Is the U.S. Current Account Deficit Sustainable? Evidence from a Cointegrated VAR model

Massimo Franchi*

PRELIMINARY VERSION

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Abstract

The aim of this paper is to analyze whether the U.S. current account deficit can be sustained in the long run by a systematic inflow of funds from abroad. Using a cointegrated VAR approach, we find evidence against the existence of such a long-run equilibrium; moreover, we find that both current and financial accounts are non stationary and even though they cointegrate, their balance is still an $I(1)$ process. These results can account for the current devaluation of the dollar and suggest that in the next years there will be a further pressure on both U.S. currency and interest rates.

Keywords: U.S. current account deficit, sustainability, cointegration.

1 Introduction

The growing concern about the sustainability of the U.S. current account deficits is testified by the recent works of a number of authors as Mann (1999, 2002, 2003, 2004), Rubin, Orszag, and Sinai (2004), Rubin and Setser (2004), Summers (2004a,b), Obstefeld and

*E-mail address: massimo.franchi@uniroma1.it.

Rogoff (2000, 2004), Mussa (2004), Truman (2004), IMF (2004a, 2004b), who have expressed serious concerns about the the large, and rapidly growing, stock of external debt of the U.S. economy.

Even though in the last twenty years U.S. has had no difficulty in financing ongoing current account deficits increasing its external debt stock at limited costs, nothing guarantees that this policy is sustainable in the long run. In fact, the limited costs of the existing U.S. debt are associated to two conditions: one is the low level of world interest rates and the second is the dollar's position as reserve currency. As debt stock rises and interest rates return to higher levels, the payments on the existing debt stock could start to exert a small, but still noticeable drag on the economy (Rubin and Setser, 2004). Moreover, the rapid deterioration of U.S. net external debt position could imply a change in foreign investor sentiment about the desirability of holding a large share of U.S. assets in their portfolios and of continuing to provide the net inflow of financial capital (Mann, 2002). On the other hand, the dollar is by definition *the* reserve currency and a reserve currency is such that the investors perceive it almost as risk free; the recent consistent depreciation with respect to the euro and the yen can surely help to lower the trade balance deficit but can equally increase the expectations of future devaluations and by this channel push in the direction of higher returns on U.S. debt. A very important aspect of these very last years, a period which has been labelled as "Bretton Woods Two" by Dooley, Folkerts-Landau, and Garber (2003, 2004b,a), involves the composition of the net capital inflows directed to U.S. from abroad: an increasing portion (roughly 30% in 2003) of the current account deficit is now being financed by foreign central banks rather than by the private sector. More specifically, most Asian banks are building up their reserves: greater portions of their large current account surpluses have been translated into U.S. treasuries and other safe assets and whether this will continue to be the case in the future is a debated issue (Rubin and Setser, 2004).

In this paper we address the issue of the long run sustainability of U.S. current account deficit performing a likelihood analysis of a cointegrated VAR model (Johansen, 1996) derived from some basic accounting definitions in the balance of payments. Our aim is not to provide a structural model of the current account but rather model the aggregated data in a parsimonious way in order to investigate the presence of stable long run relations among them.

A number of studies have analyzed long run relations by the means of cointegration analysis; they include for example Juselius (1995) which studies the long-run foreign transmission effects among Danish and German prices, exchange rates, and interest rates, Juselius (2001) that investigates the monetary transmission mechanism in Italy finding that long run price homogeneity is strongly rejected and Juselius and MacDonald (2004) whose focus is on the long run properties of the key interest-parity conditions between U.S. and Japan and show that they do not hold as stationary relations.

The paper is organized as follows: in section 2 we review some basic accounting definitions of the balance of payments and introduce the notation and the notions of long run equilibrium; in section 3 we describe the historical dynamics of U.S. current and financial accounts; section 4 presents the econometric model and the misspecification analysis, and section 5 describes its cointegration properties. In section 6 we perform a sequence of tests on the cointegrating space in order to address the issue of long run sustainability. The last section concludes and indicates further directions for research.

2 Balance of payments: basic accounting definitions

The balance of payments records the international transactions between one country and the rest of the world; it is divided into the current account CA_t and the capital and financial account CFA_t.

The current account CA_t records the flows due to transactions in goods and services (balance on goods and services), income receipts and payments due to home-country owned assets abroad and foreign-owned assets in the home country (balance on income) and unilateral current transfers due to home-country government grants, pensions and other private remittances (net unilateral current transfers).

The capital and financial account CFA_t is the sum of the capital and the financial accounts; the former records the flows due to net capital account transactions and the latter the flows due to the acquisition/dismission of home-country owned assets abroad (net home-country owned assets abroad) and due to the acquisition/dismission of foreign owned assets in the home country (net foreign-owned assets in the home country).

