Mean reversion of the current account: evidence from the panel data unit-root test

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Abstract

Theoretically, the modern intertemporal model of current account determination implies the stationarity of the current account. However, the empirical finding in the literature indicates nonstationary current account balances based on conventional unit-root tests. Applying the panel data unit-root test of Im, Pesaran and Shin, we find support for the mean-reverting property of the current account. This, in turn, lends support to the intertemporal approach to the current account. The policy implication of our findings is that current account deficits in major industrial countries are sustainable. © 2000 Elsevier Science S.A. All rights reserved.

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JEL classification: F32

1. Introduction

For an open economy linked to a world market, one important aspect of intertemporal plans is the time path of the current account, which measures changes in national net indebtedness. Temporary current account deficits are not ‘bad’ as they reflect reallocation of capital to the country where capital is more productive. However, persistent deficits can have serious effects. First, they might increase domestic interest rates to attract foreign capital, and, secondly, the accumulation of external debt owing to persistent deficits will imply increasing interest payments which imposes an excess burden on future generations.
Policy makers and commentators are concerned about the aggravation of current accounts. Instead of emphasizing the size of current account deficits at any particular point in time, economists are more concerned with the country's intertemporal solvency constraint. This constraint focuses on the long-run path of the current account (Husted, 1992; Wu et al., 1996). A stationary current account is consistent with a finite external debt-to-GNP ratio, and hence with sustainability of external debts. In this case there is no incentive for the country to default on its international debts.

Moreover, the stationarity of the current account is also important to the validity of the modern intertemporal model of the current account. Theoretically, the modern intertemporal model of current account determination combines the assumptions of perfect capital mobility and consumption-smoothing behavior to predict that the current account acts as a buffer to smooth consumption in the face of shocks. This approach implies that the current account will typically be a stationary series. Empirically, a large volume of literature applies the Campbell and Shiller (1987) technique to test the validity of the intertemporal model of the current account (Otto, 1992; Ghosh, 1995; Shibata and Shintani, 1998). However, a common feature of these papers is the finding of a nonstationary current account using conventional unit-root tests such as Dickey and Fuller (1979).

Conventional unit-root tests examine the unit-root null based on a single-equation method. However, it is well known that these tests have low power when the root is close to one. In addition, Shiller and Perron (1985) find that the power of ADF tests is low with short time spans. Therefore, one potential reason for the failure of rejecting the nonstationarity of the current account in the existing literature may be the low power of the test.

As a result, exploiting cross-sectional information may increase the power of unit-root tests. Recently, the panel data unit-root tests of Levin and Lin (1992, 1993) have been widely applied in the empirical literature — particularly in the literature on purchasing power parity (Papell, 1997; O'Connell, 1998). The attractiveness of the Levin–Lin test is its high power relative to conventional single-equation-based tests. Levin and Lin (1992) demonstrate that implementing a unit-root test on a pooled cross-section data set, rather than performing separate unit-root tests for each individual series, can provide dramatic improvement in statistical power.

However, the Levin–Lin test has been criticized for assuming the same long-run multiplier across countries under the alternative hypothesis (Im et al., 1997; Maddala and Wu, 1998). To address this limitation, Im et al. (1997) propose a new panel data unit-root test based on the mean group approach. Moreover, they show that their $t$-bar statistic achieves more accurate size and higher power relative to the Levin–Lin test by allowing for a greater degree of heterogeneity across individuals.

The purpose of this paper is to apply the panel data unit-root test of Im et al. (1997) to re-examine the time-series property of the current account among industrial countries. The empirical finding supports current account stationarity among industrial countries, which lends support to the modern intertemporal model of the current account. Moreover, it implies that the current account deficits among industrial countries are sustainable.

