Supplement for

Robust Standard Errors in Transformed Likelihood Estimation of Dynamic Panel Data Models with Cross-Sectional Heteroskedasticity

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Abstract

This supplement provides complete tables of the simulation results reported in the above paper.

1 Simulation design

1.1 ARX(1) case

y_{it} and x_{it} are generated as

$$
\begin{aligned}
y_{it} &= \alpha_i + \gamma y_{i,t-1} + \beta x_{it} + u_{it}, & (t = -m+1, -m+2, .., 0, 1, ..., T), \\
y_{i,-m} &= 0 \\
x_{it} &= \mu_i + \zeta_{it}, & (t = -m, -m+1, .., 0, 1, ..., T) \\
\zeta_{it} &= \phi \zeta_{i,t-1} + \varepsilon_{it}, & (t = -49-m, -48-m, ..., 0, 1, ..., T), \\
\xi_{i,-m-50} &= 0
\end{aligned}
$$

where the long-run coefficient is $\psi = \beta/(1-\gamma)$. We discard the first m observations in y_{it} and x_{it}, and use the observations $t = 0$ through T for estimation[1]. We discard the first 50 observations of ζ_{it} and use the remaining $(T+1+m)$ observations for generating x_{it}.

In the simulations, we try

$$
\begin{aligned}
T &= 5, 10, 15, & N = 50, 150, 500, \\
\gamma &= 0.0, 0.4, 0.9, & \phi = 0.5, \\
\beta^2 &= \left(\frac{R_y^2 - \gamma^2}{1 - R_y^2}\right) \frac{(1-\phi^2)(1-\phi\gamma)}{(1+\phi\gamma)} & \text{for} \quad (\gamma, R_y^2) = (0.0, 0.10), (0.4, 0.26), (0.9, 0.91) \\
u_{it} &\sim \mathcal{N}(0, \sigma_i^2), & \sigma_i^2 \sim \mathcal{U}[0.5, 1.5] \\
\varepsilon_{it} &\sim \mathcal{N}(0, \sigma_{\varepsilon i}^2) & \sigma_{\varepsilon i}^2 \sim \mathcal{U}[0.5, 1.5] \\
\alpha_i &= \eta(\mu_i + \bar{u}_i + v_i) \\
\tau^2 &= \frac{N^{-1}\sum_{i=1}^{N} Var(\alpha_i)}{N^{-1}\sum_{i=1}^{N} Var(u_{it})} = \frac{\eta^2(T^{-1}\bar{\sigma}_N^2 + 2)}{\bar{\sigma}_N^2} & \text{for} \quad \tau^2 = 1, 5, \\
\mu_i &\sim iid\mathcal{N}(0,1),
\end{aligned}
$$

1.2 AR(1) case

The y_{it} are generated as

$$
\begin{aligned}
y_{it} &= \alpha_i + \gamma y_{i,t-1} + u_{it}, & (t = -m+1, ..., 1, ..., T; i = 1, ..., N), \\
y_{i,-m} &= 0.
\end{aligned}
$$

In the simulations, we try

$$
\begin{aligned}
T &= 5, 10, 15, 20, & N = 50, 150, 500, \\
\gamma &= 0.0, 0.4, 0.9, \\
u_{it} &\sim \mathcal{N}(0, \sigma_i^2), & \sigma_i^2 \sim \mathcal{U}[0.5, 1.5] \\
\alpha_i &= \eta(\bar{u}_i + v_i) \\
\tau^2 &= \frac{N^{-1}\sum_{i=1}^{N} Var(\alpha_i)}{N^{-1}\sum_{i=1}^{N} Var(u_{it})} = \frac{\eta^2(T^{-1}\bar{\sigma}_N^2 + 2)}{\bar{\sigma}_N^2} & \text{for} \quad \tau^2 = 1, 5
\end{aligned}
$$

The number of replications is 1000 for all cases. Mean biases, median biases, the root mean squared errors (RMSE), the median absolute errors (MAE), empirical sizes and powers with 5% significance level are reported.

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[1] Hence, $T+1$ is the actual length of data.

2 Notes

2.1 Note to Tables A.1, A.2, A.4, A.5, A.7, A.8, A.11, A.12, A.14, A.15, A.17, A.18, A.21, A.22, A.24, A.25, A.27, A.27

"DIF1" denotes the moment conditions $E(y_{is}\Delta u_{it}) = 0$ for $s = 0, ..., t-2; t = 2, ..., T$ and $E(x_{is}\Delta u_{it}) = 0$ for $s = 1, ..., t; t = 2, ..., T$(Arellano and Bond 1991).

"DIF2" denotes the moment conditions $E(y_{i,t-2-l}\Delta u_{it}) = 0$ with $l = 0$ for $t = 2$, $l = 0, 1$ for $t = 3, ..., T$ and $E(x_{i,t-l}\Delta u_{it}) = 0$ with $l = 0, 1$ for $t = 2$, $l = 0, 1, 2$ for $t = 3, ..., T$(Arellano and Bond 1991).

"DIF3" denotes the moment conditions $\sum_{t=2}^{T} E(y_{i,t-2}\Delta u_{it}) = 0$, $\sum_{t=2}^{T-1} E(y_{i,t-2}\Delta u_{it}) = 0$, $\sum_{t=2}^{T} E(x_{it}\Delta u_{it}) = 0$ and $\sum_{t=2}^{T-1} E(x_{it}\Delta u_{it}) = 0$.

"SYS1" and "SYS2" denote the moment conditions $E[\Delta y_{i,t-1}(\alpha_i + u_{it})] = 0$ and $E[\Delta x_{it}(\alpha_i + u_{it})] = 0$ for $t = 2, ..., T$ in addition to the ones used in "DIF1" and "DIF2", respectively. "SYS3" denotes the moment conditions $\sum_{t=2}^{T} E(\Delta y_{i,t-1}(\alpha_i + u_{it})) = 0$, $\sum_{t=2}^{T-1} E(\Delta y_{i,t-1}(\alpha_i + u_{it})) = 0$, $\sum_{t=2}^{T} E(\Delta x_{it}(\alpha_i + u_{it})) = 0$ and $\sum_{t=2}^{T-1} E(\Delta x_{it}(\alpha_i + u_{it})) = 0$, in addition to the one used in "DIF3".

The numbers of moment conditions of "DIF1", "DIF2", "SYS1" and "SYS2" are 24, 18, 32, 26 when $T = 5$, 99, 43, 117, 61 when $T = 10$ and 224, 68, 252, 96 when $T = 15$. The number of moment conditions of "DIF3" and "SYS3" are 4 and 8 for any T, respectively.

"−" denotes the cases where the GMM estimators are not computed since the number of moment conditions exceeds the sample size.

2.2 Note to Tables A.3, A.6, A.9, A.13, A.16, A.19, A.23, A.26, A.29, A.33, A.37, A.41

In addition to the results based on the conventional standard errors, results using Windmeijer's standard errors for two-step GMM and Newey and Windmeijer's standard errors for continuous-updating GMM are also reported. "−" denotes the cases where the GMM estimators are not computed since the number of moment conditions exceeds the sample size.

2.3 Note to Tables A.31, A.32, A.35, A.36, A.39, A.40

"DIF1" denotes the moment conditions $E(y_{is}\Delta u_{it}) = 0$ for $s = 0, ..., t-2; t = 2, ..., T$(Arellano and Bond 1991).

"DIF2" denotes the moment conditions $E(y_{i,t-2-l}\Delta u_{it}) = 0$ with $l = 0$ for $t = 2$, $l = 0, 1$ for $t = 3, ..., T$(Arellano and Bond 1991).

"DIF3" denotes the moment conditions $\sum_{t=2}^{T} E(y_{i,t-2}\Delta u_{it}) = 0$, $\sum_{t=2}^{T-1} E(y_{i,t-2}\Delta u_{it}) = 0$ and $\sum_{t=2}^{T-2} E(y_{i,t-2}\Delta u_{it}) = 0$.

"SYS1" and "SYS2" denote moment conditions $E[\Delta y_{i,t-1}(\alpha_i + u_{it})] = 0$ for $t = 2, ..., T$ in addition to the ones used in "DIF1" and "DIF2", respectively (Blundell and Bond 1998). "SYS3" denotes moment conditions $\sum_{t=2}^{T} E(\Delta y_{i,t-1}(\alpha_i + u_{it})) = 0$, $\sum_{t=2}^{T-1} E(\Delta y_{i,t-1}(\alpha_i + u_{it})) = 0$ and $\sum_{t=2}^{T-2} E(\Delta y_{i,t-1}(\alpha_i + u_{it})) = 0$.

The numbers of moment conditions of "DIF1", "DIF2", "SYS1" and "SYS2" are 10, 7, 14, 11 when $T = 5$, 45, 17, 54, 26 when $T = 10$, 105, 27, 119, 41 when $T = 15$ and 190, 37, 209, 56 when $T = 20$. The numbers of moment conditions of "DIF3" an "SYS3" are 3 and 6 for any T, respectively.

"−" denotes the cases where the GMM estimators are not computed since the number of moment conditions exceeds the sample size.

2.4 Note to Tables A.10, A.20, A.30, A.34, A.38, A.42

"Anderson and Rubin test" denotes Anderson and Rubin test for GMM(Stock and Wright 2000).

"Lagrange multiplier test" denotes Kleibergen's(2005) LM test.

"Conditional likelihood ratio test" denotes the conditional likelihood ratio test of Moreira (2003)(extended by Kleibergen(2005)).

"−" denotes the cases where the GMM estimators are not computed since the number of moment conditions exceeds the sample size.

