PANOECONOMICUS, 2016, Vol. 63, Issue 3, pp. 339-358
Received: 14 September 2012; Accepted: 06 October 2015.

UDC 339.7 (1-773+1-775)
DOI: 10.2298/PAN1603339D
Original scientific paper

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The Sustainability of Current Account in the Presence of Endogenous Multiple Structural Breaks: Evidence from Developed and Developing Countries

Summary: The purpose of this study is to test for the sustainability of current account in 18 developed and 10 developing countries. The stability of the relationship between export (inflows) and import (outflows) is assessed using the tests proposed by Mohitosh Kejriwal and Pierre Perron (2010). In particular, the nature of the long-run relationship, when multiple regime shifts are identified endogenously, is analyzed using the residual-based test of the null hypothesis of cointegration with multiple breaks proposed by Kejriwal (2008). The results clearly indicate that, for all countries, (i) the stability tests reject the null of coefficient stability of the long-run relationship between exports and imports; (ii) the cointegration tests that correspond to the number of breaks selected reject the null of cointegration (weak form of sustainability); and (iii) the strong form of sustainability hypothesis is not supported by the data for all countries in most regimes but not for 20 of 28 countries especially in the last regime (the post-2000 era). For eight countries (Canada, New Zealand, Spain, Brazil, Mexico, South Africa, Thailand, and Turkey), the findings may be perceived as a warning to creditors and policymakers unless there are policy distortions or permanent productivity shocks to the domestic economies.

Key words: Cointegration, Current account sustainability, Multiple structural breaks.

JEL: C22, F32.

Current account imbalances and its sustainability have been subjected to a vigorous debate in the world economy over the past couple of decades. The large global current account imbalances due to the ongoing integration of the world economy raised the key question of their sustainability. Dimitris K. Christopoulos and Miguel A. León-Ledesma (2010) pointed out that unsustainable current accounts might end either abruptly by generating debt and exchange rate crises and output collapse or by achieving a soft landing that will inevitably imply investment, consumption, and growth slowdowns. Giancarlo Corsetti, Paolo A. Pesenti, and Nouriel Roubini (1998) also stressed the relevance of current account deficits in speculative currency attacks. According to Craig S. Hakkio (1995), persistent current account deficits tend to have certain harmful effects on the domestic economy. Deficits impose an excessive burden on future generations, who will have to pay back high amounts of accumulated external debts and hence face lower standards of living. Therefore, the current account for an individual country is a barometer for both policymakers and investors, as it represents an indicator of the economic performance (Nicholas Apergis, Konstantinos P. Katrakilidis, and Nicholas M. Tabakis 2000). For example, Jorge Uxó, Jesús Paúl, and Eladio Febrero (2011) indicated that current account imbalances within the eurozone are at the roots of its economic crisis.

Current account sustainability has been most commonly assessed within the intertemporal budget approach. The main purpose of this paper, following Steven Husted (1992), analyzes the current account sustainability based on the intertemporal budget constraint for a group of developed and developing countries, using a new methodology proposed by Kejriwal (2008) and Kejriwal and Perron (2010), not previously applied in this area. The major finding of this study indicates that, for all countries, (a) the stability tests reject the null of coefficient stability of the long-run relationship between exports and imports; (b) the cointegration tests that correspond to the number of breaks selected reject the null of cointegration (weak form of sustainability); and (c) the strong form of sustainability hypothesis is not supported by the data for all countries in most regimes but not for 20 of 28 countries especially in the last regime (the post-2000 era).

The outline of this paper is as follows. Section 1 reviews the literature. Section 2 deals with the analytical framework to treat intertemporal budget constraint in an open economy to get a statistically testable measurement of current account sustainability. Section 3 briefly describes the methodology used to test the current account sustainability. Section 4 contains the empirical results. Section 5 concludes the paper.

1. Literature Review

Malcolm Knight and Fabio Scacciavillani (1998) also stressed that the evolution of economic thinking on current account balance has shifted the focus of analysis from short-term considerations to an intertemporal framework that emphasizes on long-term sustainability. The intertemporal approach is focusing on the long-run current account equilibrium in economies with forward-looking agents, flexible prices, free capital flows, intertemporal saving, and investment decisions of the private sector (Maurice Obstfeld and Keneeth Rogoff 1999). In this approach, the current account is viewed as a solution to the dynamic optimization problem. The intertemporal approach indicates that a country will run a current account deficit only if it expects its net output to increase in the future, unless there are policy distortions or permanent productivity shocks (Manuchehr Irandoust and Boo Sjöö 2000). In this context, the intertemporal approach for exploring current account sustainability is well established in the literature. There are two widespread methods of determining intertemporal sustainability (Ayla O. Binatli and Niloufer Sohrabji 2012). The first method is through the intertemporal benchmark model where the optimal consumption-smoothing current account series is estimated and compared to the actual consumption-smoothing current account. The second method is the intertemporal budget constraint as a sustainability criterion.

Studies on intertemporal budget constraint as a sustainability criterion can be mainly divided into two groups based on the econometric methodologies used. The first group is to test the stationarity of current account series using univariate, panel, and nonlinear unit root tests or the Markov Switching process because the difference stationarity of current account is sufficient to satisfy the intertemporal budget constraint (Michael R. Wickens and Merih Uctum 1993; Peter C. Liu and Evan Tanner 1996; Jyh-Lın Wu 2000; Marzia Raybaudi, Martin Sola, and Fabio Spagnolo 2004; Richard H. Clarida, Manuela Goretti, and Mark P. Taylor 2007; Bong-Han Kim et al. 2009; Christopoulos and León-Ledesma 2010; Mark J. Holmes, Jesus Otero, and Theodore Panagiotidis 2010; Shyh-Wei Chen 2011a, b). The second group is to investigate the long-run relationship between exports (inflows) and imports (outflows) using cointegration tests with or without structural breaks and panel cointegration tests. Apergis, Katrakilidis, and Tabakis (2000), Irandoust and Sjöö (2000), Wu, Show-Lin Chen, and Hsiu-Yun Lee (2001), Augustine C. Arize (2002), Ahmet Z. Baharumshah, Evan Lau, and Stilianos Fountas (2003), Irandoust and Johan Ericsson (2004), Paresh K. Narayan and Seema Narayan (2005), László Kónya (2009), Mark J. Holmes, Theodore Panagiotidis, and Abhijit Sharma (2011), and Binatli and Sohrabji (2012) are among many others who extensively contributed to the literature on the subject. However, the results of both groups are inconclusive and hamper comparability depending on the countries, variable measurement, and the sample size.

However, Baharumshah, Lau, and Fountas (2003) demonstrated that the results based on the procedures accounting for structural breaks are more favorable for the long-run relationship between exports (inflows) and imports (outflows). In general, structural breaks are a problem for time series analysis, since they are usually affected by either exogenous shocks or changes in policy regimes. Therefore, the assumption of stability in the cointegration relationship between exports and imports would seem to be too restrictive, without appropriately accounting for structural changes. This has been an important potential shortcoming of the past researches using conventional cointegration approaches (Vicente Esteve and Cecilio Tamarit 2012). If the analysis is done without accounting for potential instabilities in the long-run relationship between exports and imports, empirical studies may yield misleading and spurious results. In other words, estimated the cointegrating relationships may not be stable and conclusions inferred may be highly misleading.