If we denote by X_t the exports of goods and services and income receipts, by M_t the imports of goods and services and income payments and by TR_t the net unilateral current transfers, then $X_t - M_t$ is the sum of the balance on goods and services and the balance on income and the current account CA_t is written as

$$CA_t = \underbrace{X_t - M_t}_{\text{Goods and services plus income}} + \underbrace{TR_t}_{\text{Unilateral transfers}} \tag{2.1}$$

Let the capital account be denoted by CTR_t, the total financial inflow (the net flow of foreign-owned assets in the home country) be FI_t and the total financial outflow (the net flow of home-country owned assets abroad) TFO_t be decomposed into official reserves R_t and net home-country owned assets abroad other than official reserves FO_t, $TFO_t = FO_t + R_t$; then we write the capital and financial account CFA_t as

$$CFA_t = \underbrace{CTR_t}_{\text{Capital account}} + \underbrace{FI_t - FO_t - R_t}_{\text{Financial account}} \tag{2.2}$$

By the accounting equalities in the balance of payments it holds that[1]

$$CA_t + CFA_t = 0 \tag{2.3}$$

that is, substituting (2.1) and (2.2) into (2.3), that

$$R_t = \overbrace{X_t - M_t + TR_t}^{CA_t} + \overbrace{CTR_t + FI_t - FO_t}^{NCFA_t} \tag{2.4}$$

where R_t denotes the change in home-country official reserves, FO_t the net home-country owned assets abroad other than official reserves and by net capital and financial account $NCFA_t$ we mean $CFA_t - R_t$, that is the financial flows other than official reserves.

The changes in the official reserves measure the imbalances in the current and financial accounts: the positive overall net inflow of funds implied by a surplus in one account which is not compensated by a corresponding deficit in the other, leads to the accumulation of official reserves. On the other hand, the positive overall net outflow of funds derived from a deficit in one account which is not compensated by a corresponding surplus in the other, leads to a decrease in the stock of official reserves.

It is obvious that a situation in which $R_t < 0\,\forall t$ cannot be a steady state of the economy because sooner or later it leads to a zero home-country stock of reserves and thus to the impossibility of paying out with R_t the difference between CA_t and $NCFA_t$; on the other hand, neither the situation in which $R_t > 0\,\forall t$ is a steady state because it implies a persistent deficit (and thus the previous situation) in some other country. Thus $R_t = 0\,\forall t$ is the only steady state equilibrium of the system.

From (2.4) we have that the change in the stock of official reserves is zero either when both CA_t and $NCFA_t$ are in equilibrium or when the imbalance in one of them is compensated by the other; that is

$$R_t = 0 \Leftrightarrow CA_t = -NCFA_t \tag{2.5}$$

[1] In real situations, this sum is not zero due to statistical discrepancy.

We will refer to a situation in which $CA_t = NFCA_t = 0\,\forall t$ with the term *full* long run equilibrium of the balance of payments and with the term long run equilibrium of the balance of payments the situation in which $CA_t = -NCFA_t\,\forall t$.

Notice that only the full long run equilibrium is a steady state: the persistence of a deficit in the trade balance, for example, can be compensated by incoming financial flows from abroad only at the cost of increasing the foreign debt; this would imply a pressure on the exchange rate and on interest rates and modify consequently the trade balance and the rest of the components of the balance of payments. So, strictly speaking, the only stable long run equilibrium relation is the full equilibrium of the balance of payments.

3 The balance of payments of the United States

The next figure displays the historical evolution[2] of the current account as a percentage of the gross domestic product:

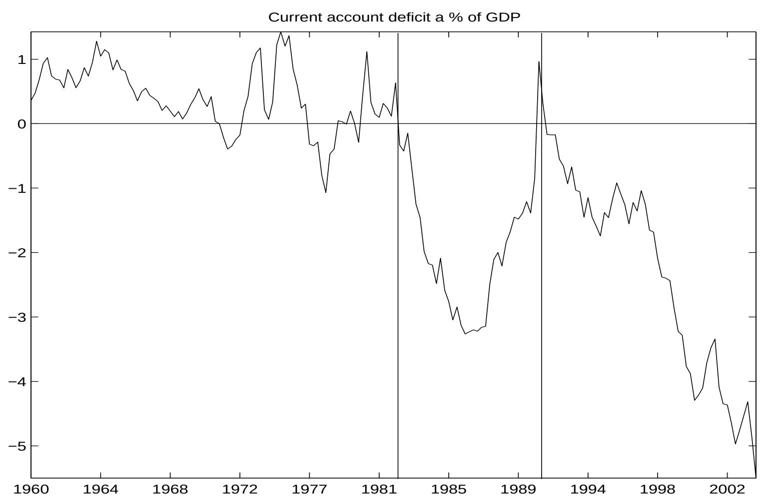

Figure 1: The U.S. current account deficit as a percentage of GDP.

In the period from 1960 to 1982 the current account as a percentage of gdp has almost always fluctuated between zero and one in a stationary fashion. During the first half of the eighties it has deteriorated continuously until roughly minus 3% in 1985; then it has increased continuously in the second half of the decade up to reaching plus 1% in the

[2]See Appendix A for a description of the dataset.

first years of the nineties. Since then a sharper and sharper decline has occurred and the deficit in the current account has gone down to roughly minus 5% of gdp in the second quarter of the 2004. Whether this tendency will be reverted or not is an open issue.