Summary of Tables

Table	Model	Output	Parameter	Case
A.1	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	γ	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.2	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	γ	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.3	ARX(1)	Size(%) and power(%)	γ	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.4	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	β	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.5	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	β	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.6	ARX(1)	Size(%) and power(%)	β	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.7	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	ψ	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.8	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	ψ	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.9	ARX(1)	Size(%) and power(%)	ψ	$\gamma = 0.0, \beta = 0.29, \psi = 0.29$
A.10	ARX(1)	Size(%) and power(%) of weak identification robust tests	$\boldsymbol{\theta}$	$\boldsymbol{\theta} = (0.0, 0.29)'$
A.11	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	γ	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.12	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	γ	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.13	ARX(1)	Size(%) and power(%)	γ	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.14	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	β	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.15	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	β	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.16	ARX(1)	Size(%) and power(%)	β	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.17	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	ψ	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.18	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	ψ	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.19	ARX(1)	Size(%) and power(%)	ψ	$\gamma = 0.4, \beta = 0.26, \psi = 0.43$
A.20	ARX(1)	Size(%) and power(%) of weak identification robust tests	$\boldsymbol{\theta}$	$\boldsymbol{\theta} = (0.4, 0.26)'$
A.21	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	γ	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.22	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	γ	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.23	ARX(1)	Size(%) and power(%)	γ	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.24	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	β	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.25	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	β	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.26	ARX(1)	Size(%) and power(%)	β	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.27	ARX(1)	Bias($\times 100$) and RMSE($\times 100$)	ψ	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.28	ARX(1)	Median bias($\times 100$) and MAE($\times 100$)	ψ	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.29	ARX(1)	Size(%) and power(%)	ψ	$\gamma = 0.9, \beta = 0.56, \psi = 5.6$
A.30	ARX(1)	Size(%) and power(%) of weak identification robust tests	$\boldsymbol{\theta}$	$\boldsymbol{\theta} = (0.9, 0.56)'$
A.31	AR(1)	Bias($\times 100$) and RMSE($\times 100$)	γ	$\gamma = 0.0$
A.32	AR(1)	Median bias($\times 100$) and MAE($\times 100$)	γ	$\gamma = 0.0$
A.33	AR(1)	Size(%) and power(%)	γ	$\gamma = 0.0$
A.34	AR(1)	Size(%) and power(%) of weak identification robust tests	γ	$\gamma = 0.0$
A.35	AR(1)	Bias($\times 100$) and RMSE($\times 100$)	γ	$\gamma = 0.4$
A.36	AR(1)	Median bias($\times 100$) and MAE($\times 100$)	γ	$\gamma = 0.4$
A.37	AR(1)	Size(%) and power(%)	γ	$\gamma = 0.4$
A.38	AR(1)	Size(%) and power(%) of weak identification robust tests	γ	$\gamma = 0.4$
A.39	AR(1)	Bias($\times 100$) and RMSE($\times 100$)	γ	$\gamma = 0.9$
A.40	AR(1)	Median bias($\times 100$) and MAE($\times 100$)	γ	$\gamma = 0.9$
A.41	AR(1)	Size(%) and power(%)	γ	$\gamma = 0.9$
A.42	AR(1)	Size(%) and power(%) of weak identification robust tests	γ	$\gamma = 0.9$

Table A.1: Mean bias($\times 100$) and RMSE($\times 100$) of γ ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

	bias($\times 100$)			RMSE($\times 100$)			bias($\times 100$)			RMSE($\times 100$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	0.632	0.054	-0.151	11.303	4.762	3.814	0.632	0.054	-0.151	11.303	4.762	3.814
150	0.003	-0.025	-0.043	6.460	2.850	2.304	0.003	-0.025	-0.043	6.460	2.850	2.304
500	0.098	0.000	-0.087	2.610	1.624	1.205	0.098	0.000	-0.087	2.610	1.624	1.205
Iterative transformed likelihood estimator												
50	0.058	0.053	-0.151	8.311	4.761	3.814	0.058	0.053	-0.151	8.311	4.761	3.814
150	-0.193	-0.025	-0.043	4.668	2.850	2.304	-0.193	-0.025	-0.043	4.668	2.850	2.304
500	0.098	0.000	-0.088	2.610	1.624	1.205	0.098	0.000	-0.087	2.610	1.624	1.205
One-step first-difference GMM estimator based on "DIF1"												
50	-4.837	—	—	10.408	—	—	-6.134	—	—	12.175	—	—
150	-1.803	-1.660	—	5.803	3.701	—	-2.455	-1.933	—	6.881	4.066	—
500	-0.455	-0.485	-0.545	3.322	1.915	1.444	-0.672	-0.576	-0.580	3.873	2.089	1.520
Two-step first-difference GMM estimator based on "DIF1"												
50	-4.561	—	—	13.219	—	—	-6.417	—	—	15.418	—	—
150	-1.797	-1.750	—	6.522	5.651	—	-2.455	-2.047	—	7.687	6.033	—
500	-0.492	-0.467	-0.557	3.392	2.219	1.928	-0.726	-0.556	-0.584	3.950	2.396	2.011
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	1.111	—	—	19.509	—	—	1.720	—	—	25.365	—	—
150	0.043	-0.180	—	7.012	7.513	—	0.154	-0.264	—	8.350	8.094	—
500	0.101	0.040	-0.043	3.407	2.288	2.068	0.096	0.027	-0.031	3.961	2.469	2.160
One-step first-difference GMM estimator based on "DIF2"												
50	-4.033	-2.743	—	10.436	6.413	—	-7.769	-6.085	—	15.069	9.661	—
150	-1.511	-1.065	-0.982	5.846	3.697	2.907	-3.226	-2.413	-2.060	8.668	5.439	4.104
500	-0.346	-0.293	-0.357	3.356	1.969	1.466	-0.877	-0.836	-0.719	4.888	2.917	2.013
Two-step first-difference GMM estimator based on "DIF2"												
50	-3.476	-1.229	—	12.551	13.433	—	-7.605	-5.145	—	18.236	18.048	—
150	-1.346	-0.632	-0.692	6.394	4.260	3.751	-3.032	-2.195	-1.997	9.382	6.332	5.220
500	-0.326	-0.128	-0.184	3.405	2.074	1.585	-0.963	-0.728	-0.581	5.036	3.060	2.164
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	1.990	2.885	—	17.007	26.562	—	2.806	1.214	—	26.615	32.737	—
150	0.429	0.946	0.762	6.768	4.813	4.385	0.544	0.608	0.209	10.277	6.815	5.705
500	0.239	0.329	0.261	3.435	2.149	1.639	0.158	0.094	0.117	5.090	3.070	2.150
One-step first-difference GMM estimator based on "DIF3"												
50	-0.460	0.127	-4.856	11.341	6.383	4.856	-0.320	0.101	-0.829	21.268	10.920	0.829
150	-0.358	-0.054	-0.063	6.388	3.813	2.942	-0.609	0.024	-0.055	12.875	6.679	4.721
500	0.085	-0.007	-0.119	3.641	2.072	1.498	0.149	-0.164	-0.189	6.892	3.691	2.447
Two-step first-difference GMM estimator based on "DIF3"												
50	-0.189	0.454	-3.790	11.768	6.573	3.790	-0.225	0.113	-0.888	21.783	11.304	0.888
150	-0.214	0.069	0.020	6.409	3.867	2.974	-0.545	0.029	0.026	12.776	6.705	4.716
500	0.112	0.048	-0.091	3.667	2.090	1.505	0.159	-0.143	-0.165	6.924	3.688	2.457
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	0.882	0.899	-3.697	12.441	6.740	3.697	3.032	0.995	-2.231	26.487	12.038	2.231
150	0.132	0.213	0.103	6.482	3.891	2.981	0.242	0.315	0.185	13.426	6.784	4.750
500	0.216	0.091	-0.067	3.678	2.098	1.505	0.397	-0.063	-0.125	7.032	3.705	2.459
One-step system GMM estimator based on "SYS1"												
50	2.423	—	—	9.540	—	—	44.936	—	—	47.552	—	—
150	0.788	0.539	—	5.470	3.471	—	24.260	21.748	—	27.044	23.015	—
500	0.377	0.142	0.021	3.132	1.904	1.354	9.470	7.903	7.177	11.559	8.690	7.644
Two-step system GMM estimator based on "SYS1"												
50	2.573	—	—	12.656	—	—	38.849	—	—	43.845	—	—
150	0.634	0.279	—	5.469	5.296	—	12.483	14.277	—	16.982	16.474	—
500	0.300	0.220	0.096	2.758	1.918	1.712	1.950	2.381	2.736	4.206	3.456	3.530
Continuous-updating system GMM estimator based on "SYS1"												
50	4.564	—	—	21.898	—	—	14.043	—	—	37.591	—	—
150	0.199	0.328	—	5.875	7.976	—	0.350	0.838	—	5.970	9.580	—
500	0.214	0.162	0.092	2.756	2.018	1.922	0.252	0.177	0.107	2.785	2.025	1.926
One-step system GMM estimator based on "SYS2"												
50	3.053	—	—	9.833	—	—	48.564	—	—	51.042	—	—
150	0.988	0.990	0.880	5.533	3.729	2.898	27.240	27.239	25.995	30.073	28.564	26.889
500	0.445	0.277	0.174	3.140	1.979	1.437	10.966	10.381	9.705	13.213	11.279	10.242
Two-step system GMM estimator based on "SYS2"												
50	3.138	—	—	12.051	—	—	41.537	—	—	46.523	—	—
150	0.893	0.975	0.700	5.560	4.401	4.085	14.023	16.268	16.468	18.798	18.682	18.214
500	0.358	0.372	0.239	2.801	2.009	1.601	2.300	2.772	2.624	4.579	3.944	3.453
Continuous-updating system GMM estimator based on "SYS2"												
50	3.373	—	—	18.220	—	—	12.803	—	—	31.917	—	—
150	0.364	0.499	0.223	5.785	4.910	5.159	0.534	0.666	0.306	5.920	4.925	5.129
500	0.240	0.214	0.084	2.793	2.042	1.616	0.284	0.248	0.117	2.827	2.072	1.620
One-step system GMM estimator based on "SYS3"												
50	0.613	0.284	5.269	9.723	5.857	5.269	13.289	2.641	25.147	24.769	12.316	25.147
150	-0.024	0.013	-0.017	5.627	3.600	2.783	3.679	0.790	0.428	15.013	7.595	4.959
500	0.157	0.029	-0.097	3.229	1.948	1.433	1.051	0.334	0.011	8.951	4.118	2.689
Two-step system GMM estimator based on "SYS3"												
50	2.560	1.405	8.066	10.821	6.564	8.066	13.260	3.772	22.168	24.540	11.266	22.168
150	0.743	0.404	0.255	5.776	3.715	2.886	3.904	1.201	0.729	11.773	6.094	4.239
500	0.416	0.177	-0.001	3.235	1.969	1.449	1.347	0.376	0.098	6.059	3.161	2.152
Continuous-updating system GMM estimator based on "SYS3"												
50	2.182	1.276	6.384	11.554	6.889	6.384	3.989	1.521	2.740	20.261	10.888	2.740
150	0.462	0.356	0.215	5.784	3.744	2.903	0.547	0.385	0.322	10.561	5.825	4.157
500	0.317	0.155	-0.014	3.236	1.973	1.449	0.300	0.109	-0.034	5.766	3.130	2.140