To avoid the problems discussed hitherto, we test the cointegration relation when multiple regime shifts are identified endogenously. The procedures developed by Kejriwal and Perron (2010) not only enable us to detect parameter instability in cointegration regressions but also allow us to estimate the number of breaks consistently. In particular, the nature of the long-run relationship between exports and imports is analyzed using the residual-based test of the null hypothesis of cointegration with multiple breaks as proposed by Kejriwal (2008). Kejriwal (2008) extended the cointegration test with the known or unknown structural break tests proposed by Yoichi Arai and Eiji Kurozumi (2007) to analyze multiple structural breaks under the null hypothesis of cointegration. Thus, this paper contributes to this literature by using recently developed cointegration techniques, which allow for multiple breaks in the data to test the current account sustainability.

2. A Framework for Testing

The ongoing integration of the world economy with an increase in international trade and capital mobility has contributed to current account sustainability or unsustainability. Thus, the intertemporal approach has become a more appropriate framework in applied literature. The intertemporal approach gained popularity after the works of Hakkio and Mark Rush (1991) and Husted (1992), which are based on whether a nation is satisfying its budget constraint over a defined period.

The theoretical framework for testing the dynamics of the current account is adapted from Husted (1992). Assume a representative agent model of a small open economy that consumes a single traded good over two periods with unlimited access to borrowing and lending on the world capital market and has no government. The agent is assumed to have perfect foresight and maximizes a lifetime utility subject to budget constraints (Jocelyn Horne 2001). The sustainability literature is based on the budget constraint equation. The interest rate is stationary with the unconditional mean r, and there is no restriction on international borrowing and lending. The budget constraint in real terms (as a proportion of nominal GDP) is as follows:

$$c_t = y_t - i_t + b_t - (r_t - r)\, b_{t-1} - (1 + r)\, b_{t-1}, \tag{1}$$

where c_t, y_t, b_t, i_t, and r are consumption, output, international borrowing, investment, and one-period world interest rate, respectively. In the current period, b_t is the inverse of the balance of current account (ca), $-ca$. Defining $z_t = m_t + (r_t - r)b_{t-1}$, we can rewrite Equation (1) as:

$$z_t = x_t - (1 + r)\, b_{t-1} + b_t\,, \tag{2}$$

where m and x are the imports and exports of goods and nonfactor services, respectively. Equation (2) can be solved forward as:

$$m_t + r_t\, b_{t-1} = x_t + \sum_{j=0}^{\infty} \beta^{j+1} (\Delta x_{t+j+1} - \Delta z_{t+j+1}) + \lim_{j\to\infty} \beta^{j+1}\, b_{t+j}\,, \tag{3}$$

where $\beta = 1/(1 + r)$, and Δ is the first difference operator. The left-hand side of Equation (3) represents spending on imports and interest payments on the foreign debt. If x_t is subtracted from both sides of Equation (3) and each side is multiplied by -1, then the left side becomes the country's current account. An additional simplifying assumption, following Husted (1992), is that mm ($mm = m_t + r_t b_{t-1}$) and x are nonstationary processes, each integrated order one. If this is the case, Equation (3) may be rewritten as:

$$mm_t = \alpha + x_t + \lim_{j\to\infty} \beta^{j+1}\, b_{t+j}\,. \tag{4}$$

Lastly, if we assume that the limit term is equal to zero, then rewrite Equation (4) as a standard regression equation:

$$x_t = \mu + \delta\, mm_t + e_t\,. \tag{5}$$

The null hypothesis states that the country satisfies its intertemporal budget constraint. This implies that the country must be able to generate sufficient current account surpluses in the future to repay its debt (Ross S. Guest and Ian M. McDonald 1999). Thus, it is expected that $\delta = 1$, and $\{e_t\}$ is a stationary process. If these necessary and sufficient conditions hold (strong form), then it means that the balance of the current account is equal to zero in the long-run. In other words, current account sustainability is present. Furthermore, Carmela E. Quintos (1995) pointed out that the $\{e_t\}$ is a stationary process that gives us only a necessary condition (weak form) for the intertemporal budget constraint to be obeyed. However, this necessary condition $0 < \delta < 1$ has serious policy implications, because a country that continues to run current account deficits has a high risk of default, and therefore, it would have to offer higher interest rates to service its debt.

3. Econometric Methodology

Cointegration without structural break analysis over full sample periods is inappropriate for investigating sustainability, as it fails to take into account the fact that sustainability is an ongoing process. Christopoulos and León-Ledesma (2010) also pointed out that changes in the agents' perceptions about risk, portfolio allocation decisions, future policy changes, and transaction costs in international financial flows can lead to changes in the dynamics of current account. Thus, traditional tests for the presence of cointegration over the entire sample period would tend to reject the hypothesis that the series are cointegrated if the extent of cointegration changes over time. One approach to assess the process of sustainability is to search for structural breaks that may cause shifts in their long-run relationship.

Recently, Jushan Bai and Perron (1998, 2003) discussed the parameter stability and testing multiple structural changes of unknown timing by minimizing the sum of squared residuals in linear regression models when all variables are stationary. The methodology used in this study is proposed by Kejriwal and Perron (2010), which is related to multiple structural changes of unknown timing in regression models involving nonstationary but cointegrated variables. The global minimization procedure of the break fractions is the same as that of Bai and Perron (1998, 2003), involving an algorithm based on the principle of the dynamic programming. However, the distribution of the break fraction estimates and the distribution of the sub-Wald test statistics are different from the one Bai and Perron (2003) due to the nonstationarity of the time series.

The methodology used in this study starts by investigating the order of integration of both series. The second stage of our analysis consists of assessing the stability of relationship between exports and imports in the long-run using the tests proposed by Kejriwal and Perron (2010). If the empirical applications of the Kejriwal-Perron tests reject the stability of the relationship, then, according to Kejriwal (2008), these tests must be complemented with a cointegration analysis as confirmatory tests to make sure that the relation between exports and imports is not a purely spurious one. The third stage of our analysis consists of assessing the cointegration relationship of exports and imports with multiple breaks using that of Kejriwal (2008), which extends the cointegration test with the one break proposed by Arai and Kurozumi (2007). As a final stage, we compare the parameters of the whole sample period and the sub-periods to see how the relationship between exports and imports may have altered over time. The condition of having achieved sustainability may be different from that of achieving sustainability with endogenous breaks.

3.1 Structural Break Tests

Kejriwal and Perron (2010) considered three types of test statistic for testing multiple breaks. The first is sub-Wald test of the null hypothesis of no structural break *versus* the alternative hypothesis of a fixed number of k breaks:

$$\sup F_T^*(k) = \sup_{\lambda \in \Lambda \varepsilon} \frac{SSR_0 - SSR_k}{\hat{\sigma}^2}, \tag{6}$$

where SSR_0 denotes the sum of squared residuals under the null hypothesis of no breaks; SSR_k denotes the sum of squared residuals under the alternative hypothesis of k breaks; $\lambda = \{\lambda_1, \ldots, \lambda_m\}$ denotes the vector of the break fraction defined by $\lambda_i = T_i/T$ for $i = 1, \ldots, m_i$; and T_i are the break dates.

