, before concluding that current account stationarity is applicable to *all* OECD members, it should be remembered that these results are based on a single statistic and are consistent with just a single series from within the panel being responsible for rejecting the null hypothesis of joint non-stationarity. Furthermore, these tests do not adequately account for cross equation correlation and in addition to this, the Levin and Lin test is based on the very restrictive alternative hypothesis that the autoregressive parameter is equal across the panel series. To address these concerns, Table 3 reports the SURADF estimates for the panels of eleven current account balances along with 1, 5 and 10% critical values specifically tailored to this study where each ADF statistic has been generated using Monte Carlo simulations. These results indicate current account stationarity in the cases of Australia and the UK at the 1% significance level. In addition to this, stationarity is also confirmed in the cases of Belgium and Japan at the 10% significance level. The increased power offered by the SURADF test over the univariate ADF unit root tests in Table 1 enables us to confirm that more OECD countries, though less than half the full sample, exhibit current account stationarity. This highlights the possibility that a small number of panel members are responsible for driving the conclusion drawn from Table 2 and the study by Wu (2000) that sustainability holds for the OECD countries as a whole.

Table 4 reports the Pedroni cointegration tests based on equation (6). These tests include time-specific dummies to allow for the possibility that residuals are correlated across countries. The null of non-cointegration is accepted and rejected at

⁵ The qualitative conclusions drawn are unaffected by alternative selections methods such as the Schwarz information criterion.

the 5% significance level by the *panel ADF* and *group ADF* tests respectively. The former test is relatively more restrictive in that a common value for the autoregressive coefficient is specified under the alternative hypothesis of cointegration. The *group ADF* test allows for the autoregressive coefficient to vary across countries under the alternative hypothesis and it may be this flexibility that facilitates a rejection of the non-cointegration null. Table 5 reports the FMOLS panel estimates of the cointegrating relationships between exports and imports. These results confirm a long-run relationship between X and M . According to the group mean estimate, $\beta = 0.869$. At the 5% significance level, this coefficient is both significantly different from zero and unity with t -statistics of 16.651 and -3.172 respectively (see columns 3 and 4). Table 5 also reports $\beta_i > 0$ in all cases but there exists considerable variation in the country-by-country experiences. The null of a zero slope coefficient is rejected at the 5% significance level in all cases except France, Italy (only rejected at 10% significance) and Norway. At the 5% significance level, the null of a unity slope coefficient and therefore current account stationarity is accepted in the cases of Australia, Belgium, Canada, Japan, UK and the US. With the Pedroni panel cointegration analysis, we are able to add Canada and the US to the group of countries exhibiting sustainability. The null of a unity slope is rejected in the cases of France, Germany, Italy, Norway and Spain. In very broad terms, the cases of sustainability and non-sustainability can be respectively divided into non-Euro members and Euro members.⁶ With respect to the latter Euro members, there are implications for the stability of the Euro area. Since savings minus investment equals the current account surplus plus the government budget deficit, more emphasis on domestic intertemporal

⁶ This categorisation is general in the sense that Belgium is a Euro member whereas Norway is not. Although an EU member, the UK has opted to remain outside of the Euro area.

balance, or fiscal discipline, may be required for overall sustainability of the combined domestic and international intertemporal balances. One may reflect on this viewpoint given the difficulties of some Euro members in satisfying the agreed Stability Pact.

4. Summary and Conclusion

This paper contributes towards the debate concerning the long-run sustainability of OECD current account balances. Economic theory suggests that sustainability is desirable and this can be reflected in current account balances that are stationary where exports and imports are cointegrated with a long-run coefficient of unity. Much of the existing time-series evidence finds against sustainability in many countries. Given that low test power could be responsible for acceptance of the nulls of non-stationarity and non-cointegration, the application of panel data unit root and cointegration tests enables researchers to investigate sustainability with increased test power. Unlike existing panel data studies of current account balances, this paper offers a new panel data evidence of sustainability where it is possible to identify which members from within the panel exhibit current account sustainability. Using a sample of eleven OECD countries, the results indicate that at most, six countries exhibit sustainability- Australia, Belgium, Canada, Japan, UK and the US. Five countries- France, Germany, Italy, Norway and Spain- do not offer evidence in favour sustainability. These results highlight the danger of drawing conclusions from existing group-based panel tests that offer a single test statistic on whether sustainability holds or not. With the additional insight provided by these new tests, it appears that sustainability of the external balance is more lacking among Euro members than outside the Euro area. Potential avenues for future research are to consider the

economic and institutional factors that contribute towards the lack of sustainability in the Euro area. In addition, one might also consider whether non-linearities play a significant role in stationarity of current account balances and the long-run relationship between exports and imports.