In the next figure we plot the historical path followed by the two components of (2.4), the current account CA_t and the net capital and financial account $NCFA_t$:

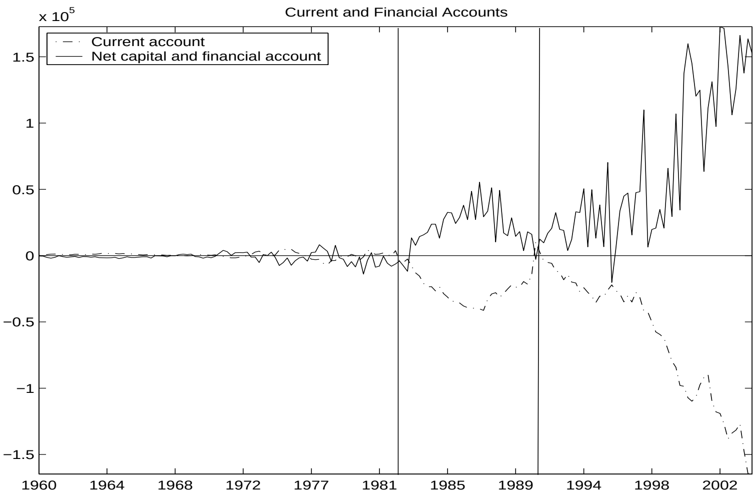

Figure 2: The U.S. current and net capital and financial accounts.

Until the beginning of the eighties CA_t and $NFCA_t$ have fluctuated around zero in a stationary fashion; in the eighties the current account deficit has first increased and then decreased back to equilibrium values at the end of the decade. From the first years of the nineties larger and larger current account deficits have been compensated by large net capital inflows from abroad. Is this dynamics sustainable in the long run?

Mann (2002) points out that: "By the mid-1980s, the accumulation of the current account deficits and net foreign capital inflows had turned the net international investment position of the United States from positive to negative; that is, foreign investors now hold more U.S. assets than U.S. investors hold of foreign assets. The negative net international investment position bears on the question of the sustainability of the current account deficit and the associated inflow of capital. The large stock of financial obligations implies flows of income payments and receipts that must be paid out of the economy's current production and that could get large enough to reduce current consumption and investment. Moreover, even a large economy such as the United States must consider the implications of a change in foreign investor sentiment about the desirability of holding a large share of U.S. assets in their portfolios and of continuing to provide the net inflow of financial capital."

4 Econometric specification and misspecification tests

We specify and estimate the following VAR(3)

$$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-2} + \Pi_3 X_{t-3} + \Phi D_t + \epsilon_t,\ t = 1, \cdots, T \tag{4.1}$$

where the unobservable terms ϵ_t are independent Gaussian with mean zero and variance Ω, the vector of observed variables[3] $X_t = [X_t,\ M_t,\ FI_t,\ FO_t]'$ and D_t contains a constant and a time trend. The sample runs from the first quarter of 1980 to the third quarter of 2004 (99 observations).

As next figure shows, (4.1) provides a satisfactory fit[4] of the actual series:

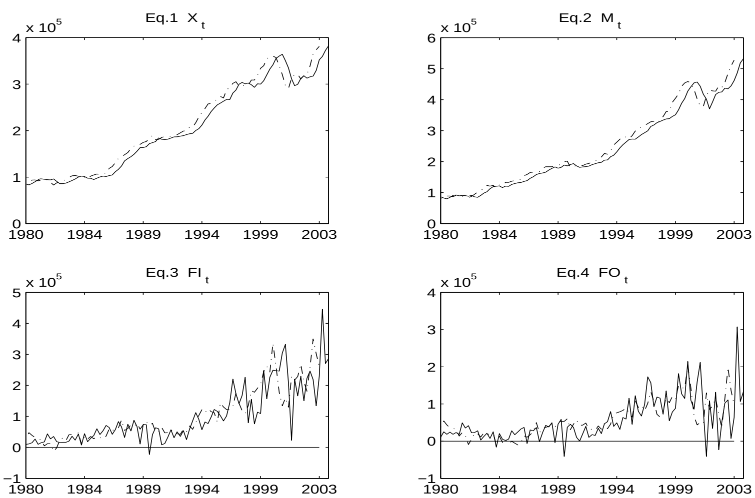

Figure 3: Actual and fitted (dotted line) values.

Since we want to conduct a likelihood analysis of (4.1), we need to check carefully whether the assumption $\epsilon_t \sim N(0, \Omega)$ can be hold as true in this context.

[3] We don't include unilateral transfers TR_t and capital account CTR_t because of their small weight in the balance and because they stem from non strictly economic motivations. Thus we approximate CA_t with trade and income balances and $NCFA_t$ with the financial account, that is $CA_t = X_t - M_t$ and $NCFA_t = FI_t - FO_t$.

[4] The R^2 of the regressions are respectively 0.99, 0.99, 0.84 and 0.62; the F-test for the null hypothesis that all the coefficients except the intercept are zero is strongly rejected in all the equations.