Table A.2: Median bias(×100) and MAE(×100) of γ ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

N/T	median bias(×100)			MAE(×100)			median bias(×100)			MAE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	-0.091	0.113	-0.191	5.741	3.208	2.686	-0.091	0.113	-0.191	5.741	3.208	2.686
150	-0.260	0.005	-0.048	3.178	2.015	1.674	-0.260	0.005	-0.048	3.178	2.015	1.674
500	0.018	-0.036	-0.117	1.690	1.106	0.803	0.018	-0.036	-0.117	1.690	1.106	0.803
Iterative transformed likelihood estimator												
50	-0.136	0.112	-0.192	5.656	3.209	2.686	-0.136	0.112	-0.192	5.656	3.208	2.686
150	-0.260	0.005	-0.048	3.165	2.016	1.674	-0.260	0.006	-0.048	3.165	2.016	1.674
500	0.016	-0.037	-0.117	1.690	1.105	0.803	0.018	-0.036	-0.117	1.691	1.106	0.803
One-step first-difference GMM estimator based on "DIF1"												
50	-5.114	—	—	7.125	—	—	-6.382	—	—	8.678	—	—
150	-1.970	-1.621	—	4.074	2.419	—	-2.581	-1.895	—	4.798	2.827	—
500	-0.486	-0.515	-0.584	2.246	1.250	1.022	-0.734	-0.571	-0.582	2.708	1.455	1.109
Two-step first-difference GMM estimator based on "DIF1"												
50	-3.908	—	—	8.850	—	—	-6.108	—	—	10.393	—	—
150	-1.638	-1.699	—	4.558	3.746	—	-2.669	-1.972	—	5.504	3.985	—
500	-0.540	-0.514	-0.567	2.372	1.474	1.345	-0.775	-0.655	-0.634	2.744	1.595	1.337
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	0.583	—	—	11.589	—	—	0.882	—	—	14.971	—	—
150	0.325	-0.058	—	4.831	4.886	—	0.199	-0.224	—	5.857	5.188	—
500	0.031	-0.042	-0.067	2.349	1.505	1.435	-0.001	0.007	-0.079	2.774	1.644	1.456
One-step first-difference GMM estimator based on "DIF2"												
50	-4.230	-2.842	—	7.113	4.441	—	-8.120	-6.091	—	10.800	6.840	—
150	-1.620	-0.996	-1.036	4.074	2.468	2.043	-3.749	-2.343	-2.320	6.089	3.573	3.022
500	-0.382	-0.304	-0.376	2.179	1.331	1.001	-0.990	-0.811	-0.729	3.207	1.945	1.331
Two-step first-difference GMM estimator based on "DIF2"												
50	-3.323	-1.558	—	8.185	8.245	—	-7.962	-4.862	—	13.051	12.053	—
150	-1.321	-0.624	-0.693	4.239	2.916	2.547	-3.392	-2.063	-1.920	6.643	4.180	3.454
500	-0.391	-0.117	-0.231	2.270	1.371	1.112	-1.087	-0.740	-0.594	3.297	2.031	1.432
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	1.639	1.390	—	10.074	12.407	—	1.500	0.131	—	15.680	16.924	—
150	0.566	0.923	0.775	4.387	3.210	2.974	0.186	0.790	0.475	6.901	4.425	3.946
500	0.157	0.323	0.226	2.293	1.420	1.133	-0.072	0.013	0.086	3.448	1.937	1.420
One-step first-difference GMM estimator based on "DIF3"												
50	-0.263	0.294	-4.856	7.297	4.389	4.856	-1.538	-0.022	-0.829	13.409	7.641	0.829
150	-0.401	0.118	-0.079	4.234	2.608	2.102	-0.955	0.054	-0.087	8.441	4.540	3.255
500	0.006	0.006	-0.134	2.416	1.463	1.065	0.071	-0.105	-0.128	4.579	2.582	1.600
Two-step first-difference GMM estimator based on "DIF3"												
50	-0.351	0.546	-3.790	7.665	4.467	3.790	-1.188	-0.175	-0.888	13.709	7.606	0.888
150	-0.233	0.147	0.033	4.285	2.635	2.123	-1.061	-0.011	0.005	8.412	4.488	3.212
500	0.032	0.042	-0.111	2.377	1.452	1.085	0.104	-0.060	-0.121	4.620	2.553	1.634
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	0.257	0.948	-3.697	7.970	4.494	3.697	1.022	0.439	-2.231	15.002	8.004	2.231
150	0.041	0.300	0.117	4.277	2.714	2.087	-0.342	0.299	0.209	8.733	4.535	3.220
500	0.162	0.085	-0.080	2.414	1.445	1.084	0.416	-0.009	-0.089	4.642	2.540	1.630
One-step system GMM estimator based on "SYS1"												
50	2.180	—	—	6.622	—	—	46.239	—	—	46.239	—	—
150	0.606	0.660	—	3.628	2.398	—	24.085	21.316	—	24.085	21.316	—
500	0.307	0.142	0.052	2.022	1.294	0.941	9.354	7.719	6.980	9.369	7.719	6.980
Two-step system GMM estimator based on "SYS1"												
50	2.173	—	—	7.984	—	—	39.743	—	—	39.743	—	—
150	0.672	0.292	—	3.772	3.407	—	10.682	13.919	—	10.741	13.919	—
500	0.214	0.186	0.087	1.734	1.334	1.158	1.619	2.223	2.620	2.470	2.328	2.626
Continuous-updating system GMM estimator based on "SYS1"												
50	2.874	—	—	12.325	—	—	9.473	—	—	17.247	—	—
150	0.217	0.418	—	4.040	5.047	—	0.401	0.561	—	4.071	5.435	—
500	0.097	0.107	0.098	1.727	1.394	1.332	0.146	0.066	0.109	1.722	1.437	1.331
One-step system GMM estimator based on "SYS2"												
50	2.763	—	—	6.715	—	—	49.882	—	—	49.882	—	—
150	0.826	1.036	0.893	3.629	2.602	2.044	27.203	26.955	25.717	27.203	26.955	25.717
500	0.353	0.315	0.158	2.050	1.305	1.025	11.051	10.182	9.477	11.053	10.182	9.477
Two-step system GMM estimator based on "SYS2"												
50	2.745	—	—	7.757	—	—	42.167	—	—	42.167	—	—
150	1.023	1.080	0.701	3.630	2.909	2.631	11.993	15.432	15.829	12.009	15.432	15.829
500	0.278	0.322	0.196	1.793	1.327	1.112	1.883	2.543	2.404	2.658	2.611	2.419
Continuous-updating system GMM estimator based on "SYS2"												
50	2.189	—	—	10.991	—	—	6.900	—	—	12.905	—	—
150	0.629	0.429	0.210	3.952	3.082	3.298	0.576	0.576	0.269	3.912	3.083	3.324
500	0.230	0.175	0.055	1.806	1.386	1.084	0.278	0.118	0.021	1.816	1.418	1.106
One-step system GMM estimator based on "SYS3"												
50	0.782	0.368	5.269	6.542	3.994	5.269	15.426	2.965	25.147	18.735	8.510	25.147
150	-0.051	-0.036	-0.026	3.881	2.391	1.917	4.234	0.862	0.578	10.719	5.183	3.277
500	0.090	0.004	-0.092	2.217	1.311	1.037	0.908	0.372	-0.024	6.181	2.724	1.878
Two-step system GMM estimator based on "SYS3"												
50	2.180	1.320	8.066	6.840	4.442	8.066	13.755	3.794	22.168	17.830	7.335	22.168
150	0.703	0.318	0.287	3.888	2.590	2.060	3.809	1.141	0.848	7.753	4.188	2.954
500	0.372	0.217	0.006	2.142	1.350	1.051	1.316	0.290	0.171	4.072	2.176	1.456
Continuous-updating system GMM estimator based on "SYS3"												
50	1.629	1.051	6.384	7.323	4.572	6.384	2.665	0.997	2.740	14.073	7.183	2.740
150	0.451	0.328	0.229	4.024	2.627	2.050	0.479	0.264	0.469	6.770	3.879	2.856
500	0.304	0.178	-0.013	2.185	1.351	1.054	0.195	0.048	0.032	3.741	2.124	1.443

Table A.3: Size(%) and power(%) of γ ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

