

Inflation-Adjusted Government Budget Deficits and Real Economic Activity *Rejoinder*

Robert EISNER, Paul J. PIEPER*

Giuseppe Tullio sees “three major problems” in our work on the role of real or inflation-adjusted budget deficits: 1. we use reduced forms; 2. we do not include certain other variables; 3. we use the real high employment surplus rather than the change in that surplus (or perhaps the actual surplus). Tullio proceeds to add variables—particularly the real price of oil, the real wage, various dummies and first differences of the surplus and the (real) monetary base—and two “small countries” (the Netherlands and Denmark). In some instances shortening the sample period¹, Tullio then claims empirical results which indicate that the inflation adjustment is not “unambiguously” helpful, that the effect of fiscal expansion is strong only for the US and Japan, with crowding out in smaller economies, and the smaller the country the more that foreign fiscal and monetary variables dominate.

First, as to reduced forms, it is hard to know what to make of Tullio's objection, since he too used reduced forms. We have acknowledged the desirability of setting our relations in a full macroeconomic model and are currently working on that, with some supportive results for consumption and investment functions. Tullio suggests that ignoring reaction functions of fiscal authorities contributes to simultaneous equation bias, but his concern is quite out of place. If, for example, smaller high-employment surpluses (or greater deficits) were responses to declines in the rate of growth of GNP which were themselves autocorrelated, there would tend to be a *positive* relation between those variables. To the extent that this factor was operative, our negative relation would have been reversed. The fact that it is not means that Tullio's argument only adds to the force of our

* R. EISNER : William R. Kenan Professor of Economics, Northwestern University, Evanston, Illinois 60208; P. J. PIEPER : Assistant Professor of Economics, University of Illinois at Chicago, Chicago, Illinois 60680.

1. Various to the years 1967-81 and 1973-84. The Eisner and Pieper results which Tullio presents in his Table 1, generally for data from 1967 to 1981, were abstracted from Eisner and Pieper [1984], Table 7, p. 20, which was based on data from 1956 to 1981, with shift and slope dummies to derive different parameters for the less inflationary, higher-growth 1956-66 years and the later, more inflationary, slower-growth 1967-81 period. Our article in the *Annales* (1986 a) reported on regressions based on US observations from 1957 to 1984 and observations for other countries from 1971 to 1982.

findings. The negative relation between surpluses and GNP (or GDP) growth appears all the more robust for having survived this “bias.”

Tullio’s main argument against the Eisner-Pieper findings is his claim that the inflation-adjusted deficit does not prove a better explanatory variable than the adjusted deficit when his additional variables are included. His own Table 3 for large countries, however, finds a substantially better fit with the inflation-adjusted deficit variables ($R^2 = .81$ versus $.76$). And the fact that the inflation-adjusted variables do not *uniformly* improve the fit was clear in our article. (See, for example, the cases of Canada, Germany, Japan and the United Kingdom in Table 8 and Canada again in Table 9.)

Tullio’s additional variables either confirm our findings or yield results with fairly obvious explanations quite at variance from his. First, with regard to ΔDF ; the *change* in the budget surplus or deficit variable to which Tullio devotes substantial attention, his own results for the United States, reported in his Table 1, indicate estimated parameters that do not differ significantly from zero. We could have reported similar hitherto unpublished results and here do. Our new Table 1 makes clear that, while changes in the budget deficit do show some positive relation with growth in GNP, that relation is wiped out when the deficit (surplus) itself is entered.

As for the role of the monetary base, Tullio merely confirms what we have reported in a number of papers². As may be seen in equation 1.2 of Table 1, the real budget deficit and increases in the real monetary base have both been associated with increases in real GNP. Both fiscal policy and monetary policy matter.

But Tullio’s other additional variables serve largely to muddy the waters. We pass over this liberal use of dummy variables (for Germany in 1976, Japan in 1978 and the US in 1982). Tullio reports, in particular, that the US price-adjusted high-employment surplus no longer performs better than the unadjusted surplus once the change in the real price of oil and the lagged change in real wages are added to the regression.

It is possible, even with the limited observations that Tullio has employed, to offer some evidence as to whether correct structural relations would include changes in the real value of the government debt or changes in real wages and the relative price of oil. Changes in real wages turn out to serve as a partial proxy for inflation effects on the government debt. The correlation between the two variables over the 1967-1981 period used by Tullio is $-.67$.³ What was happening at this time was that increases in oil prices in the United States were associated with general inflation. Both reduced real wages and created a positive price effect reducing the real or adjusted deficit.