The remainder of the paper is organized as follows. Section 2 briefly describes the model and econometric strategy. Section 3 reports empirical results from the Im–Pesaran–Shin test. Critical values are simulated by bootstrap to correct for small sample bias. An important issue that we consider is the appropriate critical values for the panel data unit-root test in the presence of serial correlation and contemporaneous correlation. A detailed discussion of the procedure of simulations is given in Appendix A. Finally, conclusions are summarized in the final section.
2. The model and econometric methodology

Following Ghosh (1995), we write down a country’s budget constraint as follows:

\[
F_{t+1} = (1 + r)F_t + Y_t - C_t - I_t - G_t
\]

\[
= (1 + r)F_t + X_t - C_t,
\]

where \( F_t \) denotes the economy’s stock of net foreign claims at the end of period \( t \). \( X_t \) is the country’s net output defined as \( X_t = Y_t - I_t - G_t \). Therefore, the current account, \( D_t \), is defined as:

\[
D_t = rF_t + X_t - C_t.
\]

We assume that the utility function is quadratic and that the consumers’ discount rate equals the given interest rate. Then, optimal consumption in the case of perfect capital mobility is given by:

\[
C_t = r\left\{ F_t + (1/(1 + r))\sum_{i=0}^{\infty} (1/(1 + r))^i E_t X_t \right\}.
\]

Substituting (3) into (2), one can derive the optimal current account:

\[
D_t = -(r/(1 + r))\sum_{i=0}^{\infty} (1/(1 + r))^i E_t (X_{t+i} - X_t)
\]

\[
= -\sum_{i=1}^{\infty} (1/(1 + r))^i E_t (\Delta X_{t+i}).
\]

Eq. (4) points out that the current account is determined by future expectations of net output changes. If \( \Delta X_t \) is stationary, then the current account is stationary too.

Suppose that there is a group of \( N \) current accounts, \( D_{it} \), which have the following time-series representation:

\[
\tilde{D}_{it} = \alpha_i + \beta_i \tilde{D}_{it-1} + \eta_{it}, \; i = 1, \ldots, N,
\]

where \( \tilde{D}_{it} = D_{it} - (1/N)\sum_{i=1}^{N} \tilde{D}_{it} \). The Im–Pesaran–Shin test examines the null hypothesis:

\[
H_0 : \beta_1 = \beta_2 = \cdots = \beta_N = 1,
\]

against

\[
H_1 : \beta_i < 1, \; \text{for all } i.
\]

Since \( \eta_{it} \) is assumed to be stationary, we correct the possible serial correlation in \( \eta_{it} \) with the ADF method. Hence, the model to be estimated is given as follows:

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1The null hypothesis in Levin and Lin (1992, 1993) is \( \beta = \beta = \cdots = \beta = 1 \), and the alternative hypothesis is \( \beta = \beta = \cdots = \beta < 1 \). The alternative hypothesis is implausible in empirical analysis, because it means that the current account in each country reverts to its respective unconditional mean over time at the same rate.
\[ \Delta \tilde{D}_{it} = \alpha_t + \beta_t \tilde{D}_{i,t-1} + \sum_{j=1}^{w_i} \gamma_{ij} \Delta \tilde{D}_{i,t-j} + \zeta_{it}, \]  

(6)

where \( \zeta_{it} \) is assumed to be uncorrelated over time, and mutually uncorrelated across individuals. Let us define the \( t \)-statistic of \( \tilde{\beta}_t = 0 \) in (6) as \( t_{ij}(w_i) \). The \( t \)-bar statistic is defined as follows:

\[ \tilde{z}_{1NT} = \sqrt{N} [\bar{t}_{NT} - a_{NT}] / \sqrt{b_{NT}}, \]  

(7)

where

\[ \bar{t}_{NT} = (1/N) \sum_{i=1}^{N} t_{ij}(w_i), \]

\[ a_{NT} = (1/N) \sum_{i=1}^{N} E[t_{ij}(w_i)] \]

and

\[ b_{NT} = (1/N) \sum_{i=1}^{N} V[t_{ij}(w_i)]. \]

\( E[t_{ij}(w_i)] \) and \( V[t_{ij}(w_i)] \) are the mean and variance of \( t_{ij}(w_i) \). The adjustment terms in the test statistic, \( a_{NT} \) and \( b_{NT} \), depend on the selection of the lag length \( w_i \) and the time span \( T \). Because the adjustment terms for our sample size are not tabulated by Im et al. (1997), they are generated by simulation through 100,000 iterations. Moreover, \( \tilde{z}_{1NT} \) is asymptotically distributed as a standard normal distribution.