	size ($H_0 : \gamma = 0.4$)			power ($H_1 : \gamma = 0.3$)			size ($H_0 : \gamma = 0.4$)			power ($H_1 : \gamma = 0.3$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	8.1	6.0	5.0	31.1	52.8	74.4	8.1	6.0	5.0	31.1	52.8	74.4
150	5.7	4.3	5.7	62.2	93.8	99.7	5.7	4.3	5.7	62.2	93.8	99.7
500	5.7	6.0	5.2	96.7	100.0	100.0	5.7	6.0	5.2	96.7	100.0	100.0
Iterative transformed likelihood estimator												
50	7.8	6.0	5.0	31.0	52.8	74.4	7.8	6.0	5.0	31.0	52.8	74.4
150	5.6	4.3	5.7	62.2	93.8	99.7	5.6	4.3	5.7	62.2	93.8	99.7
500	5.7	6.0	5.2	96.7	100.0	100.0	5.7	6.0	5.2	96.7	100.0	100.0
One-step first-difference GMM estimator based on "DIF1"												
50	10.8	–	–	39.8	–	–	10.7	–	–	35.8	–	–
150	7.0	8.4	–	55.9	94.5	–	6.8	8.7	–	46.8	91.6	–
500	6.3	5.7	5.1	89.1	99.9	100.0	5.8	6.5	5.7	78.9	99.8	100.0
Two-step first-difference GMM estimator based on "DIF1"												
50	40.5	–	–	61.2	–	–	41.7	–	–	62.1	–	–
150	15.1	56.9	–	63.1	94.6	–	16.0	57.0	–	55.4	93.9	–
500	6.9	17.1	34.8	90.5	99.9	100.0	7.5	17.9	35.8	81.5	99.6	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	5.4	–	–	15.6	–	–	5.2	–	–	15.0	–	–
150	5.4	1.2	–	45.7	22.2	–	5.9	0.7	–	37.8	20.1	–
500	5.7	5.8	2.7	87.6	99.6	99.9	5.5	6.3	2.8	76.9	99.4	99.8
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	51.4	–	–	57.7	–	–	56.3	–	–	58.5	–	–
150	16.0	65.1	–	51.4	88.3	–	18.0	65.6	–	44.3	86.0	–
500	7.4	18.2	37.1	86.7	99.6	100.0	7.2	17.8	37.5	74.6	99.5	100.0
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors												
50	12.1	–	–	18.7	–	–	16.6	–	–	21.0	–	–
150	5.5	8.2	–	31.0	34.3	–	6.0	7.2	–	24.9	30.8	–
500	4.7	6.1	4.8	81.5	99.0	99.4	5.1	6.5	5.0	67.3	97.8	99.1
One-step first-difference GMM estimator based on "DIF2"												
50	9.2	7.4	–	35.5	58.8	–	12.4	12.4	–	32.3	56.7	–
150	6.1	6.5	6.8	52.0	86.7	98.1	8.5	9.0	9.0	39.5	71.4	91.3
500	6.1	4.7	4.0	87.6	99.8	100.0	6.4	7.2	5.7	62.9	96.8	100.0
Two-step first-difference GMM estimator based on "DIF2"												
50	30.2	77.6	–	51.6	86.1	–	33.9	79.3	–	52.9	86.0	–
150	12.0	19.4	35.8	57.7	89.0	97.8	14.1	23.5	35.5	46.5	78.2	94.1
500	7.5	7.6	7.8	88.7	99.7	100.0	8.1	9.9	10.8	64.6	96.7	100.0
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	6.3	1.1	–	19.2	1.4	–	9.0	0.6	–	18.9	1.1	–
150	5.8	5.3	3.3	43.6	68.6	76.3	6.5	7.1	4.8	32.4	50.3	60.6
500	5.9	4.9	3.9	86.1	99.6	100.0	6.3	6.7	5.3	60.6	95.1	100.0
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	38.4	83.6	–	46.8	85.8	–	45.0	84.5	–	49.0	84.3	–
150	12.7	25.7	40.3	45.6	77.9	90.2	15.5	26.9	41.9	34.1	62.0	82.2
500	7.3	9.8	10.6	84.3	99.5	100.0	7.6	10.8	10.9	57.4	93.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors												
50	10.1	23.8	–	15.8	28.5	–	13.8	24.7	–	18.0	30.0	–
150	5.6	6.9	6.4	29.9	50.3	58.1	6.1	6.4	6.2	18.9	29.8	40.2
500	5.0	5.2	3.0	80.3	99.1	99.9	5.3	6.9	4.5	51.3	89.4	99.5
One-step first-difference GMM estimator based on "DIF3"												
50	5.4	4.7	0.0	19.7	35.5	100.0	5.6	4.7	0.0	12.6	18.8	0.0
150	4.9	5.5	4.7	37.6	73.5	92.2	6.0	5.4	5.1	17.2	34.5	57.5
500	6.3	4.7	2.2	79.5	99.4	100.0	5.7	5.1	4.1	32.3	78.8	98.3
Two-step first-difference GMM estimator based on "DIF3"												
50	7.5	6.5	0.0	22.0	35.5	0.0	6.9	7.0	0.0	15.0	20.2	0.0
150	5.5	5.3	5.2	37.7	72.8	92.0	6.9	5.8	5.6	18.5	34.9	56.4
500	6.4	4.7	2.8	79.5	99.4	100.0	6.2	5.0	4.6	32.7	79.0	98.1
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	5.7	5.6	0.0	18.7	32.0	0.0	6.0	4.3	0.0	13.0	17.6	0.0
150	4.8	5.2	4.7	35.8	71.4	91.9	6.3	5.3	5.0	17.5	33.8	55.5
500	6.0	4.7	2.7	78.5	99.4	100.0	5.9	4.7	4.1	32.5	78.7	98.2
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	8.6	7.2	0.0	20.3	34.2	0.0	9.0	7.5	0.0	15.5	19.2	0.0
150	5.6	6.0	5.4	35.8	71.7	91.7	7.2	6.3	5.8	18.5	33.8	55.4
500	6.4	4.8	2.8	78.5	99.4	100.0	6.4	5.2	4.6	31.6	78.1	98.1
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors												
50	5.6	5.6	0.0	15.9	28.9	0.0	6.8	4.7	0.0	12.3	15.9	0.0
150	4.7	5.5	4.5	32.5	68.8	89.8	6.1	5.3	5.1	16.3	31.3	52.5
500	6.2	4.4	2.5	76.5	96.8	96.6	5.7	5.0	3.8	30.7	77.4	97.1

	One-step system GMM estimator based on "SYS1"											
50	9.0	—	—	17.3	—	—	82.0	—	—	68.7	—	—
150	5.3	6.0	—	40.7	79.4	—	62.2	91.1	—	32.8	47.6	—
500	5.9	5.8	3.8	87.8	99.8	100.0	36.7	71.8	87.6	8.3	16.8	30.8
	Two-step system GMM estimator based on "SYS1"											
50	57.3	—	—	66.1	—	—	95.6	—	—	90.9	—	—
150	18.2	70.0	—	65.3	93.6	—	66.0	95.5	—	51.4	84.3	—
500	9.5	18.5	38.2	96.5	100.0	100.0	23.0	50.0	72.9	84.8	97.7	99.1
	Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors											
50	2.1	—	—	3.1	—	—	19.0	—	—	12.2	—	—
150	4.5	0.1	—	41.7	1.7	—	29.1	13.1	—	13.4	6.2	—
500	6.0	5.1	1.3	93.9	99.7	99.9	11.2	14.7	3.4	71.4	84.4	63.1
	Continuous-updating system GMM estimator based on "SYS1"											
50	69.9	—	—	72.5	—	—	81.9	—	—	80.0	—	—
150	21.7	77.2	—	66.8	90.6	—	26.5	83.2	—	70.2	92.0	—
500	9.6	21.5	44.1	96.1	100.0	100.0	11.4	25.2	50.3	96.1	100.0	100.0
	Continuous-updating system GMM estimator based on "SYS1" with NW standard errors											
50	19.5	—	—	24.1	—	—	26.1	—	—	27.7	—	—
150	5.9	9.5	—	42.8	29.1	—	5.9	9.1	—	40.9	30.4	—
500	6.1	6.4	4.6	94.0	99.7	100.0	5.7	5.8	4.4	93.2	99.7	99.9
	One-step system GMM estimator based on "SYS2"											
50	8.6	—	—	15.2	—	—	84.4	—	—	73.0	—	—
150	5.5	7.1	5.7	38.2	72.0	90.0	66.0	94.6	99.3	39.0	66.2	77.7
500	6.4	5.8	3.4	87.5	99.7	100.0	39.8	78.3	92.9	9.4	11.3	9.8
	Two-step system GMM estimator based on "SYS2"											
50	46.2	—	—	56.1	—	—	93.7	—	—	88.4	—	—
150	15.8	32.7	50.6	59.4	86.8	94.9	66.7	93.3	98.5	50.5	69.8	79.0
500	8.1	12.1	13.3	95.2	99.8	100.0	26.0	44.8	52.8	80.9	93.8	98.3
	Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors											
50	3.5	—	—	5.9	—	—	33.7	—	—	24.1	—	—
150	5.1	4.5	0.5	39.4	48.3	27.0	34.1	56.6	48.8	17.9	23.4	19.1
500	6.0	6.3	4.4	93.0	99.5	100.0	13.0	21.0	23.4	66.6	80.1	91.5
	Continuous-updating system GMM estimator based on "SYS2"											
50	57.7	—	—	64.3	—	—	69.9	—	—	72.6	—	—
150	17.2	35.5	59.3	61.7	86.9	92.6	23.9	44.7	65.4	65.9	90.3	93.6
500	8.1	11.8	15.0	95.6	99.8	100.0	10.3	14.6	17.1	95.4	99.8	100.0
	Continuous-updating system GMM estimator based on "SYS2" with NW standard errors											
50	15.4	—	—	19.8	—	—	23.6	—	—	28.0	—	—
150	6.1	6.5	6.6	41.0	54.0	49.7	6.9	7.1	5.7	40.2	50.9	50.3
500	5.9	6.0	4.2	92.5	99.4	100.0	6.1	6.0	4.7	92.4	99.5	100.0
	One-step system GMM estimator based on "SYS3"											
50	6.2	5.3	0.0	18.5	37.1	0.0	16.8	9.2	100.0	9.1	9.2	0.0
150	5.0	6.1	5.3	42.5	80.6	94.8	8.8	5.8	6.2	4.7	21.9	48.2
500	6.0	5.4	2.9	87.5	99.7	100.0	6.7	5.2	5.1	11.1	66.4	96.5
	Two-step system GMM estimator based on "SYS3"											
50	14.9	12.1	0.0	23.5	40.4	0.0	31.6	16.3	100.0	22.3	21.9	0.0
150	5.9	8.0	8.2	42.0	78.3	92.7	11.5	9.1	7.1	17.0	39.4	65.3
500	6.5	5.1	3.1	85.8	99.7	100.0	8.5	6.5	4.7	37.0	88.2	99.7
	Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors											
50	7.6	6.5	0.0	14.5	29.1	0.0	12.4	7.9	0.0	9.8	13.1	0.0
150	4.6	6.3	5.6	37.3	74.8	90.9	6.7	6.1	5.0	11.9	35.0	61.0
500	6.2	4.7	2.7	85.5	99.7	100.0	6.8	5.6	4.3	34.5	86.8	99.7
	Continuous-updating system GMM estimator based on "SYS3"											
50	17.1	13.9	0.0	26.5	42.6	0.0	21.5	14.9	0.0	22.7	27.5	0.0
150	7.1	7.9	7.8	43.8	78.8	92.4	10.0	7.9	6.9	23.8	44.3	67.6
500	6.8	5.3	3.0	86.2	99.7	100.0	7.1	6.1	4.8	44.1	90.0	99.8
	Continuous-updating system GMM estimator based on "SYS3" with NW standard errors											
50	8.5	6.9	0.0	15.8	29.5	0.0	15.0	8.3	0.0	15.3	18.5	0.0
150	4.5	6.4	6.0	38.1	73.6	90.1	6.9	5.8	5.1	18.0	39.6	63.3
500	6.0	4.9	2.6	85.5	99.0	99.5	5.6	5.3	4.2	40.7	89.1	99.8

