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Accounting for US current account deficits: an empirical investigation

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The sources of US current account deficits are investigated using a number of macroeconomic variables and a vector error correction model. The variables are those typically emphasized by the traditional income–expenditure approach and the intertemporal (Ricardian) approach. The results indicate that macroeconomic variables explain the current account reasonably well, and the evidence seems to support the traditional approach where budget deficits and increases in real interest rates and terms of trade are associated with current account deficits.

I. INTRODUCTION

The US current account has witnessed unprecedented deficits in the past decade. The traditional view holds that record federal government budget deficits are largely responsible for current account deficits. Accordingly, deficits financed through issuing bonds alter the behaviour of private agents and lead to increased consumption via the wealth effect and raise interest rates. Increased interest rates cause appreciation of domestic currency and reduce competitiveness leading to current account deficits. Adherents to the Ricardian Equivalence Hypothesis (REH) challenge this view arguing that the means of government finance should not affect private sector behaviour since bonds are not net wealth and they merely represent future tax liabilities. Models consistent with the Ricardian equivalence are based on intertemporal optimization and emphasize the effects on the current account balance of real factors such as productivity, terms of trade, government spending, and taxes via intertemporal substitution in consumption, production, and investment.

A number of papers have examined the sources of the US current account deficits in general and the relationship between budget and trade deficits in particular (see Arora and Dua, 1993 for a survey). Although there is near unanimity among these studies that macroeconomic factors help explain the variation in the current account, the results on the relationship between the current account and budget deficits are mixed. Miller and Russek (1989), Abell (1990), Bachman (1992), and Rosenweig and Tallman (1993) provide evidence that budget deficits are largely responsible for current account deficits while Evans (1989), Enders and Lee (1990), and Dewald and Ulan (1990) find little evidence on the effects of budget deficits. Darrat (1988) reports bidirectional causality between budget deficits and current account deficits.

This paper attempts to re-examine the relationship between the current account and a number of key macroeconomic variables using multivariate time series techniques. Various theories suggest different roles for the budget deficit, government spending, domestic and foreign income, terms of trade, real interest rates, and productivity in determining the current account. We investigate the implications of the income-expenditure and intertemporal approach to the current account using cointegration and error correction methods. Johansen (1988, 1992) and Johansen and Juselius (1990) provide a unified framework on the specification and inference in models with cointegrated variables. Recall that a vector autoregression (VAR) in first differences is misspecified if the variables in the system are cointegrated. In models with cointegrated variables, the properly specified cointegrating relationships can be imposed on the VAR to obtain a dynamic vector error-correction model (VECM). In this paper, we will use innovation accounting methods based on a VECM to investigate the interrelationships between the current account and macroeconomic variables suggested by competing theories.

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II. THEORETICAL FRAMEWORK

The following National Income accounting identity indicates that the current account reflects an economy's saving investment balance:

$$X - M = (T - G) + (S - I) \quad (1)$$

where X is exports of goods and services, M is imports of goods and services, G is government expenditures, T is government revenue, S is domestic private saving, and I is domestic private investment. The response of private saving to a budget deficit provides the basis for the contrasting views on the impact on the current account.

The conventional income–expenditure approach emphasizes domestic absorption as a primary determinant of the current account. In a small open economy with demand determined output and high capital mobility (e.g. the Mundell–Fleming model), a budget deficit, for example, raises domestic absorption and the interest rates. Higher domestic interest rates induce an incipient capital inflow which leads to a domestic currency appreciation. A higher value of domestic currency crowds out exports and increases imports. In fixed exchange rate regimes, interest arbitrage ensures the equality between domestic and foreign interest rates. In this case, a fiscal expansion gains full potency in raising output and employment since the interest rate effect is absent. The current account deteriorates due to higher imports propelled by higher income. In the large-country case, a similar result obtains except for a dampened effect on the current account since the expansion raises interest rates at home as well as abroad.

