Table 1

Data Generating Processes

A. Parameters of Cost Function

| Mnemonic | $\beta_1$ | $\beta_2$ | $\beta_3$ |
|---|---|---|---|
| A | 0.160 | 0.016 | 0.002 |
| B | 0.126 | −0.252 | 0.376 |
| C | 0.099 | 0.199 | 0.01001 |
| D | 0.197 | −0.099 | 0.010 |

B. Parameters of Exogenous Processes

| $\phi_1$ | $\phi_2$ | var($\epsilon_S$) | var(u) | $\rho(\epsilon_S, u)$ |
|---|---|---|---|---|
| .75 | .20 | .120833 | 3.5 | −.5 |

C. Implied Coefficients of Inventory Equation

| DGP | $\lambda_1+\lambda_2$ | $-\lambda_1\lambda_2$ | $\pi_1$ | $\pi_2$ |
|---|---|---|---|---|
| A | 1.22 | −0.42 | 0.14 | −0.12 |
| B | 0.24 | −0.14 | 0.38 | 0.05 |
| C | 1.07 | −0.22 | 0.10 | −0.09 |
| D | 1.43 | −0.69 | 0.33 | −0.15 |

Notes:

1. $\beta_1$, $\beta_2$ and $\beta_3$ are the regression parameters in (3.1); $\phi_1$ and $\phi_2$ are the autoregressive parameters of the sales process defined in (2.2); $\epsilon_S$ is the sales shock defined in (2.2); u is the cost shock defined in (2.1); $\lambda_1+\lambda_2$, $-\lambda_1\lambda_2$, $\pi_1$, and $\pi_2$ are the coefficients of the reduced form inventory equation (2.3b).

Table 2

Parameters of the MA(2) Disturbance

| DGP | $\theta_1$ | $\theta_2$ | Modulus of Larger Root |
|---|---|---|---|
| A | 1.27 | −0.45 | 0.67 |
| B | 0.50 | −0.19 | 0.43 |
| C | 0.93 | −0.18 | 0.67 |
| D | 1.44 | −0.71 | 0.85 |

Notes:

1. $\theta_1$ and $\theta_2$ are the parameters of the MA(2) disturbance $v_{t+2}$; see (3.1) and (3.9). The modulus presented is that of the larger of the two roots to $z^2-\theta_1 z-\theta_2 = 0$.

Table 3

Asymptotic Standard Errors, IVq Relative to IV*

| DGP | Estimator | Parameter $\beta_1$ | $\beta_2$ | $\beta_3$ |
|---|---|---|---|---|
| A | IV4 | 2.21 | 2.26 | 1.40 |
| A | IV6 | 1.46 | 1.47 | 1.13 |
| A | IV8 | 1.19 | 1.20 | 1.05 |
| A | IV12 | 1.03 | 1.03 | 1.01 |
| B | IV4 | 1.12 | 1.10 | 1.02 |
| B | IV6 | 1.00 | 1.00 | 1.00 |
| B | IV8 | 1.00 | 1.00 | 1.00 |
| B | IV12 | 1.00 | 1.00 | 1.00 |
| C | IV4 | 1.49 | 1.51 | 1.31 |
| C | IV6 | 1.16 | 1.17 | 1.10 |
| C | IV8 | 1.06 | 1.07 | 1.04 |
| C | IV12 | 1.01 | 1.01 | 1.01 |
| D | IV4 | 3.02 | 2.99 | 1.31 |
| D | IV6 | 1.67 | 1.63 | 1.07 |
| D | IV8 | 1.23 | 1.22 | 1.03 |
| D | IV12 | 1.08 | 1.08 | 1.03 |

Notes:

1. IVq is the conventional instrumental variables estimator described in (3.2) and (3.3), where $Z_t$ consists of q instruments (q=4,6,8, or 12); IV* is the optimal estimator described in (3.12) and (3.13). The table presents the ratio of the square roots of the diagonal elements of (1)the variance-covariance matrix of IVq (computed according to (3.5)), to (2)the variance-covariance matrix of IV* (computed according to (3.11)).

