Appendix B

In this appendix different estimates of the seven expenditure equations of the model will be compared. In Table B–1 three estimates are presented for each of the seven equations. The first estimate for each equation is the one included in the model and was obtained by using the technique described in Chapter 2. The second estimate for each equation was obtained by using the Cochrane–Orcutt technique. The Cochrane–Orcutt technique differs from the technique described in Chapter 2 in that no account is taken of possible simultaneous equation bias when using the Cochrane–Orcutt technique. The third estimate for each equation in Table B–1 was obtained by using ordinary least squares. Ordinary least squares does not take account of possible simultaneous equation bias nor of possible serial correlation of the error terms. The three estimates for each equation are denoted as TSCORC, CORC, and OLSQ respectively.

Comparing the TSCORC and CORC estimates first, the results are actually quite close. The largest differences occurred for the plant and equipment investment equation (4.4), the inventory investment equation (6.15), and the import equation (7.3). For equation (4.4), the TSCORC estimate of the coefficient of GNP_t is smaller than the CORC estimate (.0686 vs. .0626), the TSCORC estimate of the coefficient of $PE2_t$ is larger (.687 vs. .624), and the TSCORC estimate of the serial correlation coefficient is smaller (.689 vs. .741). For equation (6.15), the TSCORC estimate of the coefficient of the $CD_{t-1} + CN_{t-1} - CD_t - CN_t$ variable is smaller (.0954 vs. .2290), and the TSCORC estimate of the coefficient of V_{t-1} is larger in absolute value ($-.357$ vs. $-.313$). For equation (7.3), the TSCORC estimate of the coefficient of GNP_t is larger (.0780 vs. .0737).

One would expect the CORC estimates of the GNP_t coefficients to be biased upward for the first five equations in Table B–1 and biased downward for the import equation. One would thus expect the CORC estimates of the GNP_t coefficients in Table B–1 to be larger than the TSCORC estimates for the first five equations and smaller for the import equation. The results in Table B–1 are consistent with this, except for the housing investment equation (5.5), where the CORC and TSCORC estimates are the same. One would also expect the CORC estimate of the coefficient of $CD_{t-1} + CN_{t-1} - CD_t - CN_t$ in equation (6.15) (which is the same as the estimate of coefficient of $-CD_t - CN_t$, since $CD_{t-1} + CN_{t-1}$ is included as a separate variable

Table B–1. Comparison of the Expenditure Equations of the Model Estimated by the Technique Described in Chapter 2 (TSCORC), by the Cochrane–Orcutt Technique (CORC), and by Ordinary Least Squares (OLSQ).

Estimation Technique	Equation		$\hat{r}$	SE	No. of Observations
TSCORC	(3.1)	$CD_t = -25.43 + .1027\widehat{GNP}_t + .110MOOD_{t-1}$ (4.22) (39.78) (1.88) $+ .092MOOD_{t-2}$ (1.54)	.648 (6.01)	1.125	50
CORC	(3.1)	$CD_t = -25.52 + .1029GNP_t + .110MOOD_{t-1}$ (4.22) (39.42) (1.88) $+ .091MOOD_{t-2}$ (1.53)	.649 (6.03)	1.125	50
OLSQ	(3.1)	$CD_t = -25.94 + .1018GNP_t + .099MOOD_{t-1}$ (6.26) (78.52) (1.33) $+ .114MOOD_{t-2}$ (1.53)	0	1.515	50
TSCORC	(3.7)	$CN_t = .0807\widehat{GNP}_t + .646CN_{t-1} + .147MOOD_{t-2}$ (5.40) (9.30) (4.67)	−.381 (2.47)	1.383	36
CORC	(3.7)	$CN_t = .0816GNP_t + .642CN_{t-1} + .148MOOD_{t-2}$ (5.51) (9.32) (4.76)	−.378 (2.45)	1.383	36
OLSQ	(3.7)	$CN_t = .0976GNP_t + .567CN_{t-1} + .182MOOD_{t-2}$ (4.86) (6.08) (4.31)	0	1.482	36
TSCORC	(3.11)	$CS_t = .0218\widehat{GNP}_t + .945CS_{t-1} - .023MOOD_{t-2}$ (4.15) (47.77) (7.37)	−.077 (0.55)	.431	50
CORC	(3.11)	$CS_t = .0235GNP_t + .938CS_{t-1} - .023MOOD_{t-2}$ (4.70) (49.66) (7.78)	−.077 (0.53)	.431	50
OLSQ	(3.11)	$CS_t = .0237GNP_t + .938CS_{t-1} - .023MOOD_{t-2}$ (4.39) (40.11) (7.28)	0	.432	50
TSCORC	(4.4)	$IP_t = -8.50 + .0626GNP_t + .687PE2_t$ (4.86) (8.87) (8.34)	.689 (6.72)	1.011	50
CORC	(4.4)	$IP_t = -9.40 + .0686GNP_t + .624PE2_t$ (4.56) (9.25) (7.32)	.741 (7.80)	1.007	50
OLSQ	(4.4)	$IP_t = -6.78 + .0491GNP_t + .835PE2_t$ (9.04) (11.72) (16.42)	0	1.345	50
TSCORC	(5.5)	$IH_t = -3.53 + .0157\widehat{GNP}_t + .0242HSQ_t + .0230HSQ_{t-1}$ (2.31) (13.12) (5.37) (4.45) $+ .0074HSQ_{t-2}$ (1.66)	.449 (3.01)	.582	36
CORC	(5.5)	$IH_t = -3.50 + .0157GNP_t + .0242HSQ_t$ (2.30) (13.12) (5.37) $+ .0230HSQ_{t-1} + .0074HSQ_{t-2}$ (4.45) (1.67)	.447 (2.99)	.582	36
OLSQ	(5.5)	$IH_t = -3.17 + .0151GNP_t + .0246HSQ_t$ (3.00) (20.15) (4.92) $+ .0229HSQ_{t-1} + .0073HSQ_{t-2}$ (3.11) (1.46)	0	.644	36