The static income–expenditure model has been challenged on the grounds that it is based on aggregate behavioural relationships and pays little attention to capital and debt accumulations. Proponents of the dynamic optimizing approach (Obtsfeld, 1981; Frenkel and Razin, 1986; Razin, 1993) emphasize intertemporal aspects of the current account since it reflects the net saving position of an open economy. The saving decision is an intertemporal decision by nature; hence, one must pay attention to intertemporal optimization, the associated intertemporal budget constraints, and solvency over time.

A key proposition of the dynamic optimizing approach is that an economy's private real spending and the current account are invariant to the means of government finances. According to the Ricardian equivalence hypothesis, the level of government spending rather than the means of its finance can be expected to induce a current account deficit. If individuals (and the government) can freely borrow at the same interest rate, they would be indifferent to the substitution of a current $1 tax cut with $1 bond paying the same interest rate, since a current tax cut must be matched by an equal increase in the present value of future taxes. If the government runs a deficit, individuals respond by increasing their private saving by the same amount. In this framework, individuals are informed about the path of government spending, have infinite horizons/intergenerational bequest motives, there is no uncertainty about future taxes/incomes, and taxes are non-distortionary.[1]

Another implication of the dynamic optimizing approach is that temporary rather than permanent income shocks affect the current account. This conclusion is a consequence of the Permanent Income Hypothesis (PIH) and is based on intertermporal smoothing in consumption. Consumption smoothing occurs when individuals wish to smooth the time profile of their consumption relative to fluctuating income over time. A permanent income or productivity shock raises income and consumption in each period and does not create any incentive for saving or dissaving leaving the current account unaffected. However, a temporary increase in income/productivity raises consumption and induces saving (current account surplus) or borrowing from abroad (current account deficit) to finance the (optimal) consumption profile.

It should be noted that in this framework government spending can have a nontrivial influence on the current account. Government spending withdraws resources that otherwise would be available to the private sector and has the same effect as an income/endowment shock. Therefore, temporary rather than permanent government spending shocks can be expected to influence the current account. Government spending also may affect the marginal evaluation of private goods and may influence real interest rates. Thus, a key distinguishing feature of the intertemporal approach is that government spending shocks, along with productivity, and real interest rates should explain the bulk of the variation in the current account. The properly specified model that includes these variables can shed some light on the role of the budget deficit, government spending, domestic and foreign income, productivity, real interest rates, and terms of trade on the current account.

III. METHODOLOGY AND DATA

Given the ample evidence regarding unit root properties of macroeconomic time series, our approach is to look for evidence of cointegration between the current account and macroeconomic variables suggested by theory. A cointegration relationship has the interpretation of a long-run equilibrium relationship where short-run deviations from equilibrium are eliminated by an error-correction mechanism in the sense of Engle and Granger (1987). Johansen (1988) and Johansen and Juselius (1990) provide a full

[1]Barro (1974) formulates REH with inter-generational bequest motive. Examples of the controversies surrounding REH can be seen in Barro (1989) and Bernheim and Bagwell (1988). Seater (1993) is an extensive survey.

information maximum likelihood cointegration method which can detect multiple cointegrating vectors, and allows various specification tests. Consider the dynamic specification:

$$\Delta X_t = A(L)\Delta X_{t-1} + \Pi X_{t-k} + \mu + \varepsilon_t \qquad (2)$$

where X_t is an $n \times 1$ vector of variables, $A(L)$ is an $n \times n$ matrix with elements which are k-order polynomials in the lag operator L, μ is a column vector of constants, ε_t is a column vector of disturbances, and Δ is the first difference operator. Other than the right-hand-side term ΠX_{t-k}, Equation 2 is a VAR in the first differences. The hypothesis of cointegration places a restriction on the rank of the long-run matrix Π, where the rank Π is $0 < r < n$. In this case, Π can be partitioned such that $\Pi = \alpha\beta'$ where β is $n \times r$ matrix of cointegration coefficients, and α is an $n \times r$ matrix of adjustment coefficients. Each vector β_i, $i = 1, \ldots, r$ in the matrix β is called a cointegrating vector and has the property that $z_i = \beta_i' X_t$ is stationary. The number of cointegrating vectors r can be found using a likelihood ratio test based on the trace of the stochastic matrix. Moreover, it is possible to test exclusion restrictions on the cointegrating vectors and perform weak exogeneity tests to characterize the adjustment process (Johansen, 1992).