We start from a visual inspection of the plots of the estimated residuals:

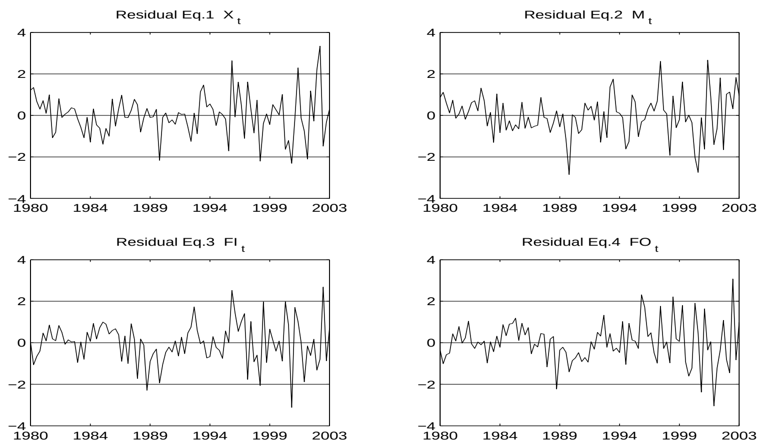

Figure 4: Plots of the estimated residuals.

The standardized residuals in fig.4 all look very satisfactory: the great majority of the observations lies in the interval $[-2, 2]$ except for few values that are more than two standard deviations away from the mean. We thus conclude that there is no need for introducing outliers and dummies in the model.

In the next figure we plot the autocorrelograms of the residuals:

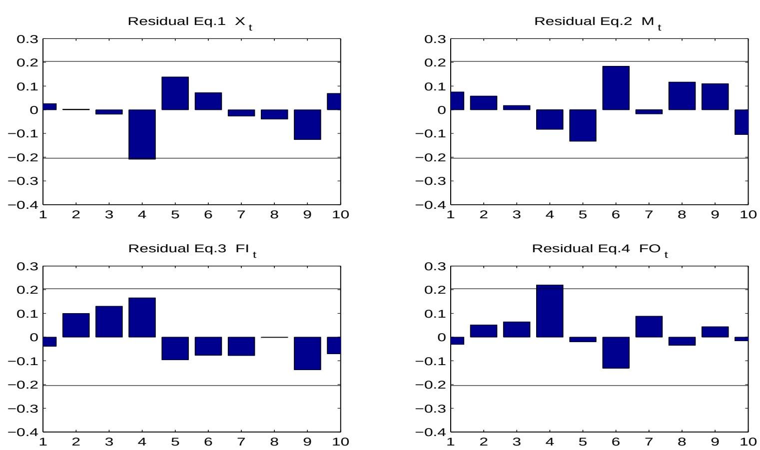

Figure 5: Autocorrelograms of the estimated residuals.

All the autocorrelations lie between the 95% confidence interval; thus, there is no evidence about the presence of autocorrelation in the residuals.

The Ljung-Box test provides a formal test of the null hypothesis of no autocorrelation up to order l; in the next table we report the results:

Autocorrelation: Ljung-Box Test				
Lag	Residual eq.1 X_t	Residual eq.2 M_t	Residual eq.3 FI_t	Residual eq.4 FO_t
1	Accept H_0	Accept H_0	Accept H_0	Accept H_0
2	Accept H_0	Accept H_0	Accept H_0	Accept H_0
3	Accept H_0	Accept H_0	Accept H_0	Accept H_0
4	Accept H_0	Accept H_0	Accept H_0	Accept H_0
5	Accept H_0	Accept H_0	Accept H_0	Accept H_0
6	Accept H_0	Accept H_0	Accept H_0	Accept H_0

Table 1: Ljung-Box test for the null hypothesis of no autocorrelation up to order l at 95% confidence level.

At 95% confidence level the null hypothesis of no autocorrelation is accepted by all the residuals at any lag. We thus conclude that there is no evidence against the independence assumption.

Next we check for the presence of heteroscedasticity in the residuals applying the Engle test for the null hypothesis of no arch effect up to order l:

Heteroscedasticity: Engle Test				
Lag	Residual eq.1 X_t	Residual eq.2 M_t	Residual eq.3 FI_t	Residual eq.4 FO_t
1	Accept H_0	Accept H_0	Accept H_0	Accept H_0
2	Accept H_0	Accept H_0	Accept H_0	Accept H_0
3	Accept H_0	Accept H_0	Accept H_0	Accept H_0
4	Accept H_0	Accept H_0	Accept H_0	Accept H_0
5	Accept H_0	Accept H_0	Accept H_0	Accept H_0
6	Accept H_0	Accept H_0	Accept H_0	***Reject*** H_0

Table 2: Engle test for the null hypothesis of no arch effect up to order l at 95% confidence level.

As table 2 shows, while for the first three residuals the null hypothesis of no arch effect up to order l is accepted for any lag, the residuals from the FO_t equation presents some evidence of residual heteroscedasticity at the sixth lag. However, since these effects are moderate and simulation studies have demonstrated that the (cointegrated) VAR estimates are robust against moderate ARCH effects in the residuals (Juselius, 2003), we conclude that they don't represent a crucial issue for the validity of the analysis.