Table B–1 (cont.)

Estimation Technique	Equation		r	SE	No. of Observations
TSCORC	(6.15)	$V_t - V_{t-1} = -114.76 + .728(CD_{t-1} + CN_{t-1})$ (4.09) (4.27) $- .357V_{t-1}$ (3.94) $+ .0954(CD_{t-1} + CN_{t-1} - \widehat{CD}_t - \widehat{CN}_t)$ (0.42)	.791 (9.15)	2.540	50
CORC	(6.15)	$V_t - V_{t-1} = -101.04 + .645(CD_{t-1} + CN_{t-1})$ (4.57) (4.77) $-.313V_{t-1}$ (4.36) $+ .2290(CD_{t-1} + CN_{t-1} - CD_t - CN_t)$ (1.68)	.772 (8.58)	2.515	50
OLSQ	(6.15)	$V_t - V_{t-1} = -52.98 + .345(CD_{t-1} + CN_{t-1}) - .154V_{t-1}$ (3.46) (3.60) (3.04) $+ .0651(CD_{t-1} + CN_{t-1} - CD_t - CN_t)$ (0.32)	0	3.592	50
TSCORC	(7.3)	$IMP_t = .0780\widehat{GNP}_t$ (8.70)	1.0	.637	45
CORC	(7.3)	$IMP_t = .0737GNP_t$ (8.64)	1.0	.635	45
OLSQ	(7.3)	$IMP_t = -8.45 + .0627GNP_t$ (7.70) (34.44)	0	1.787	45

in the equation) to be biased downward. The results in Table B–1 are not consistent with this, however, since the CORC estimate of the coefficient is larger than the TSCORC estimate.

Comparing the OLSQ estimates with the TSCORC and CORC estimates, the results are much different. The fits tend to be much worse for the OLSQ estimates, and many of the coefficient estimates are quite different. The most dramatic results occur for the inventory equation, where the OLSQ coefficient estimates are much smaller in absolute value than the TSCORC and CORC estimates.

The results in Table B–1 thus indicate that it is more important to account for serial correlation problems than it is to account for simultaneous equation bias. For a more formal test of this conclusion, the regular two-stage least squares estimates should have been computed as well, but the results in Table B–1 are sufficiently striking to indicate that further attempts to support the conclusion are not needed. If serial correlation is less pronounced in larger models than it is in the present model, the conclusion reached here may need modifying, but for small or even medium-sized models the results in

Table B–1 indicate that serial correlation problems are likely to be more severe than are problems of simultaneous equation bias.

Given that serial correlation problems are to be accounted for, the question arises as to whether the TSCORC procedure is worth the extra effort. The TSCORC and CORC results for equations (4.4) and (7.3), and perhaps for equation (6.15), in Table B–1 indicate that the TSCORC procedure may be worth the extra effort. There does appear to be at least some degree of simultaneous equation bias that needs to be accounted for. It should also be noted that the TSCORC procedure was needed in Chapter 9 to estimate the equation explaining the labor force participation of secondary workers, where there was evidence of rather large bias. The bias in this case was due to measurment error problems.