We let the vector X_t consist of the current account (CA), government spending (G), terms of trade (TT), long-term real interest rate (RLR), budget surplus (BS), foreign income (YF) domestic income (Y), and productivity (PR):

$$X_t = [CA \;\; G \;\; TT \;\; RLR \;\; BS \;\; YF \;\; YPR]' \qquad (3)$$

Our choice of variables is motivated by factors typically emphasized in the income–expenditure and the intertemporal approaches to the current account. Current account is measured as export of goods and services minus imports of goods and services in constant dollars and expressed as percent of GDP. The budget surplus is measured as the consolidated federal and state government revenues minus expenditures and expressed as percentage of GDP; government spending by government consumption, and domestic income by GDP. All of these variables are deflated by their respective deflators to obtain real values. We also measure productivity (PR) by the economy-wide labour productivity index, and foreign income by a trade weighted index of GDP of 10 major trading partners of the US (see Appendix for construction). Terms of trade is measured as the export unit values divided by import unit values, and the real long-term interest rate (RLR) is computed as $[(1 + i)/(1 + \pi) - 1]$ where i is the ten-year government bond rate and π is the inflation rate as measured by the GDP deflator. All variables except the current account (CA), government budget balance (BS), and the real interest rate (RLR) are expressed in logarithms. The sample consists of quarterly data from 1960.1–1994.4. Given the extensive data period and theoretical considerations, we investigate the effects of real shocks on the current account and exclude nominal variables from the analysis. All data are from Citibase except interest rates and terms of trade which are taken from the *International Financial Statistics.*

IV. EMPIRICAL RESULTS

Before implementing the maximum likelihood cointegration test, we pretest variables for unit roots using augmented Dickey–Fuller tests. In the majority of cases the null hypothesis of a unit root cannot be rejected; hence, the cointegration framework is appropriate.[2] Next, we test whether variables in Equation 3 are cointegrated. In testing for cointegration, we consider the possibility of linear deterministic trends in the data. The likelihood ratio statistic based on the trace of the stochastic matrix is given in Table 1.

Table 1 indicates that the hypothesis of no-cointegration can be rejected by the likelihood ratio test at the 5% significance level. Moreover, the null hypothesis that there are up to three cointegrating vectors is also rejected at the same significance level. However, the test does not reject the hypothesis that there are up to four cointegrating vectors. Hence, we assume there are four cointegrating vectors in the data.

It is known that the cointegration matrix β is not uniquely identified, and the stationary linear combinations $\beta' X_t$ are unique up to a linear transformation. The common practice is to normalize each vector in β with respect to one element. We normalize the cointegrating vectors with respect to the current account, and the results are given in the upper portion of Table 2. Since there is more than one cointegrating vector, the interpretation of cointegrating vectors

Table 1. *Cointegration of the current account and other macroeconomic variables*

Null hypothesis	Eigenvalue	Likelihood ratio (trace)	5% critical value
$r = 0$	0.3539	231.33*	156.00
$r \leqslant 1$	0.3390	172.37*	124.24
$r \leqslant 2$	0.2671	116.47*	94.15
$r \leqslant 3$	0.2127	74.51*	68.52
$r \leqslant 4$	0.1234	42.23	47.21
$r \leqslant 5$	0.1050	24.45	29.68
$r \leqslant 6$	0.0589	9.48	15.41
$r \leqslant 7$	0.0094	1.27	3.76

Variables included in the test are CA, G, TT, RLR, BS, YF, Y and PR. Sample period is 1960.1–1994.4. The number of lags in the VAR is 4. Statistical significance at the 5% level is indicated by an asterisk.

[2]The results of unit root tests are not reported for the sake of brevity. The cointegration framework can be implemented provided that at least two of the variables have a unit root.