Table 4

Distributions of Standardized Parameter Estimates, From Simulations, T=100

| DGP/ Estimator | $\hat{\beta}_1-\beta_1$ 50% CI | Median | Trimmed MSE | $\hat{\beta}_2-\beta_2$ 50% CI | Median | Trimmed MSE | $\hat{\beta}_3-\beta_3$ 50% CI | Median | Trimmed MSE |
|---|---|---|---|---|---|---|---|---|---|
| A | | | | | | | | | |
| IV4 | (-0.6,0.8) | 0.07 | 1.14 | (-0.8,0.6) | -0.10 | 1.20 | (-3.1,1.6) | -0.68 | 2.51 |
| IV12 | (-0.3,0.9) | 0.29 | 0.92 | (-0.9,0.3) | -0.30 | 0.98 | (-4.3,0.8) | -1.26 | 2.52 |
| IV* | (-0.4,0.4) | 0.04 | 0.61 | (-0.5,0.4) | -0.06 | 0.63 | (-2.7,1.6) | -0.39 | 2.27 |
| asy* | (-0.3,0.3) | 0.00 | 0.21 | (-0.3,0.3) | 0.00 | 0.20 | (-0.5,0.5) | 0.00 | 0.51 |
| B | | | | | | | | | |
| IV4 | (-0.5,1.0) | 0.27 | 1.13 | (-1.1,0.4) | -0.38 | 1.24 | (-0.5,1.2) | 0.23 | 1.47 |
| IV12 | (-0.2,1.0) | 0.47 | 0.94 | (-1.4,-0.0) | -0.63 | 1.34 | (-0.2,1.7) | 0.67 | 1.79 |
| IV* | (-0.5,0.7) | 0.14 | 0.93 | (-0.9,0.4) | -0.22 | 1.09 | (-0.5,1.1) | 0.24 | 1.33 |
| asy* | (-0.6,0.6) | 0.00 | 0.79 | (-0.6,0.6) | 0.00 | 0.82 | (-0.7,0.7) | 0.00 | 0.97 |
| C | | | | | | | | | |
| IV4 | (-0.7,0.8) | 0.11 | 1.14 | (-0.8,0.6) | -0.13 | 1.17 | (-1.1,2.8) | 0.66 | 2.41 |
| IV12 | ( 0.0,1.0) | 0.54 | 0.98 | (-1.1,-0.1) | -0.59 | 1.06 | (-2.3,1.0) | -0.59 | 2.18 |
| IV* | (-0.8,0.5) | -0.06 | 0.91 | (-0.5,0.8) | 0.03 | 0.91 | (-0.4,3.9) | 1.19 | 2.06 |
| asy* | (-0.5,0.5) | 0.00 | 0.45 | (-0.4,0.4) | 0.00 | 0.44 | (-0.5,0.5) | 0.00 | 0.59 |
| D | | | | | | | | | |
| IV4 | (-0.6,0.9) | 0.11 | 1.23 | (-0.9,0.6) | -0.11 | 1.28 | (-3.1,0.5) | -1.02 | 2.30 |
| IV12 | (-0.4,0.8) | 0.15 | 1.05 | (-0.8,0.5) | -0.15 | 1.06 | (-3.6,0.3) | -1.39 | 2.38 |
| IV* | (-0.3,0.4) | 0.05 | 0.53 | (-0.5,0.3) | -0.07 | 0.55 | (-2.6,0.5) | -0.84 | 2.11 |
| asy* | (-0.2,0.2) | 0.00 | 0.11 | (-0.2,0.2) | 0.00 | 0.11 | (-0.5,0.5) | 0.00 | 0.58 |
| asy4 | (-0.7,0.7) | 0.00 | 1.00 | (-0.7,0.7) | 0.00 | 1.00 | (-0.7,0.7) | 0.00 | 1.00 |

Notes:

1. The estimating equations are: IV4, (3.3); IV12, (3.3); IV*, (3.13).

2. The difference between estimated and population parameter is standardized by dividing by asymptotic standard error for IV4.

3. The "50% CI" is a 50 percent confidence interval constructed using the 250'th and 750'th largest of the 1000 estimates; "Median" is the 500'th largest such entry; "Trimmed MSE" is a mean squared error computed after dropping observations greater than 3.0 in absolute value, and is expressed relative to the MSE for a standard normal similarly trimmed.