We now turn to check the plausibility of the normality assumption of the residuals; the next figure plots the histograms of the standardized residuals:

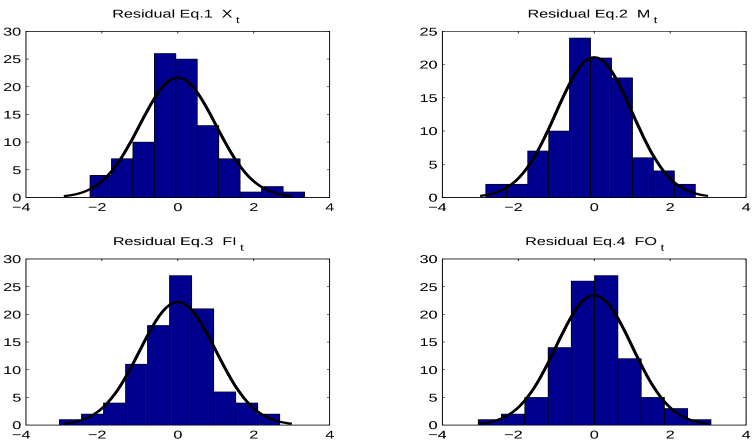

Figure 6: Histograms of the estimated residuals.

As fig.6 shows, there seems not be a great difference between the histograms and the superimposed standard normal density; the eventual differences can be visualized through the QQ-plots[5]:

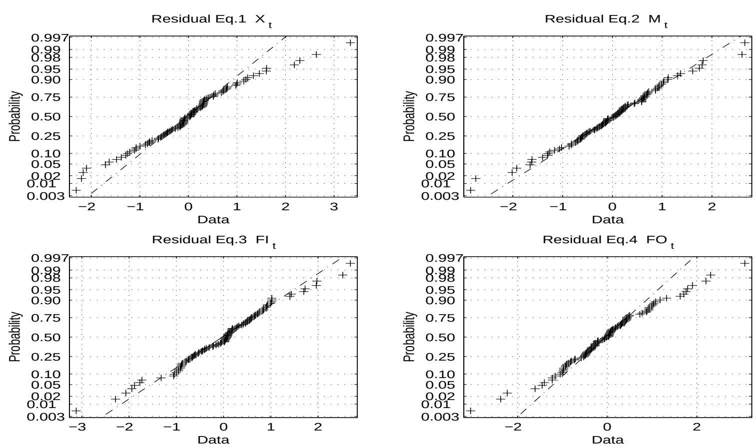

Figure 7: QQ-plots of the estimated residuals.

[5]This view plots the quantiles of the chosen residual against the quantiles of the normal distribution. If the two distributions are the same, the QQ-plot should lie on a straight line. If the QQ-plot does not lie on a straight line, the two distributions differ along some dimension.

While the residuals of the M_t and FI_t equations lie exactly on the straight line, the QQ-plots of the first and the fourth residual are not exactly linear. This indicates that there may be a problem in assuming normality for those residuals.

In order to understand that, we perform the Jarque-Bera test for the null hypothesis of normal distribution; in the next table we report the results and the indexes of skewness and kurtosis of the estimated residuals:

Normality: Jarque-Bera Test				
Lag	Residual eq.1	Residual eq.2	Residual eq.3	Residual eq.4
Jarque-Bera	Accept H_0	Accept H_0	Accept H_0	Accept H_0
Skewness	0.32	-0.14	-0.13	0.15
Kurtosis	4.12	3.69	3.79	4.02

Table 3: Jarque-Bera test for the null hypothesis of normality at 95% confidence level, skewness and kurtosis (normal values 0 and 3).

As table 3 shows, the normality assumption is accepted for all the residuals even though some excess kurtosis seem to be present in all of them.

On the basis of the analysis of the goodness of fit behind fig.3, the graphical analysis in fig.4-7 and the tests' results reported in tab.1-3 we conclude that the assumptions on ϵ_t can be hold as true; thus model (4.1) is correctly specified and the likelihood analysis of cointegration will be consistent with it.

5 Cointegration analysis

We rewrite (4.1) in the error correction form (Johansen, 1996)

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{2} \Gamma_i \Delta X_{t-i} + \Phi D_t + \epsilon_t,\ t = 4, \cdots, T \qquad (5.1)$$

where $\Delta X_t = X_t - X_{t-1}$, $\Pi = \Pi_1 + \Pi_2 + \Pi_3 - I$, $\Gamma_1 = -\Pi_2 - \Pi_3$, $\Gamma_2 = -\Pi_3$, D_t is the deterministic component and $\epsilon_t \sim N(0, \Omega)$.

Under the assumption that $X_t \sim I(1)$, we rewrite (5.1) as a reduced rank regression

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{2} \Gamma_i \Delta X_{t-i} + \Phi D_t + \epsilon_t,\ t = 4, \cdots, T \qquad (5.2)$$

where α and β are the $p \times r$ matrices of full rank r that define the adjustment space $sp(\alpha)$ and the cointegration space $sp(\beta)$.

In order to determine whether the $I(1)$ assumption is correct and if there is evidence of cointegration among the variables, we perform a Johansen LR test; the null hypothesis of an r dimensional cointegration space is tested against the alternative that X_t is a vector of stationary variables:

$$\begin{cases} H(r) : \ rank(\Pi) = r \\ H(p) : \ rank(\Pi) = p \end{cases}$$

Under the null $H(r)$, the LR statistic $-2lnQ(H(r)|H(p))$ has a non standard distribution and critical values have to be computed numerically (Johansen, 1996).