2. EISNER and PIEPER [1986 *b*] and EISNER [1986], in particular.

3. Tullio reported that his real wage series was aggregate compensation of employees divided by the GNP implicit price deflator, which would not be a measure of real hourly wages. We used, instead, average hourly earnings in the private non-agricultural sector, also divided by the GNP price deflator. The source for both series is the *Economic Report of the President*.

TABLE 1

Change in U.S. Real GNP and Price-Adjusted High Employment Surplus and Change in Surplus and in Monetary Base

$$\Delta \text{GNP}_t = b_{01} X_1 + b_{02} X_2 + \sum_{i=1}^2 b_{1i} \text{PAHES}_{t-i} + b_2 \Delta \text{MB}_{t-1} + b_3 \Delta \text{PAHES}_{t-1}$$

Regression Coefficients and Standard Errors*

Equation	Constants		PAHES _{t-1} (b ₁₁)	PAHES _{t-2} (b ₁₂)	ΔMB (b ₂)	ΔPAHES _{t-1} (b ₃)	R ²	D-W
	1961-66 (b ₀₁)	1967-84 (b ₀₂)						
1.1	8.662 (0.856)	4.328 (0.422)	-2.306 (0.370)				.662	1.88
1.2	6.417 (1.257)	3.353 (0.576)	-1.461 (0.501)		6.628 (2.907)		.719	1.70
1.3	8.497 (0.856)	4.262 (0.422)	-2.332 (0.390)	0.116 (0.414)			.647	1.89
1.4	4.710 (0.872)	2.290 (0.503)				-1.310 (0.436)	.328	1.59
1.5	8.497 (0.856)	4.262 (0.422)	-2.217 (0.496)			-0.116 (0.414)	.647	1.89

* Ordinary least squares

$$X_1 = 1, \quad X_2 = 0 \quad \text{for } t = 1961, \dots, 1966$$

$$X_1 = 0, \quad X_2 = 1 \quad \text{for } t = 1967, \dots, 1984$$

ΔGNP = percent change in GNP.

PAHES = price-adjusted high-employment surplus as percent of GNP.

ΔPAHES = change in PAHES.

ΔMB = real change in monetary base as percent of GNP.

What apparently makes a difference in Tullio's ordinary least squares regressions is that his variables measuring changes in the real price of oil and especially changes in real wages are picking up the inflation effects that would otherwise be captured by adjustments to the budget deficit. Particularly for the 1967-1981 period to which Tullio restricts himself, inflation in the United States, the one country where the oil price variable was significant, increased with the rise in oil prices but at a lesser rate. Therefore, higher inflation was associated with an increase in the relative price of oil. If the inflation effect reduces growth in GDP, this then would be picked up in the negative coefficient that Tullio estimates for his oil price change variable. This explanation is consistent with Tullio's observation that oil prices did not enter significantly in countries other than the US, where nominal oil prices were held relatively rigid, so that real oil prices, there, were *not* positively related to inflation.

Real wages would be generally depressed by increases in prices of imported goods associated with the oil price increases and accompanying inflation. Thus, declines in real wages, correlated with inflation under these

circumstances, would also, because of the inflation effect, be associated with declines in real GNP, as is confirmed by the positive coefficients Tullio estimates for this variable, but would lose much of their explanatory power in regressions including an inflation-adjusted budget variable.

In Table 2, including the change-in-surplus variable to maintain consistency with Tullio's analysis, we confirm the superiority of the price-adjusted variables, as measured by the coefficients of determination, \hat{R}^2 , for the years 1967-81, as shown in equations 2.1 and 2.2. The introduction of the Δ POIL variable does nothing to eliminate that superiority, as shown in 2.3 and 2.4; comparative results with the addition of the Δ WAGE variable, 2.5 versus 2.6 and 2.7 versus 2.8, however, suggest that, as Tullio claims, the unadjusted or "official" surplus gives a better fit. But then, when we extend the observations to include all of the years from 1961 to 1984, so that the oil-price shocks and related effects on real wages are not so dominant,⁴ the results, even with both the Δ POIL and Δ WAGE variables, reconfirm the superiority of the price adjusted surplus. This is evidenced by the coefficient of determination of .685 for equation 2.10, as against .652 for equation 2.9, which includes the unadjusted surplus.