References

- Abuaf, N., and Jorion, P. (1990), "Purchasing Power Parity in the Long Run", *Journal of Finance*, 45, 157-74.
- Breuer, J.B., McNown, R., and Wallace, M. (2002), "Series-specific Unit Root Tests with Panel Data", *Oxford Bulletin of Economics and Statistics*, 64, 5, 527-46.
- Coakley, J., and Kulasi, F. (1997), "The Cointegration of Long Span Saving and Investment", *Economics Letters*, 54, 1-6.
- Coakley, J., and Hasan, F., and Smith, R. (1999), "Saving, Investment and Capital Mobility in LDCs", *Review of International Economics*, 7, 4, 632-40.
- Engle R., and Granger, C. (1987), "Cointegration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, 251-76.
- Gundlach, E., and Sinn, S. (1992), "Unit Root Tests of the Current Account: Implications for International Capital Mobility", *Applied Economics*, June, 617-20.
- Husted, S. (1992), "The Emerging US Current Account Deficit in the 1980s: A Cointegration Analysis", *Review of Economics and Statistics*, 74, 159-66.
- Im, Kyong S., Pesaran, M. Hashem, and Yongcheol Shin.(1997), "Testing for Unit Roots in Heterogeneous Panels." Department of Applied Economics Working Paper, University of Cambridge, December.
- Johansen, S. (1991), "Estimation and Testing of Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica*, 59, 1551-80.
- Levin, Andre, and Chen-fu Lin. (1993), "Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties." Unpublished manuscript, University of California at San Diego.
- Liu, P., and Tanner, E. (1996), "International Intertemporal Solvency in Industrialised Countries: Evidence and Implications", *Southern Economic Journal*, 62, 3, 739-49.
- Maddala, G.S. and Shaowen Wu (1997). "A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test." Ohio State University. mimeo.
- O'Connell, Paul G. J. (1998). "The Overvaluation of Purchasing Power Parity." *Journal of International Economics*. 44, 1-19.
- Otto, G. (1992), "Testing a Present-Value Model of the Current Account: Evidence from US and Canadian Time Series", *Journal of International Money and Finance*, October, 414-30.

- Papell, David. (1997). "Searching for Stationarity: Purchasing Power Parity under the Current Float." *Journal of International Economics*. 43, 313-32.
- Pattichis, C., and Kanaan, M. (2001), "Is Lebanon's trade deficit sustainable? A cointegration analysis", *Economia Internazionale*, 54, 1, 49-56.
- Pedroni, P. (1999), "Critical values for cointegration tests in heterogeneous panels with multiple regressors", Economics Working Paper, Indiana University, *Oxford Bulletin of Economics and Statistics*, Special Issue, 653-70.
- Pedroni, P. (2000), "Fully modified OLS for heterogeneous cointegrated panels" in *Advances in Econometrics, Nonstationary panels, panel cointegration and dynamic panels*, 15, 93-130.
- Pedroni, P. (2001), "Purchasing power parity in cointegrated panels", *Review of Economics and Statistics*, 83, 727-731.
- Phillips, P.C.B., and Hansen, B.E. (1990), "Statistical inference in instrumental variables with I(1) processes", *Review of Economic Studies*, 57, 99-125.
- Philips, P. and Ouliaris, S. (1990), "Asymptotic Properties of Residual Based Tests for Cointegration", *Econometrica*, 58, 165-93.
- Sarno, L. and M. Taylor (1998), "Real Exchange Rates Under the Recent Float: Unequivocal Evidence of Mean Reversion", *Economics Letters*, 60, 131-7.
- Taylor, Mark P., and Lucio Sarno. (1998) "The Behaviour of the Real Exchange Rate During the Bretton Woods Period." *Journal of International Economics* 46 (December): 2, 281-312.
- Trehan, B. and Walsh, C. (1991), "Testing Intertemporal Budget Constraints: Theory and Applications to US Federal Budget Deficits and Current Account Deficits", *Journal of Money, Credit and Banking*, May, 206-23.
- Wickens, M., and Uctum, M. (1993), "The Sustainability of Current Account Deficits: A Test of the US Intertemporal Budget Constraint", *Journal of Economic Dynamics and Control*, May, 423-41.
- Wu, J-L (2000), "Mean Reversion of the Current Account: Evidence from the Panel Data Unit Root Test", *Economics Letters*, 66, 215-22.
- Wu, J-L, Chen S-L, and Lee, H-Y (2001), "Are Current Account Deficits Sustainable? Evidence from Panel Cointegration", *Economics Letters*, 72, 219-24.
- Wu, Shaowen and Jyh-Lin Wu. (1998). "Purchasing Power Parity under the Current Float: New Evidence from Panel Data Unit Root Tests." SUNY at Buffalo. mimeo.