Table 2. *Normalized cointegrating vectors and the adjustment coefficients*

	Normalized cointegrating vectors					
	β_1	β_2	β_3	β_4	χ^2-stat	Prob.
CA	1.000	1.000	1.000	1.000	23.12	0.000
G	7.075	− 0.832	− 1.045	0.078	26.96	0.000
TT	− 1.913	1.482	0.136	0.770	29.05	0.000
RLR	0.003	0.008	0.009	0.001	24.91	0.000
BS	11.623	− 0.529	− 1.556	− 3.674	27.16	0.000
YF	8.203	0.562	− 2.713	1.080	25.57	0.000
Y	− 19.169	0.723	4.361	− 1.642	33.27	0.000
PR	6.253	− 1.077	0.440	− 0.006	16.11	0.003
	Speed of adjustment coefficients					
	z_1	z_2	z_3	z_4	F-stat	Prob.
ΔCA	− 0.12	0.11	− 0.06	− 0.0008	4.32	0.002
ΔG	0.06	− 0.21	0.08	0.0008	8.18	0.000
ΔTT	− 0.20	0.24	− 0.36	− 0.0017	4.37	0.002
ΔRLR	− 16.87	1.45	− 17.61	− 0.1028	2.92	0.024
ΔBS	− 0.10	0.08	− 0.21	− 0.0011	5.41	0.001
ΔYF	− 0.06	− 0.03	− 0.04	− 0.0004	1.94	0.108
ΔY	− 0.08	− 0.01	− 0.10	− 0.0007	7.11	0.000
ΔPR	− 0.07	− 0.05	− 0.01	− 0.0006	10.14	0.000

χ^2-statistic tests the significance of an individual variable across all cointegrating vectors. The F-statistic tests the joint significance of the speed of adjustment coefficients.

is no longer straightforward. However, statistical inference based on the VECM facilitates understanding the dynamic interrelationships in the system. An interesting question is whether all of the variables belong to the system. To that end, we carry out some specification tests. The restriction that an individual variable can be excluded from the system (it has zero coefficients in the cointegrating vectors) is tested using a likelihood ratio test, which is distributed as χ^2 with four degrees of freedom. This test statistic is reported under the χ^2-stat column in Table 2. It is apparent that none of the variables can be excluded from the system at conventional significance levels.

Overall, the cointegration results suggest that the data generating mechanism in the eight-dimensional system should be modelled as a vector error correction model. An eight-dimensional VECM with four cointegrating vectors is specified as:

$$\Delta X_t = A(L)\Delta X_{t-1} - \alpha z_{t-1} + \mu + \varepsilon_t \qquad (4)$$

where, in addition to variables defined before, $z_{t-1} = \beta' X_{t-1}$ contains the error correction terms from the cointegrating relationships, and α is the speed of adjustment matrix. Elements in α indicate the speed at which the variables adjust towards long run equilibria.

Equation 4 is estimated using four lags. Residual diagnostics and the Box–Pierce Q-statistic indicate that four lags are sufficient to capture the dynamics and whiten the residuals. The estimated speeds of adjustment coefficients are reported at the bottom portion of Table 2. The estimated adjustment coefficients indicate that the majority of variables adjust rather slowly toward the long run relationships. The speeds of adjustment coefficients contain other useful information on the adjustment process. The condition for a variable y_t to be weakly exogenous for β is that the speeds of adjustment coefficients α_i in the Δy_t equation are zero, which would imply the equation Δy_t does not contain information about the long run parameters in β. An F-test for the joint significance of α_i for each variable is given in Table 2. The test statistic indicates that, with the exception of foreign income, weak exogeneity can be rejected for all variables at the 5% significance level. This implies that domestic variables form a system of endogenous variables with simultaneous adjustment toward long run equilibria.

Variance decompositions and impulse response functions

The interrelationships among variables and the dynamic adjustment to various disturbances in the system can be understood by examining variance decompositions and impulse response functions based on VECM. Table 3 reports variance decomposition of the current account at various forecasting horizons and the correlation matrix of innovations. The innovations are orthogonalized using Choleski decomposition with an ordering implied by Table 3: *CA*, *G*, *TT*, *RLR*, *BS*, *YF*, *Y*, *PR*. Table 3 indicates that variables in