The results are reported in the next table:

Cointegration rank: Johansen LR test				
$p-r$	r	$-2lnQ(H(r)\|H(p))$	$C_{.95}$	result
4	0	99.95	62.61	***Reject*** $H(0)$
3	1	42.03	42.20	Accept $H(1)$
2	2	8.54	25.47	Accept $H(2)$
1	3	0.04	12.39	Accept $H(3)$

Table 4: Johansen LR test for the null hypothesis of r against p cointegrating relations at 95% confidence level. Critical values $C_{.95}$ for the model with restricted linear trend as in CATS, new version.

We strongly reject that $r = 0$ while we accept that there may be at most one, two or three cointegrating relations.

In order to estimate the exact number of cointegrating relations we perform the Johansen maximum eigenvalue test; the null hypothesis of an r dimensional cointegration space is tested against the alternative that its dimension is $r + 1$:

$$\begin{cases} H(r) & : \ rank(\Pi) = r \\ H(r+1) & : \ rank(\Pi) = r + 1 \end{cases}$$

Under the null $H(r)$, the LR statistic $-2lnQ(H(r)|H(r + 1))$ has a non standard distribution and critical values have to be computed numerically (Johansen, 1996).

From tab.4 we know that there are at most three cointegrating relations; thus we need to test $r = 0$ against $r = 1$, $r = 1$ against $r = 2$ and $r = 2$ against $r = 3$: if we reject the first two hypothesis and accept the third, the dimension of the cointegrating space is equal to two.

This is indeed the case, as the results reported in the next table show:

Cointegration rank: Johansen λ_{max} test				
$p - r$	r	$-2lnQ(H(r)\|H(p))$	$C_{.95}$	result
4	0	60.08	32.27	***Reject*** $H(0)$
3	1	33.49	25.99	***Reject*** $H(1)$
2	2	8.50	19.48	Accept $H(2)$

Table 5: Johansen λ_{max} test for the null hypothesis of r against $r + 1$ cointegrating relations at 95% confidence level. Critical values for the model with restricted linear trend as in CATS, new version.

We thus conclude that (5.2) is a reduced rank regression model that embeds a cointegrating space of dimension $r = 2$.

The maximum likelihood estimate of the cointegrating space $sp(\beta)$ and of the corresponding adjustment space $sp(\alpha)$ is derived applying the Johansen procedure (Johansen, 1996) and it is reported in the next table:

Johansen procedure			
Basis of $sp(\beta)$		Basis of $sp(\alpha)$	
1.00	-1.00	-0.22	0.05
-0.97	0.07	-0.24	0.06
0.88	-0.12	-1.58	-1.37
-0.71	0.94	-0.51	-1.53

Table 6: The maximum likelihood estimate of the cointegrating space $sp(\beta)$ and of the adjustment space $sp(\alpha)$.

It is important to emphasize that the specific cointegrating vectors and corresponding adjustment coefficients in tab.6 have no economic interpretation: the estimated β (and α) form a basis of the cointegrating (the adjustment) space and thus any r vectors that span the same space could be equally chosen without changes in the value of the likelihood function.

Economic questions about the long run relations among the variables in (4.1) can be investigated specifying and testing linear hypothesis on the coefficients β.

The restrictions[6] are specified through a $4 \times q$ matrix R of rank q and the the null hypothesis is tested against the alternative of no restrictions on β:

$$\begin{cases} H_0 & : \ R'\beta = 0 \\ H(r) & : \ \beta \text{ unrestricted} \end{cases} \tag{5.3}$$

Under the null H_0, the LR statistic $-2lnQ(H_0|H(r))$ is asymptotically distributed as χ^2 with rq degrees of freedom (Johansen, 1996).

6 Economic questions

We are interested in understanding whether the current account deficit can be sustained in the long run by a surplus in the financial account. In other terms, we want to investigate whether there is evidence in the data about the existence of a long run equilibrium in the U.S. balance of payments.

We will refer to a situation (see section 2) in which both the current and the financial account are in equilibrium in the long run with the term *full* long run equilibrium of the balance of payments. When the deficit in one account is compensated by a surplus of the same amount in the other we will say that there is a long run equilibrium of the balance of payments.

Since the only stable long run equilibrium relation is the full equilibrium of the balance of payments, we will first check for the existence of such long run relation and if it is not the case, turn to consider the other concept. This task can be easily implemented through (5.3) since the accounting relations that define the current account, the financial account and the change in official reserves are all linear: the current account is defined as $CA_t = X_t - M_t$, the financial account as $NCFA_t = FI_t - FO_t$ and the change in official reserves is the sum of current and financial accounts, $R_t = CA_t + NCFA_t$. The analysis conducted in section 5 involves the variables X_t, exports of goods and services and income receipts, M_t, imports of goods and services and income payments, FO_t, net U.S.-owned assets abroad other than official reserves, FI_t, net foreign-owned assets in the United States, and has determined that there are two cointegrating relations among them.

[6] All the tests in section 6 are of this form.