The second test checks the null hypothesis for no structural breaks against the alternative of an unknown number of breaks, given some upper bound M for the number of breaks, is a double maximum test (*UD-max*):

$$UD\max F_T^*(M) = \max_{1 \leq k \leq m} F_T^*(k). \tag{7}$$

The third test involves a sequential procedure (SEQ) that analyzes the null hypothesis of k breaks against the alternative hypothesis of $k + 1$ breaks:

$$SEQ_T(k+1|k) = \max_{1 \leq j \leq k+1} \sup_{\tau \in \Lambda_{j,\varepsilon}} \left\{ \frac{SSR_T(\hat{T}_1, \ldots, \hat{T}_k) - SSR_T(\hat{T}_1, \ldots, \hat{T}_{j-1}, \tau, \hat{T}_j, \ldots, \hat{T}_k}{SSR_{k+1}} \right\}, \tag{8}$$

where $\Lambda_{j,\varepsilon} = \{\tau : \hat{T}_{j-1} + (\hat{T}_j - \hat{T}_{j-1})\varepsilon \leq \tau \leq \hat{T}_j - (\hat{T}_j - \hat{T}_{j-1})\varepsilon\}$. The model with k breaks is obtained by a global minimization of the sum of squared residuals, as in Bai and Perron's (1998) study. Kejriwal (2008) also used two alternatives to the SEQ to select the number of breaks, namely, the Bayesian Information Criterion (BIC) and the modified Schwarz criterion (LWZ).

In this study, the stability analysis of the relationship between exports and imports, following Kejriwal (2008), using the SEQ (S) as well as the information criteria to investigate the existence of breaks in the export regressions, is employed.

3.2 Cointegration Tests with and without Structural Changes

The conventional test used in this study allows us to test for a linear combination of exports and imports. One of the most widely used and straightforward cointegration tests is the Yongcheol Shin (1994) C_μ statistics constructed from the Dynamic Ordinary Least Squares (DOLS) residuals, adding the leads and lags of the first differences of the regressors.

Kejriwal and Perron (2010) showed that the structural change tests they suggested have good size and power properties. As pointed out by Kejriwal (2008), the conventional cointegration tests are biased towards the non-rejection of the null hypothesis of no cointegration when the cointegrating relation is unstable. Therefore, the findings in the literature of no cointegration for the variables may be due to structural changes in the cointegrating vector. In this sense, cointegration analysis should consider the structural changes. Allan W. Gregory and Bruce E. Hansen (1996) developed residual-based tests for the null of no cointegration against several alternative hypotheses of cointegration subject to one shift in the cointegration vector at an unknown time. However, these tests are developed to have power against the alternative of a single break and therefore can have a low power when there is more than a single break in parameters. In addition, the test statistics, which would be based on the minimal values of overall possible breakpoints, are not generally consistent estimates of a break date if a change exists (Kejriwal 2008). Finally, if the primary concern is cointegration with structural breaks, then the null of cointegration is a more natural choice from the viewpoint of conventional hypothesis testing.

To avoid these problems, consequently, Kejriwal (2008) extended the cointegration test with known or unknown one structural break proposed by Arai and Kurozumi (2007) to analyze multiple breaks under the null hypothesis of cointegration. The regime shift model used in this study is written as follows:

$$export_t = c_i + import_t\,\delta_i + u_t \qquad if\ T_{i-1} < t < T_i \qquad for\ i = 1,.....,k+1, \tag{9}$$

where k is the number of breaks, and $import_t$ is a one vector of $I(1)$ regressor and where, by conversion, $T_0 = 0$ and $T_{k+1} = T$. Augmenting the above regression model to deal with the simultaneity bias, we use the DOLS, adding the leads and lags of the first differences of the regressor.

$$export_t = c_i + import_t\,\delta_i + \sum_{j=-l_T}^{l_T} \Delta import_{t-j}\,\Pi_j + u_t^{*}. \tag{10}$$

The test statistic is given by:

$$\widetilde{V}_1(\hat{\lambda}) = \frac{T^{-2}\sum_{t=1}^{T} S_1(\hat{\lambda})^2}{\Omega_{11}}, \tag{11}$$

where Ω_{11} is a consistent estimation of the long-run variance of u_t^{*}, $\hat{\lambda} = (\hat{T}_1/T,......,\hat{T}_k/T)$ and $\hat{T}_1,...,\hat{T}_k$ are obtained by minimizing the sum of squared residuals. The study uses this test considering the number of breaks indicated by the SEQ and the information criteria.

4. Empirical Results

The quarterly data used in this paper are taken from the International Monetary Fund's Balance of Payments Statistics. The sample periods are different across countries depending on the availability of data. The sources and description of the data are in Appendix.

To scrutinize the integrating level of variable, the Serena Ng and Perron (2001) tests that have good size and power properties are employed in the first stage. The results of the Ng and Perron (2001) tests are reported in Appendix Table A1. The null hypothesis of non-stationary cannot be rejected at 1% significance level by any of the tests for all countries. For only Israel and South Africa, a unit root in the export series is rejected at the 10% level but not at the 5% level. The import series are stationary for New Zealand, Norway, Indonesia, and South Africa at 5% level but not at the 1% level. Thus, according to these results, we conclude that all series are $I(1)$.

The second stage is to assess the stability of the long-run relationship. The hypothesis concerns the stability of the long-run relationship between exports and imports (as a percentage of GDP) and runs as follows: there is no structural change in the long-run relationship between exports and imports. The number of breaks selected by SEQ and the information criteria follows Kejriwal (2008). The main results obtained from the application of Kejriwal and Perron methodology are reported in Table 1. First, in all countries, the tests offer evidence in favor of the presence of break(s). Second, the last break is detected at the end of the 1990s and the beginning of 2000 [especially in all countries of the European Union (EU), United States, and Canada]. The tests reject the null hypothesis of no structural change in the long-run relationship for Denmark, Israel, Japan, United States, Indonesia, Peru, Thailand, and Turkey and the information criteria select two or three breaks. In the case of Thailand, SEQ (S) test selects two breaks, a result supported by information criteria and other tests. For Israel, United States, and Indonesia, SEQ and other tests reject stability.

We test for the presence of multiple structural changes in the long-run relationship between exports and imports when the intercept and the slope of the model are allowed to change. This means that these structural changes make a difference in the level and the slopes of the long-run relationship. Therefore, the presence of structural changes, endogenously identified by the data, indicates potentially the structural nature of the observed adjustment without the details of such regime shift. On the contrary, the existence of a regime shift characteristically signals a change in the structure of the economy whose story could not possibly be told fully by the applied model. All in all, it is not always easy to interpret the dates of the structural change. As a consequence, current account sustainability among different regimes can be explained by variations, in policies and macroeconomic fundamentals of the countries, such as changes in exchange rate regimes from fixed to managed or to free float, the accession to free trade areas or other international agreements, financial crisis or liberalization, and external forces such as wars.