Table 3. *Variance decomposition of the current account*

				Due to innovations in				
Step	*CA*	*G*	*TT*	*RLR*	*BS*	*YF*	*Y*	*PR*
1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	84.3	2.7	2.0	0.9	8.6	0.5	0.4	0.5
8	53.2	1.3	8.4	1.4	32.2	0.5	0.5	2.4
16	36.9	0.7	11.8	6.0	37.1	4.4	1.1	2.0
20	34.7	0.7	10.5	6.7	36.6	5.7	3.3	1.8
				Reverse order				
1	88.2	0.3	3.8	3.8	0.6	1.8	0.8	0.7
4	66.9	1.5	10.8	6.7	4.3	2.3	4.0	3.4
8	37.6	1.0	18.5	8.4	18.2	1.0	8.1	7.2
16	22.9	0.5	24.4	16.9	19.8	3.3	6.6	5.6
20	21.9	1.1	23.0	18.2	19.8	4.8	5.0	6.1
				Correlation matrix of innovations				
	CA	*G*	*TT*	*RLR*	*BS*	*YF*	*Y*	*PR*
CA	1.00							
G	0.07	1.00						
TT	− 0.18	− 0.20	1.00					
RLR	− 0.21	− 0.10	− 0.18	1.00				
BS	− 0.06	− 0.21	0.04	0.21	1.00			
YF	− 0.15	0.03	− 0.01	0.24	0.08	1.00		
Y	0.02	0.33	− 0.05	0.26	0.20	0.29	1.00	
PR	− 0.08	0.11	0.14	0.11	− 0.01	0.34	0.60	1.00

the model explain about 65% of the variation in the current account. This is in line with the assertion that the current account is a macroeconomic phenomenon. Particularly, at a 20-quarter forecast horizon, innovations in the budget surplus account for 36.6% of the forecast error variance in the current account. Terms of trade accounts for 10.5%, the real interest rate for 6.7%,[3] and foreign income for 5.7% at the 20-quarter horizon. Other variables account for less than 5% of the variation individually. These results are broadly in line with the traditional view of the current account where the budget surplus, real interest rates, and terms of trade innovations play a significant role in explaining the variation in the current account. Note that government spending and productivity shocks explain a very negligible proportion (less than 3%) of the current account at any forecast horizon, which seems to lend little support for the intertemporal approach.

In order to ascertain whether the results are sensitive to the ordering in Choleski decomposition, we report variance decompositions from a reverse order in Table 3. Note that reversing the order does not significantly change the results. Variables in the system explain the preponderance of forecast error variance in the current account. In the reverse order, the effect of the budget surplus is diminished and terms of trade and real interest rate innovations explain a higher proportion of the current account variance. The results still favour the income–expenditure approach. The correlation matrix of innovations at the bottom of Table 3 indicates that bilateral correlations between productivity, domestic income, and foreign income innovations are high. Except for these variables, the results can be expected to be invariant to the order in the Choleski decomposition.

The dynamic adjustment of the current account to various shocks in the system are represented by the impulse response functions in Fig. 1. Fig.1a gives the response of the current account to a standard deviation shock in the budget surplus, foreign income, domestic income, and productivity. In response to a budget surplus shock, the current account improves, particularly after the fifth quarter. Note that the budget surplus shock has a permanent effect on the current account. Although a foreign income shock deteriorates the current account initially, it improves the current account permanently in the long run. Domestic income and productivity shocks worsen the current account, but only domestic income shocks seem to have a permanent effect.

Fig. 1b gives the response of the current account to a standard deviation shock in its own innovation and to innovations in government spending, terms of trade, and the real interest rate. In response to its own shock, the current

[3]These results are invariant to different measures of interest rates; the real yield on 3-year government bond and 3-month Treasury Bill rates gave similar results.