All evidence of superiority of the unadjusted surplus, for the shorter as well as the longer time period, disappears when, recognizing the low Durbin-Watson ratios in the OLS regressions, we introduce Cochrane-Orcutt first order autoregressive corrections. In the Cochrane-Orcutt regressions, shown in Table 3, with or without the addition of Tullio's Δ POIL and Δ WAGE variables, and for all years, the coefficients of determination are higher for the equations with the price-adjusted surplus. Regressions excluding the change-in-surplus (not shown) yield similar results.

We indeed do not see any good theoretical reason for either the relative price of oil or real wages in themselves, aside from effects on aggregate demand, to have a significant role in fluctuations in output. Tullio's explanation in terms of an aggregate supply curve is hard to credit. First, the shape of the aggregate supply curve has little to do with the "marginal short run cost curve," which relates to individual firms. But second, higher *real* wages do not imply higher costs of production but merely that wages are higher relative to other prices. Higher real wages may then stem from lower costs of materials or from greater investment in tangible or intangible (including human) capital. None of these would raise costs or reduce supply. And as Tullio acknowledges, the effects of changes in real wages on demand are doubtful. This is certainly true for the *relative* price of oil.

Tullio's finding that deficits do not affect output in small and medium sized European countries may stem from his failure to adjust properly for the endogeneity of the deficit. He uses the actual deficit instead of the high-employment deficit for Italy. This will seriously bias the deficit towards zero, as the deficit will rise with declines in output. Tullio's cyclically adjusted surplus for other countries, including the United States, is calculated on the basis of deviations from trend of real output. However, trend

4. The correlation coefficient between the price effect and real wages was $-.59$ as against the value of $-.67$ for the 1967-1981 period noted above.

TABLE 2

Change in US Real GNP and Adjusted High-Employment Budget Surplus and Changes in the Surplus and Changes in the Real Price of Oil and Wages: OLS Regressions

$$\Delta \text{GNP}_t = b_{01} X_1 + b_{02} X_2 + b_1 \text{HES}_{t-1} + b_2 \Delta \text{HES}_t + b_3 \Delta \text{POIL}_t + b_4 \Delta \text{WAGE}_{t-1}$$

Regression Coefficients and Standard Errors

Equation	Time Period	Constants		HES _{t-1} b ₁	ΔHES _t b ₂	ΔPOIL _t b ₃	ΔWAGE _{t-1} b ₄	R ²	D-W
		1961-66 b ₀₁	1967-81 (84) b ₀₂						
2.1 OF	1967-81		.300 (.910)	-3.290 (1.008)	-.407 (.698)			.502	1.32
2.2 PA	1967-81		4.538 (.598)	-2.369 (.609)	-.154 (.477)			.590	1.27
2.3 OF	1967-81		1.091 (.914)	-2.697 (.957)	.041 (.670)	-.015 (.008)		.596	1.07
2.4 PA	1967-81		4.485 (.519)	-1.820 (.582)	.356 (.472)	-.016 (.007)		.692	.84
2.5 OF	1967-81		-.264 (.858)	-3.389 (.901)	-.623 (.632)		.603 (.298)	.604	1.28
2.6 PA	1967-81		4.299 (.695)	-2.294 (.630)	-.225 (.498)		.237 (.331)	.572	1.18
2.7 OF	1967-81		.504 (.848)	-2.840 (.841)	-.197 (.597)	-.014 (.007)	.553 (.265)	.691	1.03
2.8 PA	1967-81		4.310 (.608)	-1.780 (.603)	.288 (.499)	-.016 (.007)	.175 (.291)	.673	.80
2.9 OF	1961-84	6.140 (.938)	.566 (.691)	-2.543 (.573)	-.282 (.487)	-.013 (.007)	.643 (.282)	.652	1.88
2.10 PA	1961-84	7.711 (1.068)	4.186 (.486)	-1.995 (.454)	.142 (.427)	-.013 (.007)	.280 (.290)	.685	1.76

X₁ = 1, X₂ = 0 for t = 1961-1966.

X₁ = 0, X₂ = 1 for t = 1967-1984.