In that sense, the existence of structural changes is intuitively associated with significant economic and political occurrences. In general, all countries of the EU in the sample have three structural breaks, reflecting the developments in the EU region such as the second oil price crisis, establishment of the EU in 1992, and introduction of the euro in 1999. For instance, break dates of 1981, 1994, and 2001 in Austria correspond with the second oil price shock, the adjustment in its exchange rate system before full membership in 1995, and after the launch of the euro together with Austria's transition from current account deficit to surplus in 2001. For Spain, the first structural break in 1981 can be attributed to the banking crisis (beginning 1978 to peak 1983) and the second oil price shock, whereas the second break in 1993 can be explained by the currency devaluation, and the last break in 2003 could be associated to the developments of the introduction of the euro. A possible explanation for the break dates of Finland (1989, 1994, and 2003), France (1991, 1996, and 2002), and The Netherlands (1992, 1997, and 2003), which have experienced surpluses in their current accounts, is the stages of the European economic integration. The structural breaks in the United Kingdom coincide with the EU integration such as the accession to free trade areas, European Monetary System (EMS) crisis (1993), and the currency regime change of the EU. The interpretation of the breaks for the remaining developed countries is as follows. The breaks in Canada may be related to the oil price shock, the oil glut experience in 1996, and the foreign demand shock that took place in the aftermath of the Asian crisis. The breaks in the United States reveal the impacts of international debt and oil crisis, the banking crisis (1988), and the 2001 recession, aggravated by the 9/11 2001 attacks in the United States.

When it comes to emerging and developing countries, in the case of Argentina, three structural changes are found. Three breaks call for different types of adjustment in four regimes. The possible explanations of these breaks are the devaluation of 2001, when Argentina defaulted on its foreign debt in 2001, the currency crisis in 2003, and the beginning of Argentina's debt restructuring and repayment that began in 2005. For Brazil, the first break in 1994 can be attributed to the banking crisis, and the second break is associated with policy changes following the 2002 election, and the last break in 2007 is probably related to economic recession due to the global financial crisis and the resulting weak demand of its trading partners. The break dates of 1986, 1990, and 1995 in Mexico may correspond with the currency, debt, and again currency crisis, respectively. Last, in the case of Turkey and Thailand, two structural breaks are found. The breaks in Thailand correspond to the 1997 Asian financial crisis, which started with the devaluation of Thailand's baht and the negative contributions of net foreign demand to growth in 2005. The first break in Turkey in 1994 is probably related to the currency crisis or the introduction of customs union with the EU in 1995, and the second one in 2004 could be explained by the beginning of an economic growth period that was not only due to an increasing foreign demand but also due to a revival of domestic demand following an economic and financial crisis in 2001.

The next stage is to confirm the presence of cointegration between exports and imports series and to ensure that the rejection the null hypothesis of stability is indeed derived from the existence of a cointegration relationship with multiple breaks and not from a purely spurious regression. In this context, when verifying cointegration, first, the conventional no-break and one-break cointegration tests and, second, the cointegration tests with multiple structural breaks based on the Arai-Kurozumi (A-K) framework that correspond to the number of breaks by SEQ and information criteria are used.

The Shin (1994) test results are reported in column 2 of Table 2. For 11 of 28 countries, C_μ test cannot reject the null of cointegration at conventional significance levels. For the remaining 17 countries, there is no cointegration relationship between exports and imports series. These results lead us to conclude that the current accounts of these countries are unsustainable. To examine further the robustness of these results to structural breaks, the Gregory-Hansen (G-H) and A-K cointegration tests are used.

Columns 3 to 5 of Table 2 present the results for the G-H one structural break tests. For comparison purposes, we also give the A-K one structural break tests in both intercept and slope (regime shift model) in column 6. Columns 8 to 11 give the multiple structural break tests in both intercept and slope of the augmented A-K cointegration test. The results of the G-H tests reject the null hypothesis of no cointegration, except for France, Germany, Italy, Spain, United States, Brazil, Chile, Peru, Mexico, and South Africa, at the conventional significance levels. Conventional tests such as the G-H tests confirm no cointegration relation for France, Germany, Italy, Spain, Norway, Mexico, and Peru. However, the results of the A-K cointegration test rejects the null hypothesis of cointegration with a single break only for Israel at the 1% level, for France, Argentina, Brazil, Indonesia, and Thailand at the 5% level, and for Mexico at the 10% level. In short, the G-H and A-K test results for one break are consistent at all conventional significance levels for 17 countries and certainly contradict each other for Germany, Israel, Italy, Norway, Spain, United States, Chile, Indonesia, Peru, South Africa, and Thailand. This shows that multiple structural changes help to explain the exceptions of no cointegration.

The results of the A-K cointegration test with two breaks indicates that the test $\tilde{V}_2(\hat{\lambda})$ rejects the null of cointegration for The Netherlands, United Kingdom, Mexico, and Peru at the 5% level and for South Korea, Sweden, Indonesia, and South Africa at the 10% level only. Finally, the test $\tilde{V}_3(\hat{\lambda})$ indicates that the null hypothesis is rejected for only Sweden at the 1% level, for only 4 (Italy, The Netherlands, United States, and Indonesia) of 23 countries at the 5% level, and for France, Finland, and Spain at only the 10% level.

To sum up, the above-mentioned analysis shows that there is evidence of a long-run relationship between exports and imports series for all countries when one or more structural breaks are allowed. These results support the weak form of current account sustainability.

The final stage of analysis is to compare the coefficients obtained from a break model to those obtained from the full sample. The results are reported in Table 3. Columns 3 to 10 of Table 3 show the parameter estimates for the sub-periods, whereas column 12 gives the coefficient estimates from a model without any structural breaks. For Australia, the estimated slope parameters in the two-break model has a tendency to increase over time. It is very small (0.38) in the first regime but increases to 0.84 in the second regime and to 1.05 in the third regime. Furthermore, the coefficients for the last two regimes are higher than the full sample estimate from the cointegration regression without structural breaks in column 12 of Table 3. The estimates show that, for Australia, the slope estimate is significant in all regimes at the 1% level. Moreover, the *t* statistics indicate that the slope coefficients are statistically equal to one in the last two regimes. This confirms that ignoring regime changes may cause an understatement for the long-run cointegration relationship between exports and imports. In sum, the results show the evidence of a significant relationship between exports and imports series when the existence of different regimes is allowed. Moreover, Australia holds the necessary and sufficient conditions (strong form) in the last two regimes because the variables have a cointegrating relation and the estimated coefficients are very close one, whereas, in the first regime (stating 1970:Q1 and ending in 1991:Q1 before banking crisis), only the necessary condition holds (weak form). This finding indicates that Australia satisfies its intertemporal constraint and current account is sustainable in the long-run.