3. Empirical investigation

In this section, we employ the test of Im et al. (1997) to investigate the stationarity of current account balances among a group of industrial countries.

3.1. Data description

The empirical period begins in 1977Q1 and ends in 1997Q4 depending on the availability of data. The data include quarterly observations of the current account and gross domestic product, obtained from the International Financial Statistics Tape. We include 10 OECD countries in our sample: Canada (CAN), Japan (JAP), France (FRN), Germany (GER), Italy (ITA), the Netherlands (NET), Spain (SPA), Australia (AUT), the United States (US) and the United Kingdom (UK). The current account per output is constructed by dividing the current account by gross domestic product.
3.2. Unit-root tests

The conventional ADF test is applied to examine the null of a unit root in each current account. The model without trend is adopted in the empirical analysis. Since considerable evidence exists that data-dependent methods to select the value of the lag order, $k$, in the ADF regressions are superior to choosing a fixed $k$ a priori, we follow the recursive $t$-statistic procedure suggested by Campbell and Perron (1991). Findings from Table 1 point out that current account balances are nonstationary since the ADF test fails to reject the unit-root null for all countries except Spain. This finding is consistent with existing literature.

It is well known that the ADF test has low power with short time spans as pointed out by Shiller and Perron (1985). Although we have 84 quarterly observations, they span only 21 years. Therefore, one possible reason for the failure of the ADF test to reject the unit-root null is the time span of the data. We investigate this possibility by exploiting cross-section variability among countries. To do so, we apply the Im–Pesaran–Shin test to re-examine the stationarity of the current account.

Note that the current account in Spain is stationary, according to Table 1. Taylor and Sarno (1998) point out that panel unit-root tests may lead to a very high probability of rejection of the joint null hypothesis of nonstationary when there is a single stationary process in a system of otherwise unit-root processes. In addition, the attractiveness of panel data unit-root tests is their higher power relative to the conventional ADF test. Therefore, applying the panel data unit-root test is meaningful only when the ADF test fails to reject the unit-root null. Based on the previous discussion, we exclude Spain from our panel. We employ the ADF method to correct the possible serial correlation in residuals. The lag length varies country by country and is set equal to the value chosen by the single equation models in Table 1. To correct for small sample bias and to allow for the presence of serial correlation and contemporaneous correlation in innovations, we simulate the finite-sample critical values of the test with a nonparametric bootstrap.

The empirical results are reported in Table 2. In sharp contrast to conventional findings, results from Table 2 reject the unit-root null at the 5% level, which indicates that current account balances are stationary. We also consider a smaller sub-sample that includes seven major industrial countries (G7). The previous finding of the mean-reverting property of the current account is also supported for

<table>
<thead>
<tr>
<th>Table 1</th>
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<tr>
<td>The $P$-value of the ADF test</td>
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<tr>
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<tr>
<td>US</td>
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<tr>
<td>$k^a$</td>
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<td>$p^a$</td>
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$^a$ $k$ is the lag order of the ADF test selected based on the recursive procedure of Campbell and Perron (1991).

$^b$ $P$-value of the ADF test.

$^2$ Start with an upper bound, $k_{max}$, on $k$. If the last included lag is significant, choose $k = k_{max}$. If not, reduce $k$ by one until the last lag becomes significant. If no lags are significant then set $k = 0$. We set $k_{max}$ to be 6. The 10% value of the asymptotic normal distribution, 1.645, is used to assess the significance of the last lag. Furthermore, Ng and Perron (1995) discuss the advantages of this method over an alternative procedure where $k$ is chosen to minimize the Akaike Information Criterion (AIC).
Table 2
The Im–Pesaran–Shin test

<table>
<thead>
<tr>
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<th>$\bar{z}_{INT}^a$</th>
<th>$p^b$</th>
<th>Critical values</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>All countries exclude SPA</td>
<td>−2.245</td>
<td>0.034</td>
<td>−2.837</td>
</tr>
<tr>
<td>G7 countries</td>
<td>−1.489</td>
<td>0.085</td>
<td>−2.434</td>
</tr>
</tbody>
</table>

$^a \bar{z}_{INT}$ is the test statistic of Im et al. (1997).
$^b P$-values are constructed based on the bootstrapped distribution.

the G7 sample at the 10% level. Therefore, our finding lends support to the intertemporal model of the current account.