4. "asy*" presents the asymptotic values for IV* and (approximately) IV12, which vary from DGP to DGP because the ratio of standard errors of IV* to IV4 varies from DGP to DGP (see Table 3 and the text). "asy4" presents the asymptotic values for IV4.

Table 5

Distributions of Standardized Parameter Estimates, From Simulations, T=300

| DGP/ Estimator | $\hat{\beta}_1-\beta_1$ 50% CI | Median | Trimmed MSE | $\hat{\beta}_2-\beta_2$ 50% CI | Median | Trimmed MSE | $\hat{\beta}_3-\beta_3$ 50% CI | Median | Trimmed MSE |
|---|---|---|---|---|---|---|---|---|---|
| A | | | | | | | | | |
| IV4 | (−0.7,0.8) | 0.14 | 1.14 | (−0.8,0.6) | −0.15 | 1.14 | (−1.2,0.9) | −0.17 | 1.76 |
| IV12 | (−0.2,0.7) | 0.29 | 0.57 | (−0.7,0.2) | −0.29 | 0.57 | (−1.3,0.6) | −0.32 | 1.64 |
| IV* | (−0.3,0.4) | 0.08 | 0.36 | (−0.4,0.3) | −0.09 | 0.35 | (−0.9,0.6) | −0.14 | 1.38 |
| asy* | (−0.3,0.3) | 0.00 | 0.21 | (−0.3,0.3) | 0.00 | 0.20 | (−0.5,0.5) | 0.00 | 0.51 |
| B | | | | | | | | | |
| IV4 | (−0.6,0.9) | 0.21 | 1.10 | (−0.9,0.5) | −0.30 | 1.16 | (−0.6,0.9) | 0.14 | 1.21 |
| IV12 | (−0.3,1.0) | 0.41 | 0.98 | (−1.1,0.2) | −0.49 | 1.15 | (−0.4,1.2) | 0.37 | 1.38 |
| IV* | (−0.5,0.7) | 0.14 | 0.84 | (−0.8,0.4) | −0.22 | 0.92 | (−0.5,0.9) | 0.18 | 1.11 |
| asy* | (−0.6,0.6) | 0.00 | 0.79 | (−0.6,0.6) | 0.00 | 0.82 | (−0.7,0.7) | 0.00 | 0.97 |
| C | | | | | | | | | |
| IV4 | (−0.7,0.8) | 0.10 | 1.13 | (−0.8,0.7) | −0.11 | 1.14 | (−0.6,1.5) | 0.36 | 1.66 |
| IV12 | (−0.2,0.9) | 0.44 | 0.78 | (−0.9,0.1) | −0.45 | 0.78 | (−0.8,0.9) | −0.07 | 1.33 |
| IV* | (−0.7,0.4) | −0.06 | 0.70 | (−0.4,0.7) | 0.04 | 0.70 | (−0.1,1.7) | 0.58 | 1.39 |
| asy* | (−0.5,0.5) | 0.00 | 0.45 | (−0.4,0.4) | 0.00 | 0.44 | (−0.5,0.5) | 0.00 | 0.59 |
| D | | | | | | | | | |
| IV4 | (−0.6,0.8) | 0.15 | 1.14 | (−0.8,0.6) | −0.15 | 1.16 | (−1.3,0.4) | −0.34 | 1.53 |
| IV12 | (−0.3,0.6) | 0.16 | 0.48 | (−0.6,0.3) | −0.15 | 0.49 | (−1.3,0.4) | −0.43 | 1.56 |
| IV* | (−0.2,0.3) | 0.06 | 0.25 | (−0.3,0.2) | −0.06 | 0.26 | (−1.1,0.4) | −0.29 | 1.28 |
| asy* | (−0.2,0.2) | 0.00 | 0.11 | (−0.2,0.2) | 0.00 | 0.11 | (−0.5,0.5) | 0.00 | 0.58 |
| asy4 | (−0.7,0.7) | 0.00 | 1.00 | (−0.7,0.7) | 0.00 | 1.00 | (−0.7,0.7) | 0.00 | 1.00 |

See notes to Table 4.