Thus a sequence of (5.3) tests, in which the R matrix depends on the specific economic question under study, allows us to investigate the long run properties of the U.S. balance of payments.

In order to check whether the data provide any evidence of the existence of the full long run equilibrium of the balance of payments we need to check if the vectors $(1, -1, 0, 0)'$ and $(0, 0, 1, -1)'$ belong to the cointegrating space $sp(\beta)$. If this is the case, the current account $CA_t = X_t - M_t$ and the net financial account $NFCA_t = FI_t - FO_t$ are both stationary and thus imply stationary reserves $R_t = CA_t + NCFA_t$. This is the counterpart of the full long run equilibrium of the balance of payments.

If there is no evidence on the existence of the full run equilibrium, we will then check whether a long run equilibrium where deficits and surpluses cancel out exists; this would require that although CA_t and $NCFA_t$ are both non stationary, they cointegrate in a way such that $R_t = CA_t + NCFA_t$ is stationary. This amounts to check if the vector $(1, -1, 1, -1)$ belongs to $sp(\beta)$.

Before analyzing the properties of the long run equilibrium relations, we test whether there are stationary variables among X_t, M_t, FI_t and FO_t; this consists in checking if the vectors $(1, 0, 0, 0), (0, 1, 0, 0), (0, 0, 1, 0)$ and $(0, 0, 0, 1)$ belong to the cointegrating space. The results of these tests are reported in the next table:

Stationarity of X_t, M_t, FI_t and FO_t			
	$-2lnQ(H_0 \mid H(p))$	$C_{.95}$	Result
X_t	40.05	5.99	***Reject*** H_0
M_t	38.60	5.99	***Reject*** H_0
FI_t	45.08	5.99	***Reject*** H_0
FO_t	34.78	5.59	***Reject*** H_0

Table 7: The LR test for the stationarity of X_t, M_t, FI_t and FO_t at 95% confidence level. Critical values from a χ^2 with 2 degrees of freedom.

As tab.7 shows, the null hypothesis of stationarity is strongly rejected for all the variables: X_t, M_t, FI_t and FO_t are all $I(1)$ processes. This means that the two cointegrating relations found out in section 5 will involve two, three or four variables.

We now turn to the issue of the full long run equilibrium: the only way for $CA_t = X_t - M_t$ to be stationary is that $(1, -1, 0, 0)'$ belongs to $sp(\beta)$; similarly, $NCFA_t = FI_t - FO_t$ can be stationary only if $(0, 0, 1, -1)' \in sp(\beta)$. Then $R_t = CA_t + NCFA_t$ would be the sum of two stationary variables and thus it would be stationary. If one between CA_t and $NCFA_t$ turns out to be $I(1)$ and the other $I(0)$, then a full long run equilibrium would not exist: the change in official reserves would be $I(1)$. But also a long run equilibrium would be disregarded because an $I(1)$ variable cannot cointegrate with an $I(0)$.

Let's look at the results of the tests for the full long run equilibrium:

Full long run equilibrium			
	$-2lnQ(H_0\|H(p))$	$C_{.95}$	Result
CA_t	41.96	5.99	***Reject*** H_0
$NCFA_t$	40.82	5.99	***Reject*** H_0

Table 8: The LR test for the stationarity of current account $CA_t = X_t - M_t$ and financial account $NCFA_t = FI_t - FO_t$ at 95% confidence level. Critical values from a χ^2 with 2 degrees of freedom.

As tab.8 shows, the null hypothesis is strongly rejected in both cases: both the current and the financial account are $I(1)$ variables. A non stationary current account can be sustained only by a non stationary dynamics in the financial account: as the current account deficit grows larger, a larger inflow of foreign funds is needed for compensation. If this financial flow is not sufficient to eliminate the current account imbalance then the reserves have to be used for that. Thus the results in tab.8 don't exclude the existence of a long run equilibrium in the balance of payments: if the non stationary current account deficit is compensated by an inflow of funds from abroad in a way such that the changes in the reserves are stationary, then we would conclude that the data provide evidence in favor of the sustainability of the U.S. current account dynamics. Technically, this hypothesis corresponds to $CA_t \sim I(1)$ and $NCFA_t \sim I(1)$ as tab.8 indicates and $R_t = CA_t + NCFA_t \sim I(0)$, meaning that CA_t and $NCFA_t$ cointegrate with weights one. Thus we specify $R = (1, -1,\ 1, -1)'$ in (5.3) and report the result of the test in the next table:

Long run equilibrium			
	$-2lnQ(H_0\|H(p))$	$C_{.95}$	Result
R_t	42.25	5.99	***Reject*** H_0

Table 9: The LR test for the stationarity of $R_t = CA_t + FA_t$ at 95% confidence level. Critical values from a χ^2 with 2 degrees of freedom.

Unfortunately, even this hypothesis is strongly rejected by the data: there is no evidence of the existence of a long run equilibrium of the U.S. balance of payments.

The results of the analysis of cointegration are thus the following: the data strongly reject both the hypothesis of a full long run equilibrium in which the current account goes back to equilibrium values and stays there and the hypothesis of a long run equilibrium in which the current account deficits are sustained by inflows of foreign capital from abroad forever.