Table 1 Structural Break Tests

Specification[a]; y_t = {export$_t$}, z_t = {import$_t$}, q = 2, m = 5, e = 0.15, x_t = 0, p = 5

	Sub F_T					***UDmax***	**S**	**BIC**	**LWZ**
T	1	2	3	4	5				
Advanced economies									
Australia	9.62	6.23	4.62	3.77	2.92	9.62	0	2	1
Austria	6.69	8.77	8.40#	6.46	3.96	8.77	0	3	3
Canada	6.96	5.48	5.97	5.11	4.10	6.96	0	3	3
Denmark	11.28#	6.67	5.89	4.49	3.93	11.28#	0	3	3
Finland	5.99	7.08	5.51	4.13	3.31	7.08	0	3	3
France	6.34	4.66	4.36	4.03	2.89	6.34	0	4	3
Germany	4.17	3.90	4.87	4.45	3.16	4.87	0	4	3
Israel	13.88*	12.01*	8.39#	7.09#	6.17#	13.88*	1	2	1
Italy	6.01	3.97	3.22	2.48	2.19	6.01	0	3	1
Japan	10.41#	6.58	5.48	4.26	3.53	10.41	0	3	1
South Korea	6.93	5.65	4.31	3.46	2.18	6.93	0	3	2
The Netherlands	5.19	8.02	6.45	6.11	5.04	8.02	0	3	2
New Zealand	7.79	5.91	4.91	3.78	3.27	7.79	0	2	2
Norway	9.59	5.92	6.65	5.53	4.99	9.59	0	3	3
Spain	4.47	3.73	3.66	3.52	2.81	4.47	0	5	3
Sweden	7.15	7.24	7.07	6.32	5.45#	7.24	0	3	2
United Kingdom	7.20	6.90	6.06	4.94	3.98	7.20	0	3	2
United States	29.57**	3.07	2.59	1.99	1.73	29.57**	1	3	3
Emerging and developing economies									
Argentina	8.41	7.21	7.65	12.39**	8.47**	12.39*	0	4	3
Brazil	3.89	3.03	5.78	6.00	3.95	6.00	0	4	3
Chile	5.45	6.48	7.05	9.88**	9.36**	9.88	0	4	3
Indonesia	12.85*	12.87*	8.99*	15.21**	8.25**	15.21*	1	4	2
Mexico	5.12	4.35	4.26	3.38	2.84	5.12	0	3	2
Peru	10.70#	11.22*	9.87*	8.79**	6.59*	11.22#	0	3	2
Philippines	9.22	6.87	7.04	5.75	5.11	9.22	0	3	3
South Africa	3.83	4.05	3.56	3.35	2.77	4.05	0	4	2
Thailand	14.02*	14.83**	15.96**	9.78**	15.20**	15.96*	2	2	2
Turkey	10.56#	6.84	4.94	3.78	3.12	10.56#	0	2	1

Note: [a] q: number of regressors whose coefficients are allowed to change (intercept and slope); p: number of first differenced regressors used for DOLS estimation; and m: maximum number of structural changes allowed. Critical values are taken from Kejriwal and Perron (2010). **,* , and # denote significance at the 1%, 5%, and 10% levels, respectively.

Source: The authors.

Table 2 Shin, G-H, and A-K Cointegration Break Tests

	Shin[a]	G-H one break[b]			A-K one break[c]		A-K two breaks[c]			A-K three breaks[c]			
	C_μ	Z_t^*	Z_α^*	ADF_t^*	$\tilde{V}_1(\hat{\lambda})$	$\hat{\lambda}_1$	$\tilde{V}_2(\hat{\lambda})$	$\hat{\lambda}_1$	$\hat{\lambda}_2$	$\tilde{V}_3(\hat{\lambda})$	$\hat{\lambda}_1$	$\hat{\lambda}_2$	$\hat{\lambda}_3$
Advanced economies													
Australia	0.24#	-5.16*	-47.95*	-5.34*	0.040	0.52	0.053	0.52	0.81	—	—	—	—
Austria	0.14	-5.27*	-45.24#	-2.70	0.119	0.28	—	—	—	0.036	0.28	0.59	0.78
Canada	0.20	-6.08**	-60.74**	-4.66	0.058	0.73	—	—	—	0.044	0.23	0.38	0.75
Denmark	0.39*	-5.13*	-47.44*	-5.25*	0.064	0.33	—	—	—	0.044	0.31	0.53	0.69
Finland	0.28#	-6.32**	-52.57*	-4.25	0.102	0.55	—	—	—	0.058#	0.39	0.55	0.80
France	0.63**	-4.23	-33.08	-4.44	0.222*	0.61	—	—	—	0.073#	0.45	0.62	0.77
Germany	0.25#	-3.39	-21.51	-3.53	0.102	0.49	—	—	—	0.032	0.33	0.49	0.77
Israel	0.45*	-8.32**	-91.83**	-4.95#	0.357**	0.32	0.048	0.32	0.82	—	—	—	—
Italy	0.26#	-4.37	-34.13	-4.59	0.101	0.54	—	—	—	0.065*	0.35	0.53	0.78
Japan	0.98**	-5.99**	-54.06*	-5.42*	0.074	0.74	—	—	—	0.031	0.17	0.31	0.74
South Korea	0.67**	-5.02*	-40.69	-4.78#	0.096	0.62	0.079#	0.38	0.62	0.047	0.18	0.37	0.62
The Netherlands	0.23	-5.36*	-46.21#	-3.77	0.078	0.47	0.106*	0.47	0.77	0.104*	0.47	0.61	0.77
New Zealand	0.15	-6.14**	-49.92*	-6.14**	0.089	0.73	0.056	0.54	0.73	—	—	—	—
Norway	1.12**	-4.91#	-38.23	-4.28	0.060	0.69	—	—	—	0.036	0.19	0.33	0.65
Spain	0.25#	-3.65	-22.81	-3.88	0.064	0.80	—	—	—	0.053#	0.16	0.51	0.80
Sweden	0.15	-8.22**	-88.03**	-4.14	0.092	0.74	0.069#	0.34	0.74	0.115**	0.29	0.44	0.74
United Kingdom	0.38*	-5.26*	-43.10#	-5.20*	0.109	0.33	0.130*	0.33	0.49	0.052	0.33	0.49	0.66
United States	0.11	-2.30	-10.94	-3.91	0.074	0.72	—	—	—	0.072*	0.28	0.43	0.72
Emerging and developing economies													
Argentina	0.09	-3.33	-20.04	-4.82#	0.171*	0.49	—	—	—	0.042	0.43	0.58	0.80
Brazil	0.18	-2.65	-12.91	-3.21	0.160*	0.57	—	—	—	0.056	0.16	0.57	0.83
Chile	0.11	-4.37	-28.99	-4.35	0.093	0.82	—	—	—	0.037	0.16	0.49	0.82
Indonesia	0.87**	-6.07**	-50.26*	-5.77**	0.183*	0.44	0.077#	0.37	0.67	0.066*	0.22	0.39	0.67
Mexico	0.27#	-3.72	-24.11	-4.97*	0.194#	0.23	0.100*	0.24	0.53	0.059	0.17	0.31	0.46
Peru	0.56**	-4.64	-34.32	-4.62	0.105	0.37	0.097*	0.38	0.82	0.050	0.38	0.62	0.86
Philippines	0.69**	-6.29**	-60.23**	-6.26**	0.067	0.70	—	—	—	0.043	0.15	0.44	0.69
South Africa	0.14	-4.01	-28.06	-4.07	0.093	0.48	0.106#	0.18	0.38	0.038	0.15	0.30	0.49
Thailand	0.18	-6.83**	-58.53**	-5.69**	0.210*	0.24	0.062	0.24	0.69	—	—	—	—
Turkey	0.27#	-5.54**	-49.55*	-5.70**	0.058	0.71	0.055	0.37	0.71	—	—	—	—

Note: [a] Critical values are taken from Shin (1994), and 1%, 5%, and 10% critical values are equal to 0.53, 0.31, and 0.23, respectively. [b] Critical values are taken from Gregory and Hansen (1996). [c] Critical values are obtained by simulations using 500 steps and 2000 replications. **, * , and # denote significance at the 1%, 5%, and 10% levels, respectively.**

Source: The authors.