Table A.4: Mean bias($\times 100$) and RMSE($\times 100$) of β ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

| | bias($\times$100) | | | RMSE($\times$100) | | | bias($\times$100) | | | RMSE($\times$100) | | |
| | $\tau^2 = 1$ | | | | | | $\tau^2 = 5$ | | | | | |
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	-0.101	0.034	0.145	7.430	4.613	3.535	-0.101	0.034	0.145	7.430	4.613	3.535
150	-0.021	-0.095	0.091	4.526	2.870	2.130	-0.021	-0.095	0.091	4.526	2.870	2.130
500	-0.085	-0.022	-0.009	2.278	1.369	1.094	-0.085	-0.022	-0.009	2.278	1.369	1.094
	Iterative transformed likelihood estimator											
50	-0.075	0.034	0.145	7.409	4.613	3.535	-0.075	0.034	0.145	7.409	4.613	3.535
150	0.005	-0.095	0.091	4.497	2.870	2.130	0.005	-0.095	0.091	4.497	2.870	2.130
500	-0.085	-0.022	-0.009	2.278	1.369	1.094	-0.085	-0.022	-0.009	2.278	1.369	1.094
	One-step first-difference GMM estimator based on "DIF1"											
50	-0.092	—	—	8.333	—	—	0.029	—	—	8.283	—	—
150	-0.025	-0.119	—	5.081	3.394	—	0.027	-0.062	—	5.077	3.374	—
500	-0.079	0.006	0.015	2.617	1.641	1.300	-0.060	0.033	0.033	2.622	1.635	1.290
	Two-step first-difference GMM estimator based on "DIF1"											
50	0.140	—	—	11.155	—	—	0.172	—	—	10.975	—	—
150	0.000	-0.035	—	5.526	5.155	—	0.061	0.024	—	5.449	5.154	—
500	-0.086	-0.022	0.050	2.647	1.844	1.779	-0.054	0.008	0.055	2.645	1.847	1.778
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	1.075	—	—	17.039	—	—	0.728	—	—	17.284	—	—
150	0.001	-0.120	—	5.941	7.800	—	0.013	-0.101	—	5.871	7.867	—
500	-0.081	-0.029	0.085	2.667	1.913	1.986	-0.064	-0.016	0.075	2.669	1.914	1.984
	One-step first-difference GMM estimator based on "DIF2"											
50	-0.219	0.083	—	8.666	5.731	—	-0.245	-0.132	—	8.569	5.688	—
150	-0.032	-0.102	0.170	5.161	3.636	2.821	-0.055	-0.184	0.086	5.137	3.630	2.800
500	-0.061	0.027	0.028	2.667	1.702	1.442	-0.059	-0.002	-0.001	2.669	1.704	1.443
	Two-step first-difference GMM estimator based on "DIF2"											
50	-0.437	-0.021	—	10.593	12.905	—	-0.433	-0.074	—	10.364	12.919	—
150	-0.083	-0.230	0.016	5.546	4.225	3.881	-0.074	-0.341	-0.061	5.467	4.279	3.816
500	-0.106	-0.031	-0.015	2.698	1.803	1.546	-0.082	-0.055	-0.047	2.690	1.810	1.556
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	0.000	-5.64E+04	—	0.000	1.59E+06	—	0.000	1.00E+03	—	0.000	3.30E+04	—
150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	One-step first-difference GMM estimator based on "DIF3"											
50	-0.413	0.037	-16.616	15.667	8.122	16.616	0.038	0.071	-8.321	15.769	8.089	8.321
150	-0.376	-0.137	0.140	9.092	5.091	3.674	-0.321	-0.102	0.140	9.285	5.162	3.657
500	0.039	0.011	0.038	4.553	2.443	1.885	0.081	-0.013	0.036	4.608	2.494	1.918
	Two-step first-difference GMM estimator based on "DIF3"											
50	-0.643	0.084	-17.435	16.239	8.353	17.435	-0.116	0.073	-13.210	16.289	8.328	13.210
150	-0.355	-0.096	0.160	9.138	5.092	3.688	-0.225	-0.080	0.170	9.359	5.185	3.664
500	0.058	0.009	0.033	4.551	2.454	1.887	0.106	-0.010	0.041	4.623	2.501	1.921
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-0.138	0.212	-17.447	17.460	8.431	17.447	0.856	0.295	-14.722	20.219	8.491	14.722
150	-0.200	-0.055	0.175	9.234	5.101	3.694	0.032	-0.001	0.205	9.594	5.208	3.671
500	0.101	0.020	0.038	4.566	2.456	1.888	0.179	0.010	0.050	4.654	2.506	1.922
	One-step system GMM estimator based on "SYS1"											
50	1.933	—	—	9.128	—	—	4.958	—	—	13.799	—	—
150	0.760	0.766	—	5.513	3.643	—	2.755	2.784	—	8.937	5.553	—
500	0.217	0.259	0.240	2.849	1.748	1.405	1.083	1.063	0.878	4.997	2.740	2.008
	Two-step system GMM estimator based on "SYS1"											
50	1.883	—	—	12.650	—	—	3.496	—	—	17.385	—	—
150	0.656	0.619	—	5.606	5.964	—	1.127	1.572	—	7.876	6.915	—
500	0.077	0.149	0.252	2.674	1.852	1.828	0.042	0.250	0.337	2.924	2.086	1.946
	Continuous-updating system GMM estimator based on "SYS1"											
50	0.000	—	—	0.0	—	—	3.32E+04	—	—	1.05E+06	—	—
150	0.000	0.000	—	0.000	0.000	—	0.000	0.0	—	0.000	0.0	—
500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	One-step system GMM estimator based on "SYS2"											
50	1.942	—	—	9.473	—	—	5.654	—	—	14.338	—	—
150	0.798	0.871	1.126	5.676	3.940	3.181	3.423	4.078	4.482	9.336	6.661	6.022
500	0.245	0.299	0.290	2.944	1.847	1.563	1.404	1.632	1.529	5.230	3.200	2.588
	Two-step system GMM estimator based on "SYS2"											
50	1.476	—	—	11.970	—	—	2.927	—	—	16.953	—	—
150	0.478	0.344	0.629	5.684	4.471	4.529	1.045	1.064	1.334	8.009	5.868	5.577
500	0.046	0.119	0.166	2.748	1.855	1.598	0.002	0.157	0.191	2.989	2.009	1.721
	Continuous-updating system GMM estimator based on "SYS2"											
50	0.000	—	—	0.000	—	—	-2.754E+06	—	—	8.71E+07	—	—
150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	One-step system GMM estimator based on "SYS3"											
50	0.225	-0.055	1.980	12.387	7.322	1.980	2.498	-0.398	18.174	27.111	15.064	18.174
150	-0.266	-0.111	0.179	7.650	4.622	3.364	-0.777	-0.189	0.217	19.563	9.414	6.106
500	0.053	0.028	0.046	3.945	2.187	1.748	-0.046	0.073	0.053	10.897	4.869	3.132
	Two-step system GMM estimator based on "SYS3"											
50	1.259	0.479	2.644	12.524	7.539	2.644	3.735	1.001	-2.439	17.299	8.711	2.439
150	0.250	0.200	0.355	7.246	4.574	3.395	1.104	0.311	0.400	9.368	5.085	3.611
500	0.255	0.079	0.087	3.768	2.161	1.740	0.502	0.124	0.115	4.575	2.440	1.880
	Continuous-updating system GMM estimator based on "SYS3"											
50	0.200	0.019	-1.544	13.914	7.848	1.544	0.716	0.321	-9.486	17.108	8.507	9.486
150	-0.261	0.043	0.251	7.434	4.627	3.407	-0.035	0.044	0.257	9.041	5.049	3.597
500	0.098	0.028	0.058	3.797	2.165	1.741	0.092	0.041	0.074	4.485	2.430	1.876

Table A.5: Median bias(×100) and MAE(×100) of β ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