Table 6

A. Size of Nominal .05 T-Tests, from Simulations

| DGP | Estimator | T=100 $\beta_1$ | T=100 $\beta_2$ | T=100 $\beta_3$ | T=300 $\beta_1$ | T=300 $\beta_2$ | T=300 $\beta_3$ |
|---|---|---|---|---|---|---|---|
| A | IV4 | 0.061 | 0.056 | 0.004 | 0.063 | 0.060 | 0.001 |
| | IV12 | 0.142 | 0.134 | 0.020 | 0.080 | 0.067 | 0.004 |
| | IV* | 0.080 | 0.077 | 0.068 | 0.076 | 0.073 | 0.087 |
| B | IV4 | 0.073 | 0.072 | 0.065 | 0.065 | 0.053 | 0.061 |
| | IV12 | 0.193 | 0.260 | 0.231 | 0.103 | 0.104 | 0.106 |
| | IV* | 0.115 | 0.073 | 0.059 | 0.056 | 0.052 | 0.066 |
| C | IV4 | 0.073 | 0.071 | 0.010 | 0.075 | 0.076 | 0.011 |
| | IV12 | 0.264 | 0.264 | 0.031 | 0.158 | 0.154 | 0.014 |
| | IV* | 0.115 | 0.119 | 0.053 | 0.080 | 0.082 | 0.050 |
| D | IV4 | 0.020 | 0.018 | 0.002 | 0.037 | 0.028 | 0.002 |
| | IV12 | 0.047 | 0.044 | 0.026 | 0.017 | 0.015 | 0.006 |
| | IV* | 0.083 | 0.086 | 0.091 | 0.118 | 0.117 | 0.114 |

B. Size of Nominal .05 J-Tests, from Simulations

| DGP | Estimator | T=100 J-size | T=300 J-size |
|---|---|---|---|
| A | IV4 | 0.041 | 0.056 |
| | IV12 | 0.001 | 0.001 |
| B | IV4 | 0.052 | 0.061 |
| | IV12 | 0.004 | 0.023 |
| C | IV4 | 0.039 | 0.051 |
| | IV12 | 0.003 | 0.001 |
| D | IV4 | 0.042 | 0.055 |
| | IV12 | 0.001 | 0.000 |

Notes:

1. In each of 1000 simulations, we computed t-statistics testing whether each of the three $\beta_i$s equals its Table 1A population value. Panel A presents the fraction of simulations in which the square of the t-statistic exceeded 3.84, which is the .05 critical value for a $\chi^2(1)$ random variable.

2. In each of 1000 simulations, tests of instrument-residual orthogonality were computed as in (3.16). Panel B presents the fraction of simulations in which the resulting statistic was greater than 3.84 (IV4) or 16.92 (IV12), which are the .05 critical values for $\chi^2(1)$ and $\chi^2(9)$ random variables.

Table 7

Estimates of Aggregate Nondurables in Manufacturing, 1967–1992

| (1) Estimator | (2) $\hat{\beta}_1$ | (3) $\hat{\beta}_2$ | (4) $\hat{\beta}_3$ | (5) $\hat{\theta}_1$ | (6) $\hat{\theta}_2$ | (7) Modulus of Larger Root |
|---|---|---|---|---|---|---|
| IV4 | 0.114 | 0.160 | 0.004 | 0.84 | −0.35 | 0.42 |
| | (0.044) | (0.134) | (0.008) | | | |
| IV12 | 0.155 | 0.036 | −0.004 | | | |
| | (0.016) | (0.048) | (0.004) | | | |
| IV* | 0.145 | 0.068 | 0.001 | | | |
| | (0.024) | (0.071) | (0.006) | | | |

Notes:

1. The table presents estimates of IV4, IV12 and IV*, computed according to (3.3) and (3.13). The vector $\hat{R}_t$ (defined above (3.12)) was the set of lags that maximized the Schwarz criterion, where the following four sets were considered: $H_{t-1}, S_{t-1}, H_{t-2}$; $H_{t-1}, S_{t-1}, H_{t-2}, S_{t-2}$; $H_{t-1}, S_{t-1}, H_{t-2}, S_{t-2}, H_{t-3}, S_{t-3}$; $H_{t-1}, S_{t-1}, H_{t-2}, S_{t-2}, H_{t-3}, S_{t-3}, H_{t-4}, S_{t-4}$. All four also included intercept and trend.

2. Columns (5)–(7) are as described in Table 2, and are estimated from the two stage least squares residuals.