In the case of Canada, the estimates of the three-break model show that the slope estimates are significant in all regimes. The coefficients for the first two regimes are much smaller (0.69 and 0.62) than the full sample estimate (1.21), whereas the last two regime coefficients are higher (1.24 and 1.58). The *t* statistics indicate that the slope coefficients are statistically different from one in the last two regimes but not in the first and second regimes. This implies that Canada's current account is still weakly sustainable in the last two regimes because of the faster rise in Canadian exports relative to the imports but has a strong form of sustainability in the first and second regimes. The coefficient estimates in three of four regimes for Denmark and Germany and in two of four regimes for Finland are smaller than the full sample value.

Table 3 Estimated Regression under Structural Break Tests

		c_1	c_2	c_3	c_4	δ_1	δ_2	δ_3	δ_4	$\hat{T}_1$, $\hat{T}_2$, $\hat{T}_3$	δ_1^{DOLS}
Advanced economies											
Australia	*(L)*	0.09** (0.004)	0.02** (0.004)	—	—	0.37** (0.129)	0.77** (0.148)	—	—	91:Q1	0.76** (0.084)
	(B)	0.08** (0.003)	0.00 (0.005)	-0.07** (0.006)	—	0.38** (0.124)	0.84** (0.227)	1.05** (0.279)	—	91:Q1–02:Q4	—
Austria	*(B,L)*	0.10** (0.006)	-0.01* (0.005)	-0.06** (0.007)	-0.06** (0.006)	0.67** (0.131)	1.03** (0.249)	1.08** (0.151)	1.15** (0.133)	81:Q3–94:Q1–01:Q2	1.15** (0.060)
Canada	*(L,B)*	0.01** (0.002)	0.03** (0.002)	-0.03** (0.001)	-0.06** (0.002)	0.69** (0.232)	0.62# (0.335)	1.24** (0.093)	1.58** (0.231)	79:Q3–85:Q4–00:Q2	1.21** (0.081)
Denmark	*(L,B)*	-0.01** (0.007)	-0.15** (0.009)	-0.09** (0.010)	0.04** (0.007)	0.95** (0.197)	1.36** (0.210)	1.19** (0.231)	0.98** (0.147)	87:Q4–95:Q1–00:Q2	1.30** (0.108)
Finland	*(L,B)*	-0.02 (0.012)	-0.32** (0.018)	-0.24** (0.015)	0.02 (0.016)	1.01** (0.422)	1.87** (0.648)	1.80** (0.624)	1.04** (0.326)	89:Q2–94:Q4–03:Q2	1.40** (0.246)
France	*(L)*	0.06** (0.004)	0.04** (0.007)	0.11** (0.007)	0.09** (0.006)	0.78** (0.167)	0.88* (0.351)	0.72* (0.316)	0.74** (0.213)	91:Q2–96:Q4–02:Q2	0.93** (0.137)
Germany	*(L)*	0.03** (0.009)	0.09** (0.013)	-0.02* (0.009)	-0.13** (0.011)	0.92** (0.206)	0.86 (0.587)	1.03** (0.206)	1.39** (0.235)	84:Q3–88:Q2–01:Q3	1.22** (0.113)
Israel	*(S,L)*	-0.24** (0.014)	-0.10** (0.009)	—	—	1.26** (0.142)	1.20** (0.168)	—	—	84:Q3	0.75** (0.155)
	(B)	-0.23** (0.012)	-0.13 (0.09)	0.04* (0.016)	—	1.24** (0.124)	1.25** (0.165)	0.99** (0.327)	—	84:Q3–03:Q4	—
Italy	*(L)*	0.08** (0.006)	0.16** (0.007)	—	—	0.62# (0.315)	0.47* (0.207)	-	—	93:Q4	0.88** (0.151)
	(B)	0.14** (0.007)	0.04** (0.010)	0.14** (0.009)	0.06** (0.009)	0.43 (0.368)	0.77 (0.664)	0.56 (0.382)	0.77* (0.343)	87:Q4–93:Q4–02:Q4	—
Japan	*(L)*	0.08** (0.004)	0.02** (0.007)	—	—	0.52** (0.176)	1.09** (0.231)	—	—	01:Q1	0.95** (0.169)
	(B)	0.07** (0.007)	0.06** (0.008)	0.06** (0.005)	0.02** (0.006)	0.56 (0.323)	0.74* (0.319)	0.69# (0.390)	1.10** (0.200)	83:Q1–87:Q4–01:Q4	—
South Korea	*(L)*	0.28** (0. 016)	0.023 (0.020)	0.11** (0.016)	—	0.24 (0.265)	0.23 (0.736)	0.82** (0.220)	—	89:Q2–97:Q3	0.99** (0.200)
	(B)	0.15** (0.022)	0.37** (0.022)	0.20** (0.029)	0.11** (0.015)	0.55 (0.341)	0.04 (0.550)	0.30 (0.720)	0.83** (0.220)	82:Q4–89:Q1–97:Q3	—
The Netherlands	*(L)*	-0.13** (0.005)	0.15** (0.006)	0.06** (0.007)	—	1.26** (0.101)	0.83** (0.097)	1.01** (0.104)	—	92:Q2–03:Q1	1.16** (0.063)
	(B)	0.14** (0.005)	0.04** (0.009)	0.11** (0.008)	0.05** (0.007)	1.27** (0.099)	1.15** (0.228)	0.88** (0.198)	1.02** (0.101)	92:Q2–97:Q4–03:Q1	—
New Zealand	*(L,B)*	0.07** (0.005)	-0.08** (0.009)	0.22** (0.008)	—	0.66** (0.207)	1.12** (0.408)	0.28 (0.232)	—	00:Q1–04:Q2	0.74** (0.194)
Norway	*(L,B)*	0.20** (0.028)	0.13** (0.032)	0.21** (0.021)	0.02 (0.020)	0.60 (1.522)	0.63 (1.513)	0.58 (0.824)	1.32* (0.669)	85:Q4–90:Q2–01:Q2	0.25 (1.104)
Spain	*(L)*	0.16** (0.001)	0.22** (0.009)	0.08** (0.009)	0.18** (0.011)	0.01 (0.665)	0.02 (0.576)	0.70** (0.212)	0.36 (0.305)	81:Q1–93:Q2–03:Q2	0.74** (0.076)
Sweden	*(L)*	0.03** (0.004)	-0.18** (0.004)	0.02** (0.005)	—	0.89** (0.207)	1.48** (0.073)	1.18** (0.099)	—	90:Q4–02:Q4	1.48** (0.057)
	(B)	0.03** (0.004)	0.05** (0.006)	0.12** (0.004)	0.01** (0.005)	0.89** (0.194)	1.08** (0.377)	1.34** (0.111)	1.18** (0.091)	89:Q2–93:Q4–02:Q4	—
United Kingdom	*(L)*	-0.02** (0.006)	0.12** (0.009)	0.02** (0.005)	—	1.06** (0.168)	0.61 (0.397)	0.92** (0.127)	—	87:Q3–93:Q1	0.81** (0.201)
	(B)	-0.02** (0.006)	0.12** (0.008)	0.04** (0.008)	0.01 (0.006)	1.08** (0.154)	0.63# (0.364)	1.08** (0.416)	0.98** (0.130)	87:Q3–93:Q1–99:Q2	—
United States	*(S)*	0.01** (0.000)	-0.01** (0.000)	—	—	0.64** (0.040)	0.88** (0.058)	—	—	00:Q2	0.58** (0.108)
	(L,B)	0.01** (0.001)	-0.02** (0.002)	0.01** (0.001)	-0.01** (0.001)	0.79# (0.413)	1.42 (1.208)	0.57 (0.347)	0.87** (0.210)	83:Q4–89:Q2–00:Q1	—