ΔGNP = percent change in real GNP.

ΔPOIL = percent change in real price of oil.

ΔWAGE = percent change in real wages.

HES = high-employment surplus as percent of GNP.

ΔHES_t = HES_t - HES_{t-1} = change in high-employment surplus as percent of GNP.

OF = official, unadjusted surplus.

PA = price-adjusted surplus.

Change in US Real GNP and Adjusted and Unadjusted High-Employment Budget Surplus and Changes in the Surplus and Changes in the Real Price of Oil and Wages: Cochrane-Orcutt AR (1) Regressions

$$\Delta \text{GNP}_t = b_{01} X_1 + b_{02} X_2 + b_1 \text{HES}_{t-1} + b_2 \Delta \text{HES}_t + b_3 \Delta \text{POIL}_t + b_4 \Delta \text{WAGE}_{t-1}$$

Regression Coefficients and Standard Errors

Equation	Time Period	Constants		HES _{t-1} b ₁	ΔHES _t b ₂	ΔPOIL _t b ₃	ΔWAGE _{t-1} b ₄	R ²	D-W	ρ
		1961-66 b ₀₁	1967-81 (84) b ₀₂							
3.1 OF	1967-81		.099 (1.070)	-3.716 (1.176)	-770 (.748)			.566	1.59	.37
3.2 PA	1967-81		5.724 (1.192)	-3.273 (.722)	-814 (.480)			.698	1.91	.52
3.3 OF	1967-81		1.031 (1.097)	-2.855 (1.059)	-.048 (.740)	-.015 (.008)		.679	1.30	.47
3.4 PA	1967-81		5.376 (1.068)	-2.418 (.599)	.009 (.456)	-.016 (.006)		.821	1.51	.65
3.5 OF	1967-81		-.496 (1.035)	-3.957 (.983)	-954 (.651)		.607 (.332)	.658	1.55	.40
3.6 PA	1967-81		6.096 (1.723)	-3.482 (.627)	-.993 (.421)		.409 (.267)	.722	2.11	.68
3.7 OF	1967-81		.431 (1.180)	-3.170 (1.019)	-.270 (.707)	-.014 (.007)	.547 (.271)	.765	1.32	.52
3.8 PA	1967-81		5.719 (1.590)	-2.621 (.578)	-.181 (.444)	-.015 (.005)	.298 (.206)	.835	1.74	.76
3.9 OF	1961-84	6.176 (.993)	.238 (.800)	-2.957 (.697)	-.396 (.505)	-.012 (.007)	.599 (.304)	.664	2.07	.10
3.10 PA	1961-84	7.880 (1.159)	4.280 (.562)	-2.105 (.538)	.105 (.450)	-.014 (.008)	.254 (.306)	.684	1.94	.13

X₁ = 1, X₂ = 0 for t = 1961-1966.

X₁ = 0, X₂ = 1 for t = 1967-1984.

ΔGNP = percent change in real GNP.

ΔPOIL = percent change in real price of oil.

ΔWAGE = percent change in real wages.

HES = high-employment surplus as percent of GNP.

ΔHES_t = HES_t - HES_{t-1} = change in high-employment surplus as percent of GNP.

OF = official, unadjusted surplus.

PA = price-adjusted surplus.

output will be substantially affected by the general downturn of rates of growth in European countries in later years. Thus Tullio's estimate of high-employment output will be relatively close to actual output in later years, and there will be little difference between the high-employment and actual budget deficits. More realistically, most European countries in the early eighties were far below full-employment output. The high-employment deficit, properly calculated, would be much closer to surplus than the actual deficit. Tullio's procedure will not reflect this association between low high-employment deficits (or large surpluses) and slow growth of output in later years, and will thus bias the deficit coefficient downwards.

In Table 4 we provide further evidence of the positive effect of fiscal expansion on output in four European countries and Japan. We have updated the sample period of our original article to 1984.⁵ Price-adjusted deficits are significantly related to subsequent changes in real GDP in France, Italy and Japan. The coefficient of the price-adjusted deficit is also negative, but not significant, for Germany and the United Kingdom. The relations involving the price-adjusted deficit are on balance stronger than the ones involving the unadjusted deficit.