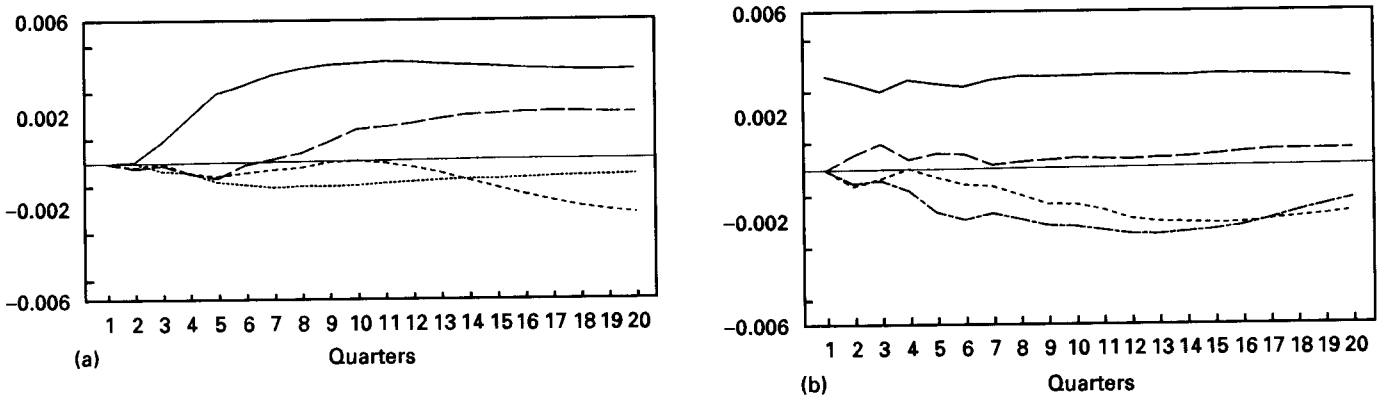

Fig. 1. *Response of the current account to one standard deviation shocks.* (*a*) (——) *Res. to BS shock,* (— —) *Res. to YF shock,* (– –) *Res. to Y shock,* (- - -) *Res. to PR shock;* (*b*) (——) *Res. to own shock* (— —) *Res. to G shock,* (— — —) *Res. to TT shock,* (- - -) *Res. to RLR shock*

account improves immediately. A government spending shock seems to improve the current account slightly; however, the improvement may be statistically insignificant. Both terms of trade and real interest rate shocks seem to worsen the current account. The current account seems to come to its original level after these latter shocks, but with a very slow adjustment process.

Note that, with the exception of the response to government spending shocks, the current account responses seem to conform to the traditional income–expenditure approach. Budget deficits have negative effects on the current account via real interest rates and terms of trade. With the government spending shocks having a negligible impact on the current account, the data do not seem to support the intertemporal approach. Recall that according to the intertemporal approach, temporary income and government spending shocks should have a positive and negative impact on the current account respectively. On the other hand, the intertemporal approach predicts that budget deficits do not alter the intertemporal budget constraint of individual agents; hence, they should have no impact on the current account. It seems that the record budget deficits and relatively high interest rates of the past decade have had a major impact on current account deficits in the US.

V. SUMMARY AND CONCLUSIONS

The surge in both budget and current account deficits in the past decade led many to believe that there is a causal relationship where budget deficits lead to current account deficits. Adherents to the Ricardian equivalence view dispute this reasoning arguing that governments' means of finance do not alter private agents' intertemporal budget constraint. Extensive empirical studies have not produced a consensus as the evidence is mixed. This study reconsiders sources of the current account deficits using an extensive set of macroeconomic variables and a vector error correction model. The model includes variables typically emphasized by the traditional income-expenditure approach and the intertemporal approach. Variance decomposition and impulse response functions indicate that macroeconomic variables account for the variation in the current account reasonably well, and the budget surplus, terms of trade, and real interest rates seem to explain a sizeable proportion of the variation in the current account. Overall, the results favour the income expenditure approach rather than the intertemporal (Ricardian) approach.

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APPENDIX

The construction of real foreign income, YF

The trade weighted foreign income index (1985 = 100) was constructed for the major trading partners of the US. Each country is weighted by its average trade volume with the US in 1984–86. Countries included in the index and their relative weight are Canada (31.4%), Japan (26.4%), Mexico (8.5%), Germany (8.3%), United Kingdom (7.5%), Korea (4.7%), France (4.4%), Italy (4.0%), Belgium (2.4%), and Australia (2.2%). These countries accounted for approximately 65% of the US trade volume in 1984–86. Quarterly data were not available for Belgium, Korea and Mexico. We substituted the industrial production index for GDP for these countries.