	median bias(×100)			MAE(×100)			median bias(×100)			MAE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	-0.037	0.190	0.031	5.181	3.059	2.396	-0.037	0.190	0.031	5.181	3.059	2.396
150	-0.105	-0.120	0.200	3.073	1.975	1.456	-0.105	-0.120	0.200	3.073	1.975	1.456
500	-0.040	-0.061	0.044	1.499	0.951	0.753	-0.040	-0.061	0.044	1.499	0.951	0.753
	Iterative transformed likelihood estimator											
50	0.024	0.190	0.031	5.159	3.059	2.396	0.024	0.190	0.031	5.159	3.059	2.396
150	-0.093	-0.120	0.200	3.063	1.975	1.456	-0.093	-0.120	0.200	3.063	1.975	1.456
500	-0.040	-0.061	0.044	1.499	0.951	0.753	-0.040	-0.061	0.044	1.499	0.951	0.753
	One-step first-difference GMM estimator based on "DIF1"											
50	0.063	−	−	5.402	−	−	0.149	−	−	5.356	−	−
150	-0.034	-0.115	−	3.577	2.228	−	-0.022	-0.027	−	3.533	2.169	−
500	-0.059	0.016	0.028	1.758	1.110	0.844	-0.073	0.062	0.036	1.731	1.047	0.839
	Two-step first-difference GMM estimator based on "DIF1"											
50	0.452	−	−	7.337	−	−	0.368	−	−	7.185	−	−
150	-0.170	-0.089	−	3.756	3.496	−	-0.104	-0.167	−	3.730	3.488	−
500	-0.108	0.009	0.104	1.795	1.237	1.202	-0.089	0.030	0.114	1.836	1.193	1.209
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	1.442	−	−	10.732	−	−	0.932	−	−	10.305	−	−
150	-0.117	-0.371	−	3.895	4.767	−	-0.157	-0.169	−	3.884	4.827	−
500	-0.091	0.010	0.175	1.824	1.256	1.322	-0.070	0.028	0.105	1.866	1.228	1.337
	One-step first-difference GMM estimator based on "DIF2"											
50	-0.224	0.001	−	5.871	3.841	−	-0.153	-0.283	−	5.641	3.837	−
150	-0.089	-0.006	0.027	3.649	2.376	1.938	-0.054	-0.084	-0.008	3.599	2.360	1.938
500	-0.048	0.025	0.025	1.771	1.177	0.949	-0.054	-0.008	-0.005	1.780	1.143	0.946
	Two-step first-difference GMM estimator based on "DIF2"											
50	-0.618	-0.410	−	7.251	8.260	−	-0.218	-0.324	−	7.151	8.172	−
150	-0.325	-0.135	-0.025	3.750	2.891	2.960	-0.367	-0.256	-0.076	3.769	2.876	2.750
500	-0.178	-0.039	-0.091	1.815	1.181	1.054	-0.098	-0.053	-0.096	1.800	1.176	1.027
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	-0.004	-0.857	−	8.775	13.037	−	0.445	-0.519	−	8.875	13.338	−
150	-0.366	-0.128	0.053	3.975	3.001	3.167	-0.416	-0.087	-0.001	3.932	3.086	3.136
500	-0.193	-0.036	-0.078	1.863	1.178	1.067	-0.063	-0.019	-0.060	1.840	1.182	1.064
	One-step first-difference GMM estimator based on "DIF3"											
50	-0.880	0.149	-16.616	10.471	5.567	16.616	-0.082	0.222	-8.321	10.401	5.520	8.321
150	-0.525	-0.166	0.019	5.990	3.530	2.386	-0.494	-0.216	0.041	6.000	3.530	2.428
500	0.147	-0.026	0.084	3.112	1.701	1.304	0.251	-0.062	0.087	3.150	1.705	1.326
	Two-step first-difference GMM estimator based on "DIF3"											
50	-0.850	0.179	-17.435	10.611	5.709	17.435	0.148	0.185	-13.210	10.584	5.513	13.210
150	-0.499	-0.087	0.014	6.053	3.468	2.454	-0.511	-0.264	0.066	6.084	3.503	2.385
500	0.112	0.011	0.061	3.187	1.667	1.318	0.254	-0.024	0.050	3.134	1.733	1.334
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-0.311	0.144	-17.447	11.014	5.725	17.447	0.867	0.513	-14.722	11.504	5.795	14.722
150	-0.455	-0.050	0.038	6.120	3.489	2.425	-0.324	-0.231	0.130	6.232	3.479	2.408
500	0.158	0.015	0.072	3.191	1.674	1.300	0.354	-0.007	0.054	3.177	1.735	1.337
	One-step system GMM estimator based on "SYS1"											
50	2.146	−	−	6.241	−	−	4.801	−	−	9.332	−	−
150	0.836	0.788	−	3.681	2.470	−	3.232	2.810	−	6.433	3.839	−
500	0.269	0.212	0.287	1.870	1.219	0.969	1.114	1.029	0.913	3.251	1.843	1.371
	Two-step system GMM estimator based on "SYS1"											
50	2.018	−	−	8.521	−	−	3.645	−	−	11.774	−	−
150	0.688	0.787	−	3.709	3.831	−	1.049	1.308	−	5.193	4.667	−
500	0.113	0.208	0.305	1.806	1.200	1.239	0.141	0.268	0.392	1.928	1.375	1.308
	Continuous-updating system GMM estimator based on "SYS1"											
50	1.620	−	−	13.469	−	−	1.649	−	−	16.544	−	−
150	0.002	-0.388	−	3.954	6.195	−	-0.090	-0.017	−	4.160	6.385	−
500	-0.032	0.039	0.241	1.831	1.266	1.308	-0.069	0.002	0.103	1.889	1.277	1.358
	One-step system GMM estimator based on "SYS2"											
50	2.325	−	−	6.475	−	−	5.528	−	−	9.454	−	−
150	0.812	0.973	1.013	3.791	2.669	2.008	3.822	4.141	4.408	6.620	4.704	4.494
500	0.223	0.266	0.325	1.956	1.233	1.073	1.394	1.590	1.559	3.350	2.110	1.801
	Two-step system GMM estimator based on "SYS2"											
50	1.332	−	−	8.273	−	−	2.816	−	−	11.530	−	−
150	0.553	0.355	0.694	3.814	3.093	2.870	0.929	1.052	1.170	5.476	4.004	3.675
500	-0.003	0.105	0.143	1.825	1.197	1.112	-0.036	0.120	0.123	1.937	1.295	1.141
	Continuous-updating system GMM estimator based on "SYS2"											
50	-0.173	−	−	10.390	−	−	0.412	−	−	11.744	−	−
150	-0.012	-0.262	0.060	4.217	3.454	3.533	-0.153	-0.144	0.202	4.111	3.550	3.598
500	-0.124	-0.030	-0.029	1.859	1.205	1.129	-0.225	-0.037	-0.060	1.880	1.232	1.107
	One-step system GMM estimator based on "SYS3"											
50	0.654	-0.158	1.980	8.526	4.859	1.980	2.747	-0.122	18.174	18.972	10.019	18.174
150	0.041	-0.117	0.092	4.992	3.024	2.235	-0.817	-0.465	0.245	13.639	6.250	4.158
500	0.199	0.046	0.081	2.618	1.539	1.216	-0.178	0.057	0.084	7.165	3.431	2.124
	Two-step system GMM estimator based on "SYS3"											
50	1.471	0.512	2.644	8.565	5.056	2.644	3.946	0.953	-2.439	10.864	5.894	2.439
150	0.163	0.257	0.304	4.979	3.005	2.246	0.788	0.090	0.325	6.307	3.352	2.410
500	0.370	0.014	0.107	2.454	1.521	1.213	0.585	0.057	0.109	3.049	1.592	1.322
	Continuous-updating system GMM estimator based on "SYS3"											
50	0.501	0.051	-1.544	9.236	5.138	1.544	0.735	0.612	-9.486	10.535	5.848	9.486
150	-0.447	0.167	0.218	5.104	3.117	2.242	-0.209	-0.126	0.205	6.038	3.322	2.403
500	0.192	-0.018	0.074	2.420	1.529	1.220	0.271	-0.010	0.065	3.008	1.594	1.338

Table A.6: Size(%) and power(%) of β ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

N/T	size ($H_0 : \beta = 0.29$)			power ($H_1 : \beta = 0.19$)			size ($H_0 : \beta = 0.29$)			power ($H_1 : \beta = 0.19$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	5.8	6.8	6.3	30.9	59.8	80.6	5.8	6.8	6.3	30.9	59.8	80.6
150	6.0	7.0	5.4	64.0	95.4	99.9	6.0	7.0	5.4	64.0	95.4	99.9
500	4.6	4.0	5.1	99.3	100.0	100.0	4.6	4.0	5.1	99.3	100.0	100.0
Iterative transformed likelihood estimator												
50	5.8	6.8	6.3	31.0	59.8	80.6	5.8	6.8	6.3	31.0	59.8	80.6
150	6.0	7.0	5.4	64.0	95.4	99.9	6.0	7.0	5.4	64.0	95.4	99.9
500	4.6	4.0	5.1	99.3	100.0	100.0	4.6	4.0	5.1	99.3	100.0	100.0
One-step first-difference GMM estimator based on "DIF1"												
50	5.4	–	–	26.3	–	–	5.2	–	–	25.8	–	–
150	5.1	6.9	–	53.6	86.4	–	5.5	7.3	–	52.6	86.8	–
500	4.8	4.9	5.3	97.0	100.0	100.0	5.5	4.6	5.3	96.4	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1"												
50	36.1	–	–	51.6	–	–	35.7	–	–	51.5	–	–
150	12.8	53.8	–	60.6	90.2	–	12.0	54.6	–	61.9	90.8	–
500	6.0	13.1	32.4	97.0	100.0	100.0	6.4	13.2	32.1	97.3	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	5.0	–	–	13.7	–	–	4.9	–	–	12.6	–	–
150	5.5	1.1	–	45.3	17.8	–	4.6	0.9	–	45.0	19.1	–
500	4.4	4.8	3.7	96.1	100.0	100.0	4.7	5.1	3.8	96.1	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	51.9	–	–	56.9	–	–	50.1	–	–	58.4	–	–
150	15.2	65.2	–	60.9	86.5	–	14.6	67.3	–	60.6	87.4	–
500	6.1	14.6	36.7	96.9	100.0	100.0	6.0	14.4	37.1	97.1	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors												
50	12.5	–	–	17.4	–	–	11.5	–	–	18.3	–	–
150	4.5	8.3	–	36.7	32.0	–	4.3	7.4	–	36.0	31.9	–
500	3.9	4.1	5.9	95.1	99.9	99.8	4.2	4.0	6.1	95.4	100.0	99.9
One-step first-difference GMM estimator based on "DIF2"												
50	5.9	6.1	–	25.3	43.3	–	5.4	6.1	–	25.3	44.8	–
150	5.9	7.5	6.0	50.5	82.3	94.0	5.7	7.9	6.0	50.0	83.2	94.3
500	4.9	3.9	5.1	96.4	100.0	100.0	5.0	3.8	4.4	96.6	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2"												
50	26.0	75.3	–	46.2	83.6	–	26.2	77.0	–	45.2	83.5	–
150	10.6	21.2	37.1	57.6	87.6	94.8	10.7	20.4	36.8	58.6	88.4	95.2
500	5.9	7.4	9.9	96.2	100.0	100.0	6.0	7.3	10.1	96.6	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	6.8	0.7	–	17.7	1.9	–	4.7	0.8	–	17.8	1.8	–
150	5.0	5.4	3.4	47.0	67.3	67.2	4.3	6.1	3.3	47.1	68.7	68.9
500	4.8	4.5	5.5	95.2	100.0	100.0	4.6	4.4	5.3	95.3	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	35.6	83.1	–	50.2	88.6	–	35.9	84.5	–	46.0	88.1	–
150	12.2	24.4	42.7	57.0	84.9	92.9	11.1	24.2	40.7	56.0	85.5	92.6
500	5.8	7.4	10.1	96.1	100.0	100.0	6.1	7.8	11.0	96.2	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors												
50	8.1	29.2	–	15.7	39.5	–	6.7	29.6	–	15.7	36.0	–
150	3.9	4.4	5.5	39.9	61.4	62.3	3.7	5.4	4.8	38.1	58.9	61.5
500	4.4	3.8	5.4	94.4	100.0	99.9	4.5	3.5	5.0	94.6	99.9	100.0
One-step first-difference GMM estimator based on "DIF3"												
50	5.1	4.4	0.0	12.5	25.5	100.0	4.6	3.8	0.0	10.1	25.1	0.0
150	5.1	5.4	6.3	21.4	55.0	77.2	5.3	5.7	5.9	21.2	54.4	76.8
500	4.1	4.5	5.5	56.7	97.2	99.9	4.2	3.8	5.8	54.9	97.3	99.9
Two-step first-difference GMM estimator based on "DIF3"												
50	7.2	6.2	0.0	14.9	27.3	100.0	6.6	6.1	0.0	13.1	26.9	100.0
150	5.2	5.6	6.9	22.4	55.0	77.7	5.6	5.9	5.4	21.4	54.7	76.8
500	4.3	4.6	5.6	57.1	97.4	99.9	4.3	3.7	5.5	55.6	97.3	99.9
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	5.5	5.4	0.0	12.4	23.6	100.0	4.9	4.1	0.0	11.1	23.7	100.0
150	4.7	5.1	6.4	21.7	53.4	77.0	5.3	5.6	5.1	20.7	54.1	75.7
500	4.2	4.4	5.6	56.8	97.2	99.9	4.1	3.8	5.5	54.9	97.3	99.9
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	7.7	6.3	0.0	15.6	27.1	100.0	8.3	6.9	0.0	14.0	26.3	100.0
150	5.4	5.6	6.8	22.2	54.5	77.6	5.8	6.0	5.5	21.5	54.6	76.6
500	4.3	4.6	5.6	56.7	97.2	99.9	4.6	3.8	5.7	54.6	97.3	99.9
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors												
50	5.2	4.8	0.0	11.2	21.5	100.0	5.4	3.9	0.0	10.6	21.8	100.0
150	4.8	5.0	6.1	20.2	52.2	75.8	5.4	5.5	5.0	19.4	51.8	74.6
500	4.0	4.3	5.4	54.9	94.5	96.5	4.3	3.6	5.6	52.7	96.7	98.9

Table A.6(cont.)