Emerging and developing economies											
Argentina	*(L)*	-0.01**	-0.06**	0.04**	-0.01**	0.85*	2.37**	0.56	1.20**	00;Q4-03:Q2–06:Q4	1.66**
		(0.002)	(0.003)	(0.003)	(0.003)	(0.374)	(0.298)	(0.774)	(0.461)		(0.128)
Brazil	*(L)*	0.03*	-0.01	0.02*	-0.05**	0.79	0.81**	0.97	1.24#	94:Q3–02:Q2–07:Q2	1.13**
		(0.012)	(0.007)	(0.009)	(0.011)	(0.938)	(0.284)	(0.638)	(0.716)		(0.402)
Chile	*(L)*	0.30**	0.04**	-0.20**	0.15**	-0.05	0.86**	1.51**	0.67**	98:Q4–03:Q2–07:Q4	1.34**
		(0.011)	(0.007)	(0.009)	(0.010)	(0.680)	(0.224)	(0.245)	(0.186)		(0.079)
Indonesia	*(S)*	-0.13**	-0.02**	—	—	1.34**	1.15**	—	—	99:Q2	1.26**
		(0.008)	(0.007)			(0.084)	(0.141)				(0.182)
	(L)	-0.01	0.01	0.05**	—	0.94**	1.08**	0.87**	—	97:Q1–03:Q4	—
		(0.007)	(0.008)	(0.007)		(0.279)	(0.073)	(0.170)			
	(B)	0.07**	-0.10**	0.00	0.06**	0.69	1.21**	1.13**	0.86**	94:Q4–98:Q2–03:Q4	—
		(0.009)	(0.010)	(0.008)	(0.007)	(0.692)	(0.086)	(0.101)	(0.169)		
Mexico	*(L)*	0.01**	-0.04**	0.02**	—	0.93	1.46**	0.71**	—	88:Q3–97:Q1	0.98**
		(0.003)	(0.003)	(0.003)		(0.490)	(0.280)	(0.00)			(0.033)
	(B)	0.06**	0.11**	0.07**	0.03**	-0.19	-0.79	0.87#	0.60#	86:Q2–90:Q4–95:Q1	—
		(0.004)	(0.004)	(0.004)	(0.002)	(0.849)	(1.267)	(0.483)	(0.334)		
Peru	*(L)*	-0.01	-0.15**	-0.00	—	0.76#	1.59**	0.97**	—	98:Q3–06:Q4	1.32**
		(0.008)	(0.007)	(0.011)		(0.392)	(0.239)	(0.315)			(0.340)
	(B)	0.04**	0.03**	-0.07**	0.08**	0.53	0.76	1.30**	0.68**	98:Q3–03:Q1–07:Q2	—
		(0.007)	(0.009)	(0.009)	(0.012)	(0.351)	(0.593)	(0.239)	(0.295)		
Philippines	*(L,B)*	0.08**	0.13**	-0.04**	0.10**	0.55	0.58**	1.02**	0.85**	85:Q4–94:Q2–01:03	1.04**
		(0.016)	(0.012)	(0.012)	(0.011)	(0.426)	(0.204)	(0.125)	(0.104)		(0.091)
South Africa	*(L)*	0.05**	0.06**	0.02**	—	0.27	0.22	0.64**	—	76:Q3–89:Q3	0.57**
		(0.004)	(0.003)	(0.002)		(0.496)	(0.379)	(0.140)			(0.143)
	(B)	0.05**	0.14**	0.03**	0.02**	0.25	0.74	0.63	0.64**	76:Q3–82:Q3–90:Q1	—
		(0.004)	(0.004)	(0.004)	(0.002)	(0.489)	(0.710)	(0.784)	(0.139)		
Thailand	*(S,L,B)*	0.11**	0.39**	0.52**	—	0.65	0.46**	0.35	—	97:Q3–05:Q2	1.09**
		(0.022)	(0.016)	(0.019)		(0.754)	(0.159)	(0.253)			(0.226)
Turkey	*(L)*	-0.01	0.14**	—	—	0.99**	0.45	—	—	02:Q4	0.75**
		(0.006)	(0.010)			(0.105)	(0.450)				(0.111)
	(B)	0.09**	0.13**	0.21**	—	0.53	0.58*	0.27	—	94:Q1–02:Q4	—
		(0.009)	(0.009)	(0.010)		(0.579)	(0.249)	(0.451)			

Note: The numbers in parentheses are their standard errors. Absolute *t* statistics for the null that the corresponding coefficients are zero. **, *, and # denote significance at the 1%, 5%, and 10% levels, respectively.

Source: The authors.

For France, New Zealand, and Spain, the results are very different from other advanced economies. In the case of France, the coefficient values are lower than the full sample. The last regime coefficient value is 0.74 (break date 2002:Q2). Because the C_μ test rejects the null hypothesis of cointegration, France does not hold the necessary condition. Nevertheless, the results of A-K cointegration test cannot reject the null hypothesis of cointegration with three breaks and the *t* statistics indicate that the slope coefficients are statistically equal to one in four regimes. France eventually holds the necessary and sufficient conditions (strong form) in all regimes. Spain and New Zealand satisfy both the necessary and sufficient conditions, except the last regime. They satisfy only the necessary condition (weak form) in the last regime (2003:Q2–2011:Q1 and 2004:Q2–2011:Q1, respectively). In sum, all advanced countries, except Canada, New Zealand, and Spain, hold the necessary and sufficient conditions (strong form) in the last regimes (around 2000s).

Although the conventional cointegration test clearly indicates no relationship between exports and imports for Indonesia, Peru, and Philippines, cointegration with multiple structural change tests confirm the long-run relationship. The estimated coefficients show that Indonesia, Philippines, and Peru hold the necessary and sufficient conditions in the last two regimes. For Argentina [in two of the four regimes (first and last)] and Chile (in three of the four regimes), current accounts are strongly sustainable. In contrast, Brazil, Mexico, South Africa, Thailand, and Turkey current account positions have a weak form of sustainability in the last regime. For South Africa, the estimated slope coefficients, in the two- and three-break models, are only statistically different from zero at the 1% level in the last regime and smaller than 1 in all regimes. In the case of Turkey, the estimates of the one- and two-break models shows that the slope estimate is insignificant in the last regime and smaller than that obtained from conventional cointegrating regression in column 12 of Table 3. Therefore, the Turkish economy is said to satisfy the weak form of the intertemporal budget constraint in the long-run and the strong form in the second regime.