Table 1. ADF Unit Root Tests on OECD Current Account Balances

	Current Account Balance	
	ADF (no trend)	ADF (trend)
Australia	-3.244**	-3.314*
Belgium	-2.222	-1.960
Canada	-1.641	-1.930
France	-1.244	-2.368
Germany	-2.156	-2.141
Italy	-2.041	-1.674
Japan	-2.843*	-3.171*
Norway	-2.022	-2.610
Spain	-2.442	-2.458
UK	-1.904	-2.241
US	-0.120	-0.670

Notes for Table 1. These are Augmented Dickey Fuller (ADF) unit root tests conducted on the current account balance expressed as a percentage of GDP. The full sample period is 1980Q1-2002Q4. For each test, the lag length was chosen using the Akaike information criterion. ***, ** and * indicate rejection of the null of non-stationarity at the 1, 5 and 10% levels of significance respectively in the ADF tests. Relevant ADF critical values taken from Fuller (1976) are -3.51, -2.89 and -2.58, while for regressions including a trend, these are -4.04, -3.45 and -3.15 respectively.

Table 2. Levin and Lin (1993) and Im *et al.* (1997) Panel Data Unit Root Tests

Test	Test Statistic
Levin and Lin (1993)	-3.043***
Im <i>et al.</i> (1997)	-1.663**

Notes for Table 2. The Levin and Lin test statistic is for the null $\rho = 1$ in the panel regression $d_{it} = \rho_i d_{it-1} + \sum_{j=1}^k \Delta d_{it-j} + \varepsilon_{it}$ where d is the current account deficit expressed as a proportion of GDP and k is set equal to 2 across the panel. The Im *et al.* test statistic is computed as the average ADF statistic across the sample using demeaned data for d . The individual lag lengths for the Im *et al.* test are based on those employed in the univariate ADF test results reported in Table 1. Both these statistics are distributed as standard normal as both N and T grow large. *** and ** denote rejection of the null of joint non-stationarity at the 1 and 5% significance levels with critical values of -2.33 and -1.64 respectively.

Table 3. SUR Analysis of Current Account Balances**Part A. Current Account Balances**

	SURADF	1%	5%	10%
Australia	-4.388***	-3.576	-3.036	-2.726
Belgium	-2.710*	-3.422	-2.852	-2.552
Canada	-1.777	-3.511	-2.953	-2.682
France	-1.354	-3.509	-2.969	-2.688
Germany	-2.622	-3.490	-2.995	-2.703
Italy	-2.687	-3.595	-3.016	-2.717
Japan	-2.849*	-3.542	-2.983	-2.659
Norway	-2.467	-3.590	-3.013	-2.731
Spain	-2.432	-3.478	-2.893	-2.598
UK	-3.682***	-3.495	-2.940	-2.658
US	0.113	-3.711	-3.126	-2.837

Notes for Table 3. SURADF refers to the ADF statistic obtained through the SUR estimation of ADF regressions for the panel of 11 current account balances each of which is expressed as a percentage of GDP. The individual lag lengths are based on those employed in the univariate ADF test results reported in Table 1. Each equation excludes a time trend. Following Breuer, McNown and Wallace (2002), the critical values reported in the three columns on the right have been simulated with 10000 replications where the error series were generated to be normally distributed with the variance-covariance matrix given by the SUR estimation of the panel. Each simulated current account balance was then generated from the error series using the SUR estimated coefficients. *** and ** indicate rejection of the null of non-stationarity at the 1 and 5 per cent significance levels.

Table 4. Panel Data Cointegration Tests

Test	Statistic
<i>panel ADF</i>	-1.026
<i>group ADF</i>	-1.883**

These are the Pedroni tests for cointegration [discussed in Pedroni (1999)] between OECD export- and import-GDP ratios. Individual lag lengths are based on the Akaike information criterion when applied to univariate regressions. *Panel ADF* is a within-dimension statistic and *Group ADF* is a between-dimension statistic. Both tests are asymptotically normal. At the 5% significance level, the latter test rejects the null of non-cointegration.

Table 5. FMOLS Estimation of the Cointegrated Panel

1	2	3	4
	$\hat{\beta}_i$	$t_{\hat{\beta}_i}$ $H_0: \beta_i = 0$	$t_{\hat{\beta}_i}$ $H_0: \beta_i = 1$
Australia	1.128	5.570	0.651
Belgium	1.074	8.895	0.609
Canada	1.016	11.012	0.171
France	0.046	0.334	-6.894
Germany	1.444	5.859	1.802
Italy	0.370	1.509	-2.568
Japan	1.167	8.639	1.234
Norway	0.217	1.216	-4.397
Spain	0.722	5.187	-2.000
UK	0.807	2.529	-0.603
US	1.573	4.294	1.565
	$\hat{\beta}$	$t_{\hat{\beta}}$ $H_0: \beta = 0$	$t_{\hat{\beta}}$ $H_0: \beta = 1$
Group	0.869	16.651	-3.172

Notes for Table 4. This table reports FMOLS panel data estimates of β_i (individual slopes) and β (group estimate of the slope) based on equation (6) using the Pedroni panel data cointegration methodology. The bottom row refers to the group-mean estimates. Each slope estimate is accompanied by two t -statistics. Column 3 reports t -statistics for the null of a zero slope, while column 4 reports t -statistics for the null of a unity slope (sustainability). These estimates include common time dummies. All t -statistics are asymptotically normal.