One-step system GMM estimator based on "SYS1"												
50	7.2	—	—	16.9	—	—	8.2	—	—	8.0	—	—
150	6.1	7.7	—	39.7	76.1	—	6.4	10.3	—	13.8	33.2	—
500	5.8	4.8	5.0	93.2	100.0	100.0	6.4	7.0	9.0	46.0	93.4	100.0
Two-step system GMM estimator based on "SYS1"												
50	54.4	—	—	61.7	—	—	62.6	—	—	64.3	—	—
150	15.9	67.6	—	59.6	91.2	—	28.9	74.5	—	54.1	88.0	—
500	7.4	15.4	38.4	96.8	100.0	100.0	9.5	20.2	42.7	95.5	100.0	100.0
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	2.5	—	—	4.6	—	—	0.8	—	—	2.0	—	—
150	5.1	0.1	—	36.5	2.4	—	6.6	0.2	—	26.6	1.2	—
500	5.0	4.3	2.3	95.4	100.0	99.7	4.8	4.0	0.9	91.2	99.4	98.3
Continuous-updating system GMM estimator based on "SYS1"												
50	69.3	—	—	73.3	—	—	73.5	—	—	80.1	—	—
150	19.7	78.9	—	62.9	88.6	—	21.9	82.3	—	65.2	89.2	—
500	8.2	17.9	41.4	97.4	100.0	99.9	8.7	19.3	45.3	97.3	100.0	100.0
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	19.8	—	—	23.2	—	—	23.1	—	—	23.4	—	—
150	4.4	14.8	—	34.0	32.7	—	4.6	13.7	—	34.2	31.8	—
500	4.1	4.1	6.1	95.0	100.0	99.3	3.8	4.1	5.9	95.0	100.0	99.4
One-step system GMM estimator based on "SYS2"												
50	7.7	—	—	16.0	—	—	8.9	—	—	7.7	—	—
150	5.8	8.1	9.5	37.2	71.1	85.0	7.0	13.9	23.3	12.3	21.0	29.4
500	5.5	4.2	5.4	91.7	100.0	100.0	6.9	9.6	13.3	41.1	86.3	98.3
Two-step system GMM estimator based on "SYS2"												
50	42.7	—	—	55.3	—	—	53.3	—	—	54.5	—	—
150	14.1	28.7	50.9	56.9	87.2	92.9	24.2	40.4	58.9	50.0	77.4	86.8
500	7.2	8.9	13.7	96.0	100.0	100.0	8.5	12.1	16.0	94.1	100.0	100.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	3.4	—	—	7.6	—	—	2.1	—	—	2.6	—	—
150	5.5	3.9	0.6	38.6	50.0	25.9	7.0	3.4	0.7	29.0	29.3	12.0
500	4.7	4.6	4.9	94.6	100.0	100.0	5.4	5.5	5.5	91.2	99.5	100.0
Continuous-updating system GMM estimator based on "SYS2"												
50	53.2	—	—	66.4	—	—	58.7	—	—	66.8	—	—
150	16.5	37.9	58.2	59.6	87.3	91.1	17.3	39.4	60.3	59.9	88.8	91.3
500	7.4	9.8	13.0	96.2	100.0	100.0	7.4	10.1	14.0	96.7	100.0	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	13.8	—	—	20.7	—	—	14.8	—	—	20.8	—	—
150	4.0	5.6	6.9	36.9	50.9	46.5	4.3	5.6	6.2	38.0	51.8	46.5
500	4.9	4.1	4.5	94.5	99.9	100.0	4.3	4.4	4.5	94.1	100.0	100.0
One-step system GMM estimator based on "SYS3"												
50	7.1	5.9	0.0	13.3	29.7	0.0	9.5	7.2	0.0	8.2	12.7	0.0
150	5.9	5.9	5.9	27.3	64.4	83.6	6.9	6.0	5.9	7.7	18.4	37.3
500	5.4	4.0	4.9	71.7	99.6	100.0	5.6	4.7	5.5	11.7	53.8	89.1
Two-step system GMM estimator based on "SYS3"												
50	11.4	10.4	0.0	19.0	35.4	0.0	15.2	10.0	0.0	16.5	30.5	0.0
150	6.0	8.1	7.3	29.5	64.2	84.7	8.5	7.3	6.1	22.0	56.4	78.4
500	5.9	4.1	5.3	74.2	99.3	100.0	5.7	4.5	5.4	56.8	97.9	100.0
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	6.7	6.5	0.0	12.8	26.2	0.0	6.6	4.8	0.0	7.1	19.0	0.0
150	4.8	6.5	6.2	25.7	60.1	82.4	4.7	5.5	4.4	15.8	52.0	74.9
500	5.6	3.9	5.0	72.7	99.3	100.0	4.9	4.3	5.2	54.1	97.9	100.0
Continuous-updating system GMM estimator based on "SYS3"												
50	14.7	11.3	0.0	24.1	37.7	0.0	14.2	10.0	0.0	19.6	32.1	100.0
150	6.8	8.6	7.5	32.8	65.9	85.4	7.9	7.1	6.6	26.0	59.1	79.7
500	6.1	4.1	5.2	75.1	99.4	100.0	5.1	4.5	5.6	60.5	97.9	100.0
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	8.3	6.8	0.0	14.5	26.2	0.0	7.4	4.1	0.0	11.4	21.5	0.0
150	5.1	5.9	5.8	25.9	59.9	82.5	5.0	5.4	4.3	20.2	52.5	75.8
500	5.5	4.0	5.0	72.6	98.7	99.5	4.1	3.9	5.1	57.7	97.9	100.0

Table A.7: Mean bias(×100) and RMSE(×100) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