5. Conclusion

This paper analyzes the current account sustainability of 28 countries using the Hakkio and Rush (1991) and Husted (1992) models and the new methodology proposed by Kejriwal (2008) and Kejriwal and Perron (2010), which accounts for the multiple breaks of unknown timing in regression models involving non-stationary but cointegrated variables. The assumption of stability in the cointegration relationship between exports and imports would seem too restrictive, without appropriately accounting for structural changes. Thus, it is also important and more useful for both policymakers and academic researchers to consider how an ongoing relationship may have changed in the long-run.

The results show that in the long-run the relationship has changed over time. The striking finding of this study supports a weak form of sustainability over the full sample for all countries in the long-run, whereas 20 of 28 countries have shown a strong form of sustainability especially in the last regime (the post-2000 era). In the case of Australia, sustainability condition is of the weak form at the first regime (1970:Q1–1991:Q1) but of the strong form for the post-1991 era. The results for Canada, New Zealand, Spain, Brazil, Mexico, South Africa, Thailand, and Turkey should also signal as a warning to creditors and policymakers unless there are policy distortions or permanent productivity shocks to the domestic economies. Although this message is reinforced by the assumption of lifetime utility maximization by private agents and perfect asset substitutability between domestic and foreign assets that underpin the key prediction of the current account optimality, it can be also a signal for macroeconomic and financial disequilibria. However, even if the model supports the sustainability of current account (weak or strong form), creditors, economists, and policymakers need to consider additional criteria such as the indicators of external sustainability in their assessment of current account sustainability.

The countries that have current account deficits are at high risk of default because of the faster rise in their imports relative to their exports. On the contrary, the countries with current account surpluses run the risk of accumulating excessive foreign currency. It should be noted that the current account imbalances, based on the financing of deficits or accumulating surpluses, are not unlimited. As a result, to satisfy intertemporal budget constraints, policymakers are compelled to adjust their macroeconomic policies such as exchange rate and trade regimes.

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Appendix

Sources and Description of the Data

The quarterly data are taken from the International Monetary Fund's Balance of Payments. The sample period for different countries are as follows: Argentina 1993:Q1–2011:Q1; Australia 1970:Q1–2010:Q4; Austria, Canada, and South Africa 1970:Q1–2011:Q1; Brazil 1991:Q1–2011:Q1; Chile 1996:Q1–2010:Q4; Denmark, Japan, and The Netherlands 1977:Q1–2011:Q1; United Kingdom, Finland, and Spain 1975:Q1–2011:Q1; France 1975:Q1–2010:Q4; Germany 1971:Q1–2011:Q1; Indonesia 1990:Q1–2010:Q4; Israel 1972:Q1–2011:Q1; South Korea 1976:Q1–2011:Q1; Mexico and Philippines 1981:Q1–2011:Q1; New Zealand 1987:Q1–2011:Q1; Peru 1991:Q1–2010:Q4; Sweden 1980:Q1–2011:Q1; Thailand 1993:Q1–2011:Q1; Turkey 1984:Q1–2011:Q1; United States and Italy 1973:Q1–2011:Q1; and Norway 1979:Q1–2011:Q1. Exports include exports of goods and services taken from the national account of the International Monetary Fund's Balance of Payments series code 1862100..9… and 1862200..9…, and imports include imports of goods and services (series code 1863100..9… and 1863200..9…) plus net transfers and net incomes. Net transfers is equal to transfer credit (series code1862379Z..9…) minus transfer debt (series code 1863379..9…). Net incomes is calculated as the difference between income credits, series code1862300..9…, and income debt, series code 1863300..9… The ratio of the exports and imports to the nominal GDP is calculated as follows: The US dollar-denominated exports and imports are converted to the local currency using the average period exchange rate line (rf) and divided by nominal GDP in local currency (line 99b). Data for Turkey on GDP from 1984:Q1–1988:Q4 are from the State Statistical Institute of Turkey.

Table A1 Unit Root Tests

	Unit root tests series *(Exports)*				Unit root tests series (*Imports*)			
	MZ_{α}^{GLS}	MSB^{GLS}	MZ_{t}^{GLS}	MP_{t}^{GLS}	MZ_{α}^{GLS}	MSB^{GLS}	MZ_{t}^{GLS}	MP_{t}^{GLS}
Advanced economies								
Australia	0.87	0.79	0.69	45.32	0.23	0.89	0.21	48.17
Austria	2.01	1.02	2.06	87.81	2.03	1.35	2.75	149.16
Canada	-1.07	0.57	-0.60	18.03	-1.29	0.56	-0.72	16.74
Denmark	1.37	0.80	1.10	51.08	-0.64	0.47	-0.30	15.76
Finland	-0.04	0.64	0.03	27.26	-2.64	0.34	-0.89	8.38
France	-1.39	0.44	-0.61	12.69	0.64	0.62	0.40	29.51
Germany	1.40	0.54	0.76	26.99	1.62	0.58	0.94	31.06
Israel	-6.36#	0.28	-1.77#	3.88*	-2.05	0.48	-0.99	11.70
Italy	0.10	0.57	0.06	23.14	0.13	0.45	0.06	17.22
Japan	-5.23	0.27	-1.41	5.25	-5.65	0.29	-1.61	4.54
South Korea	-1.58	0.31	-0.48	9.52	-3.32	0.29	-0.99	7.21
The Netherlands	1.05	0.53	0.55	24.55	0.75	0.52	0.39	22.99
New Zealand	-3.38	0.36	-1.22	7.22	-8.31*	0.25*	-2.04*	2.95**
Norway	-3.44	0.34	-1.17	7.09	-9.70*	0.23**	-2.20*	2.53**
Spain	0.71	0.83	0.59	47.37	0.55	0.73	0.40	37.46
Sweden	1.33	0.96	1.27	68.73	0.55	0.62	0.34	29.06

United Kingdom	-3.03	0.36	-1.05	7.80	-3.37	0.32	-1.07	7.17
United States	0.80	0.53	0.43	23.94	1.05	0.80	0.84	47.50
Emerging and developing economies								
Argentina	-1.17	0.57	-0.67	17.52	-0.80	0.61	-0.49	21.05
Brazil	-3.86	0.36	-1.39	6.34	-2.11	0.47	-0.99	11.28
Chile	-0.30	0.71	-0.21	29.86	-0.84	0.62	-0.52	21.47
Indonesia	-3.94	0.36	-1.40	6.22	-10.24*	0.22*	-2.26*	2.42**
Mexico	-0.80	0.50	-0.40	16.31	-0.17	0.61	-0.10	24.23
Peru	-0.66	0.48	-0.32	16.16	0.55	0.61	0.34	28.07
Philippines	-4.35	0.33	-1.45	5.67	-3.28	0.39	-1.27	7.46
South Africa	-6.06#	0.28	-1.70#	4.19*	-9.51*	0.23**	-2.15*	2.71**
Thailand	0.05	0.72	0.04	32.51	-1.24	0.51	-0.63	15.16
Turkey	-2.28	0.45	-1.03	10.51	0.55	0.69	0.37	33.59

Note: **, *, and # denote significance at the 1%, 5%, and 10% levels, respectively.

Source: The authors.