Tullio also argues that fiscal expansion in the United States, Germany and Japan causes a fall in output in small and medium sized European countries. We hardly see how expansionary fiscal policy in the United States, in itself, could "crowd out" domestic output. It is difficult to construct a plausible model in which positive fiscal effects induce endogenous, negative monetary effects sufficient to fully cancel the fiscal expansion. If the monetary authority adds an exogenous tightness in response to other stimuli that may be another matter.

It is hard to make out Tullio's concern with use of the high employment surplus rather than the actual surplus as a measure of fiscal stimulus. Surely we want to isolate the exogenous component of the surplus in measuring its impact on the economy. Tullio's further concern that current income and the distinction between current and expected future changes in wealth are relevant is more on target. We make no claim that the current high employment budget surplus or deficit and its inflation adjustments are the sole determinants of aggregate demand and output. The inflation adjustment to existing financial assets is clearly of no significance to those who are liquidity-constrained for lack of such assets. And the distinction between changes in wealth which are one-shot affairs and those that may be expected to recur is likely to prove important. It may help explain why our "interest effect" on the market value of government debt, while in the predicted

5. We have here employed a separate constant for the earlier, generally higher-growth years from 1971 to 1973. Use of the separate constant in these longer time series serves to strengthen some of our original results, most notably for Japan.

Our estimates of the high-employment surplus for the 1970-1982 period are taken from PRICE and CHOURAKI [1983]. These are updated to 1983 by first regressing the cyclical component of the deficit against changes in GNP over the 1971-82 period. The high-employment surplus in 1983 is estimated as the actual deficit minus the predicted value of the cyclical deficit in 1983.

TABLE 4

Change in Real GDP in Four European Countries and Japan and Adjusted and Unadjusted High-Employment Budget.

$$\Delta \text{GDP}_t = b_{01} X_1 + b_{02} X_2 + b_1 \text{HES}_{t-1} + b_2 \text{PAHES}_{t-1}, t = 1971-84$$

Regression Coefficients and Standard Errors*

Equation	Country	Constants		HES _{t-1}	PAHES _{t-1}	R ²	D-W
		1971-73 b ₀₁	1974-84 b ₀₂	b ₁	b ₂		
4.1	France	6.286 (.797)	3.790 (.711)	-.588 (.265)		.570	2.11
4.2	France	6.668 (.843)	4.412 (.891)		-.573 (.238)	.593	2.06
4.3	Germany	3.863 (1.118)	1.334 (.822)	-.491 (.607)		.094	1.71
4.4	Germany	3.755 (1.176)	1.512 (.655)		-.619 (.589)	.128	1.70
4.5	Italy	-2.324 (5.014)	-5.240 (5.777)	-.938 (.713)		.049	2.19
4.6	Italy	1.385 (1.767)	2.779 (.741)		-.581 (.255)	.252	1.82
4.7	Japan	7.804 (1.021)	1.547 (.987)	-.722 (.279)		.504	1.79
4.8	Japan	7.796 (1.025)	0.637 (1.316)		-1.103 (.431)	.500	2.01
4.9	UK	4.043 (1.494)	1.386 (.876)	.162 (.310)		.133	2.09
4.10	UK	4.957 (2.479)	1.626 (1.583)		-.115 (.334)	.121	2.11

* Ordinary least squares.

X₁ = 1, X₂ = 0 for t = 1971-1973.

X₁ = 0, X₂ = 1 for t = 1974-1984.

ΔGDP = percent change in real GDP.

HES = unadjusted, high-employment surplus as percent of GDP.

PAHES = price-adjusted, high-employment surplus as percent of GDP.

direction, evidences a greater lag;⁶ there is generally more of a serial correlation in the "price effects" due to the rate of inflation than in the interest effects due to changes in interest rates.

Again, we hardly wish to claim that current, cyclically and inflation-adjusted public budget deficits are the sole determinants of changes in output and employment. We have now offered substantial evidence, though, that these inflation-adjusted deficits, or the deficits and inflation adjustments

6. See EISNER [1986], especially pp. 102-105, and EISNER and PIEPER [1986 b], Tables 2, 3, 5 and 6.

taken separately, have had significant effects on the growth of GNP and GDP (and on reductions in unemployment). This is clearly true for the United States' Federal deficits and there is some evidence of lesser effects of domestic deficits in other countries as well. Tullio's comment is indeed partially corroborative of these findings and certainly does not "unambiguously" contradict them.

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