4. Conclusion

Conventional findings based on the ADF test point out that current account balances tend to be nonstationary. However, it is well known that the power of the ADF test is low when the time span is short. Therefore, it is important to determine whether the failure to reject the unit-root null is caused by the low power of unit-root tests in small samples or whether the unit-root null cannot be rejected because it is indeed the correct hypothesis.

To increase the power of the test, we employed the panel data unit root test of Im et al. (1997) to re-examine the stationarity of current account balances. We increase the span of the data by jointly testing for a unit root across a large number of current account balances. In sharp contrast to conventional findings, we find support for the hypothesis of stationary current account balances. The higher power of the Im–Pesaran–Shin test relative to those of conventional unit-root tests helps to explain the reason behind this result. Therefore, our finding supports the validity of the modern intertemporal model of the current account. An important policy implication imbedded in the finding of stationary current account balances is that current account deficits in major industrial countries are sustainable.

Appendix A

This appendix provides a detailed description of the procedure of Bootstrap.

1. We obtain the bootstrap sample of the error term $\epsilon^0_i = [\epsilon^0_{1i}, \epsilon^0_{2i}, \ldots, \epsilon^0_{Ni}]$ by estimating the following system of equations using the iterative seemingly unrelated regression (SUR) method:

$$x_{it} = \alpha_i + \beta_i x_{it-1} + \sum_{j=1}^{w} \gamma_{ij} \Delta x_{it-j} + \epsilon^0_{it}, \; i = 1, \ldots, N,$$

where $\Delta x_{it} = x_{it} - x_{it-1}, \; x_{it}$ has a unit root under the null of $\beta_i = 1$.

2. To preserve the contemporaneous correlation, we follow Maddala and Wu (1998) to resample $\epsilon^0_{it}$ as a vector instead of resampling them individually. We first generate a pseudo-random number

\begin{align*}
\vdots
\end{align*}
from the $U(0,1)$ distribution and then use it to generate a random number integer $h$ that takes on the value $1, \ldots, T$ with equal probability. Once a random number $h$ is generated, we draw a row of fitted residuals $e_t^0 = [e_{1h}^0, e_{2h}^0, \ldots, e_{Nh}^0]$ to obtain $e_t^h$. Repeating this operation $T$ times yields a complete bootstrap sample of the error terms $e_t^h$, $t = 1, \ldots, T$. The bootstrap sample $x_t^h$ for $x_{it}$ is generated as

$$\Delta x_t^h = \sum_{j=1}^{w_i} \hat{\gamma}_j \Delta x_{it-1}^h + e_t^h,$$

where $\hat{\gamma}_j$ are the SUR estimates obtained from step 1. The initial values of $x_{i0}^*$ are obtained by block resampling as described in Berkowitz and Kilian (1996). That is we divide $x_{it}$ into $T - k$ overlapping blocks with length $k + 1$ and randomly select a block with replacement for $x_{i0}^*$.

(3) We compute the $t$-values from demeaned ADF regressions for each group separately:

$$\Delta \bar{x}_{it}^h = \delta_i + \psi_i \bar{x}_{it-1}^h + \sum_{j=1}^{w_i} \beta_j \Delta \bar{x}_{it-j}^h + \text{residual},$$

where

$$\bar{x}_{it}^h = x_{it}^* - \left(1/N\right) \sum_{i=1}^{N} x_{iit}^*$$

and

$$\Delta \bar{x}_{it}^h = \bar{x}_{it}^h - \bar{x}_{iit-1}^h.$$

(4) We construct the $t$-bar statistic, $\bar{z}_{1NT}$, based on (7).

(5) We repeat previous steps 5000 times to derive the empirical distribution of $\bar{z}_{1NT}$.

References