These results imply that the U.S. current account dynamics of the last twenty years cannot be sustained in the long run.

7 Conclusion

The results of the analysis are quite strong and clear cut: the data highly reject any hypothesis of long run equilibrium in the U.S. balance of payments.

All the variables that enter the analysis, exports and imports of goods and services and income payments, financial inflows and outflows, turn out to be non stationary. Even though we have found cointegration among them, the linear combinations which define the current and the financial account turn out to be outside the cointegrating space and thus they are still $I(1)$ variables. For this reason, the evidence strongly rejects the existence of a full long run equilibrium of the balance of payments, where by full equilibrium we indicate that both the current and the financial account are in equilibrium in the long run. Unfortunately, even the existence of the situation in which the current account deficit is compensated by a surplus in the financial account is strongly rejected by the analysis: the change in official reserves turns out to be an $I(1)$ variable.

The results of the analysis suggest that the the last twenty years' U.S. policy of financing the current account deficits through an inflow of foreign funds is not a sustainable strategy in the long run.

A more sophisticated structural representation of the dynamics of the balance of payments is surely needed to address properly the effects on interest and exchange rates; this will be the focus of further research on the topic.

A Dataset

TAB.1-QA.txt (U.S. International Transactions): Quarterly seasonally adjusted data in millions of dollars from NIPA tables, Bureau of Economic Analysis. Sample: 1960 first quarter - 2004 third quarter (estimated).

TAB.F6 (Distribution of Gross Domestic Product): Quarterly seasonally adjusted data in billions of dollars from the "Flow of Funds Accounts of the United States, Second Quarter 2004", Board of Governors of the Federal Reserve System. Sample: 1952 first quarter - 2004 second quarter.

X_t: Exports of goods and services and income receipts (line 1, tab.1-QA.txt);
M_t: Imports of goods and services and income payments (minus line 18, tab.1-QA.txt);
TR_t: Unilateral current transfers, net (line 35, tab.1-QA.txt);
CTR_t: Capital account transactions, net (line 39, tab.1-QA.txt);
FO_t: U.S.-owned assets abroad other than official reserves, net (line 41 minus line 40), tab.1-QA.txt);
FI_t: Foreign-owned assets in the United States, net (line 55, tab.1-QA.txt);
GDP_t: Gross domestic product (line 1, tab.F6).

References

Dooley, M., D. Folkerts-Landau, and P. Garber (2003): "An Essay on the Revived Bretton Woods System," *NBER Working Paper*, 9971.

——— (2004a): "Direct Investment, Rising Real Wages and the Absorption of Excess Labor in the Periphery," *NBER Working Paper*, 10626.

——— (2004b): "The Revived Bretton Woods System: The Effects of Periphery Intervention and Reserve Management on Interest Rates and Exchange Rates in Center Countries," *NBER Working Paper*, 10332.

Johansen, S. (1996): *Likelihood-based Inference in Cointegrated Vector Auto-Regressive Models*. Oxford University Press.

Juselius, K. (1995): "Do Purchasing Power Parity and Uncovered Interest Rate Parity Hold in the Long Run? An Example of Likelihood Inference in a Multivariate Time-Series Model," *Journal of Econometrics*, 69, 211–240.

——— (2001): "European Integration and Monetary Transmission Mechanisms: The Case of Italy," *Journal of Applied Econometrics*, 16, 341–358.

——— (2003): "The Co-Integrated VAR Model: Econometric Methodology and Macroeconomic Applications," unpublished manuscript, University of Copenhagen.

Juselius, K., and R. MacDonald (2004): "International Parity Relationships between the USA and Japan," *Japan and the World Economy*, 16, 17–34.

Mann, C. (1999): "Is the U.S. Trade Deficit Sustainable?," *Institute for International Economics*.

——— (2002): "Persectives on the U.S. Current Account Deficit and Sunstainability," *Journal of Economic Perspectives*, 16, 131–152.

——— (2003): "The US Current Account, New Economy Services, and Implications for Sustainability," *Institute for International Economics*, August.

——— (2004): "Managing Exchange Rates: Achievement of Global Re-balancing or Evidence of Global Co-dependency?," *Business Economics*, July.

Obstefeld, M., and K. Rogoff (2000): "Perspectives on OECD Economic Integration: Implications for US Current Account Adjustment," *Federal Reserve Bank of Kansas City, Global Economic Integration: Opportunities and Challenges*, March, 169–208.

——— (2004): "The Unsustainable U.S. Current Account Position Revisited," *NBER Working Paper*, 10869.

Rubin, R., P. Orszag, and A. Sinai (2004): "Sustained Budget Deficits: Longer-Run U.S. Economic Performance and the Risk of Financial and Fiscal Disarray," *Brookings Institution*, January.

Rubin, R., and B. Setser (2004): "The U.S. as a Net Debtor: The Sustainability of the U.S. External Imbalances," *unplished manuscript*, November.

Summers, L. (2004a): "The United States and the Global Adjustment Process," *speech at the Institute for International Economics*, March.

——— (2004b): "The U.S. Current Account Deficit and the Global Economy," *Jacobsson Lecture*, September.