	bias(×100)			RMSE(×100)			bias(×100)			RMSE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	112.5	0.1	0.1	1610.1	4.7	3.6	112.4	0.1	0.1	1609.8	4.7	3.6
150	34.6	-0.1	0.1	775.2	2.9	2.2	34.6	-0.1	0.1	775.2	2.9	2.2
500	0	0	0	2.4	1.4	1.1	0	0	0	2.4	1.4	1.1
Iterative transformed likelihood estimator												
50	0.133	0.084	0.125	7.846	4.655	3.563	0.133	0.084	0.125	7.846	4.655	3.563
150	0.001	-0.086	0.089	4.625	2.921	2.173	0.001	-0.086	0.089	4.625	2.921	2.173
500	-0.039	-0.016	-0.031	2.375	1.406	1.104	-0.039	-0.016	-0.031	2.375	1.406	1.104
One-step first-difference GMM estimator based on "DIF1"												
50	-1.146	—	—	8.711	—	—	-1.321	—	—	8.737	—	—
150	-0.448	-0.556	—	5.289	3.529	—	-0.553	-0.575	—	5.339	3.489	—
500	-0.178	-0.124	-0.137	2.787	1.716	1.344	-0.213	-0.122	-0.130	2.816	1.698	1.326
Two-step first-difference GMM estimator based on "DIF1"												
50	-0.709	—	—	11.475	—	—	-1.050	—	—	11.440	—	—
150	-0.392	-0.450	—	5.804	5.324	—	-0.492	-0.481	—	5.749	5.256	—
500	-0.193	-0.143	-0.101	2.830	1.950	1.835	-0.220	-0.138	-0.104	2.857	1.937	1.823
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	Inf	—	—	Inf	—	—	—	—	—	Inf	—	—
150	0.171	-0.003	—	6.404	8.183	—	0.255	-0.018	—	6.416	8.187	—
500	-0.017	-0.002	0.084	2.865	2.034	2.062	0.007	0.008	0.077	2.901	2.019	2.047
One-step first-difference GMM estimator based on "DIF2"												
50	-1.035	-0.606	—	9.102	5.843	—	-1.830	-1.626	—	9.249	6.057	—
150	-0.368	-0.371	-0.090	5.385	3.748	2.916	-0.772	-0.790	-0.458	5.608	3.923	3.011
500	-0.126	-0.046	-0.069	2.863	1.793	1.498	-0.243	-0.216	-0.196	3.017	1.935	1.579
Two-step first-difference GMM estimator based on "DIF2"												
50	-0.931	0.186	—	11.230	14.155	—	-1.602	-0.148	—	11.525	18.836	—
150	-0.352	-0.358	-0.138	5.814	4.393	4.045	-0.704	-0.835	-0.548	5.980	4.717	4.110
500	-0.163	-0.055	-0.061	2.898	1.904	1.605	-0.286	-0.235	-0.200	3.055	2.050	1.696
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	Inf	—	—	Inf	Inf	—	—	—	—	Inf	Inf	—
150	0.188	0.145	0.283	6.225	4.856	4.639	0.522	0.148	0.224	6.779	5.295	4.775
500	0.006	0.078	0.072	2.933	1.935	1.631	0.065	0.029	0.028	3.118	2.089	1.717
One-step first-difference GMM estimator based on "DIF3"												
50	0.502	0.283	-17.183	17.672	8.720	17.183	3.841	0.744	-8.490	26.996	9.915	8.490
150	-0.176	-0.073	0.166	9.855	5.427	3.917	0.626	0.154	0.237	12.571	6.193	4.257
500	0.149	0.032	0.014	4.960	2.632	1.987	0.393	0.015	0.013	5.771	3.076	2.231
Two-step first-difference GMM estimator based on "DIF3"												
50	0.446	0.438	-17.853	18.519	9.010	17.853	4.275	0.781	-13.348	32.849	10.187	13.348
150	-0.113	0.006	0.211	9.929	5.449	3.939	0.729	0.177	0.290	12.643	6.206	4.266
500	0.176	0.046	0.018	4.962	2.649	1.994	0.425	0.023	0.025	5.799	3.077	2.239
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	1.546	0.711	-17.855	20.571	9.178	17.855	Inf	1.375	-15.031	Inf	10.734	15.031
150	0.155	0.090	0.250	10.105	5.473	3.951	1.398	0.347	0.373	13.693	6.283	4.291
500	0.250	0.069	0.029	4.990	2.654	1.995	0.578	0.067	0.046	5.897	3.091	2.243
One-step system GMM estimator based on "SYS1"												
50	2.985	—	—	10.237	—	—	37.796	—	—	50.399	—	—
150	1.078	0.962	—	5.841	3.855	—	14.141	11.993	—	19.999	14.216	—
500	0.355	0.310	0.251	3.024	1.837	1.454	4.432	3.691	3.207	7.611	4.844	3.894
Two-step system GMM estimator based on "SYS1"												
50	3.156	—	—	13.929	—	—	30.874	—	—	51.945	—	—
150	0.934	0.759	—	5.952	6.118	—	6.182	6.937	—	12.920	11.137	—
500	0.187	0.223	0.287	2.821	1.935	1.877	0.660	0.978	1.171	3.271	2.452	2.358
Continuous-updating system GMM estimator based on "SYS1"												
50	—	—	—	Inf	—	—	—	—	—	Inf	—	—
150	0.130	0.112	—	6.371	10.694	—	0.169	-Inf	—	6.504	Inf	—
500	-0.014	0.029	0.180	2.825	1.996	2.134	-0.007	0.025	0.164	2.848	2.036	2.146
One-step system GMM estimator based on "SYS2"												
50	3.210	—	—	10.724	—	—	45.169	—	—	59.915	—	—
150	1.177	1.203	1.417	6.021	4.189	3.427	17.208	17.145	16.693	23.394	19.733	18.374
500	0.405	0.391	0.347	3.127	1.951	1.631	5.432	5.277	4.855	8.664	6.504	5.610
Two-step system GMM estimator based on "SYS2"												
50	2.876	—	—	13.332	—	—	34.503	—	—	60.883	—	—
150	0.821	0.685	0.882	5.980	4.725	4.740	6.894	7.302	7.583	14.027	10.997	10.545
500	0.175	0.238	0.242	2.909	1.946	1.663	0.730	1.008	0.990	3.385	2.449	2.125
Continuous-updating system GMM estimator based on "SYS2"												
50	3.413	—	—	32.374	—	—	—	—	—	Inf	—	—
150	0.016	-0.091	0.173	6.275	5.456	5.888	0.067	-0.030	0.120	6.270	5.281	5.766
500	-0.037	0.017	0.025	2.916	1.939	1.674	-0.019	0.030	0.031	2.914	1.928	1.669
One-step system GMM estimator based on "SYS3"												
50	0.848	0.131	3.696	13.289	7.593	3.696	10.668	1.212	33.978	37.886	17.148	33.978
150	-0.128	-0.060	0.204	8.038	4.818	3.516	1.699	0.372	0.482	22.858	10.360	6.637
500	0.147	0.050	0.025	4.193	2.296	1.815	0.818	0.266	0.095	12.340	5.317	3.390
Two-step system GMM estimator based on "SYS3"												
50	2.592	1.023	5.408	14.078	7.962	5.408	12.697	2.766	5.088	31.498	10.860	5.088
150	0.623	0.370	0.461	7.768	4.821	3.580	3.174	0.845	0.696	12.384	5.939	4.104
500	0.423	0.145	0.094	4.042	2.288	1.816	1.103	0.286	0.166	5.617	2.887	2.121
Continuous-updating system GMM estimator based on "SYS3"												
50	1.532	0.543	0.319	15.673	8.301	0.319	4.937	1.333	-8.940	24.793	10.107	8.940
150	0.032	0.201	0.346	7.922	4.877	3.588	0.814	0.321	0.429	11.005	5.760	4.034
500	0.238	0.088	0.062	4.065	2.289	1.816	0.362	0.124	0.087	5.335	2.857	2.110

Table A.8: Median bias(×100) and MAE(×100) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

| | median bias(×100) | | | MAE(×100) | | | median bias(×100) | | | MAE(×100) | | |
| | $\tau^2 = 1$ | | | | | | $\tau^2 = 5$ | | | | | |
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	0.035	0.207	0.042	5.340	3.037	2.374	0.035	0.207	0.042	5.340	3.037	2.374
150	0.016	-0.115	0.104	3.141	2.007	1.485	0.016	-0.115	0.104	3.141	2.007	1.485
500	-0.030	0.003	0.002	1.589	0.953	0.775	-0.030	0.003	0.002	1.589	0.953	0.775
	Iterative transformed likelihood estimator											
50	-0.134	0.207	0.042	5.297	3.037	2.374	-0.134	0.207	0.042	5.297	3.037	2.374
150	0.009	-0.115	0.104	3.126	2.007	1.485	0.009	-0.115	0.104	3.127	2.007	1.485
500	-0.030	0.003	0.002	1.589	0.953	0.775	-0.030	0.003	0.002	1.589	0.953	0.775
	One-step first-difference GMM estimator based on "DIF1"											
50	-1.243	–	–	5.857	–	–	-1.597	–	–	5.853	–	–
150	-0.627	-0.608	–	3.868	2.344	–	-0.812	-0.648	–	3.884	2.241	–
500	-0.184	-0.101	-0.105	1.949	1.162	0.863	-0.214	-0.070	-0.127	1.880	1.133	0.872
	Two-step first-difference GMM estimator based on "DIF1"											
50	-0.652	–	–	7.678	–	–	-1.661	–	–	7.434	–	–
150	-0.649	-0.455	–	4.050	3.639	–	-0.731	-0.436	–	4.065	3.617	–
500	-0.211	-0.145	-0.068	1.906	1.325	1.207	-0.237	-0.136	-0.022	1.904	1.292	1.183
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	1.208	–	–	11.622	–	–	1.451	–	–	11.583	–	–
150	-0.142	-0.246	–	4.302	5.185	–	-0.168	-0.146	–	4.209	5.139	–
500	-0.033	-0.011	0.084	1.962	1.377	1.339	0.079	-0.009	0.194	1.937	1.374	1.311
	One-step first-difference GMM estimator based on "DIF2"											
50	-1.450	-0.656	–	6.174	4.050	–	-2.163	-1.669	–	6.243	4.088	–
150	-0.507	-0.439	-0.101	3.931	2.481	1.985	-1.168	-0.902	-0.417	3.940	2.661	2.117
500	-0.258	-0.085	-0.041	1.968	1.235	1.021	-0.409	-0.298	-0.259	2.140	1.309	1.052
	Two-step first-difference GMM estimator based on "DIF2"											
50	-1.208	-0.659	–	7.523	8.590	–	-2.242	-1.699	–	7.830	8.544	–
150	-0.637	-0.228	-0.272	4.026	2.881	2.942	-0.936	-0.712	-0.494	4.277	3.035	2.972
500	-0.243	-0.088	-0.084	1.955	1.249	1.116	-0.381	-0.275	-0.324	2.099	1.367	1.194
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	0.392	0.241	–	9.395	13.658	–	1.327	-1.104	–	10.523	15.106	–
150	-0.161	0.182	0.296	4.215	3.138	3.246	0.187	0.038	0.170	4.418	3.452	3.414
500	-0.103	0.053	0.044	2.003	1.281	1.083	0.003	-0.011	-0.048	2.191	1.392	1.153
	One-step first-difference GMM estimator based on "DIF3"											
50	-1.224	0.207	-17.183	11.257	5.880	17.183	-0.065	0.331	-8.490	12.411	6.253	8.490
150	-0.582	-0.087	-0.014	6.363	3.691	2.537	-1.013	-0.132	0.148	7.263	4.120	2.744
500	0.227	-0.027	0.018	3.486	1.759	1.382	0.438	-0.134	0.035	3.782	2.111	1.512
	Two-step first-difference GMM estimator based on "DIF3"											
50	-1.093	0.318	-17.853	11.444	5.951	17.853	-0.051	0.068	-13.348	12.302	6.326	13.348
150	-0.363	0.077	0.064	6.430	3.691	2.578	-0.662	-0.221	0.279	7.370	4.155	2.832
500	0.233	-0.006	-0.008	3.562	1.787	1.400	0.566	-0.083	0.048	3.783	2.128	1.504
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-0.331	0.583	-17.855	12.056	6.045	17.855	1.500	0.833	-15.031	14.230	6.753	15.031
150	-0.139	0.132	0.086	6.478	3.660	2.568	-0.201	-0.091	0.343	7.704	4.205	2.841
500	0.299	0.027	0.009	3.583	1.784	1.401	0.723	-0.034	0.075	3.838	2.128	1.509
	One-step system GMM estimator based on "SYS1"											
50	2.807	–	–	6.881	–	–	32.803	–	–	33.104	–	–
150	0.955	0.913	–	3.896	2.590	–	13.687	11.476	–	13.980	11.476	–
500	0.364	0.269	0.267	2.008	1.246	0.988	3.812	3.590	3.188	4.770	3.625	3.194
	Two-step system GMM estimator based on "SYS1"											
50	2.797	–	–	9.618	–	–	23.440	–	–	26.039	–	–
150	1.051	0.868	–	4.081	4.112	–	4.524	6.166	–	6.915	7.071	–
500	0.178	0.207	0.351	1.883	1.298	1.270	0.633	0.969	1.163	2.098	1.622	1.552
	Continuous-updating system GMM estimator based on "SYS1"											
50	2.040	–	–	14.493	–	–	4.248	–	–	18.768	–	–
150	0.072	-0.103	–	4.400	6.308	–	0.071	-0.006	–	4.473	6.376	–
500	0.054	0.025	0.213	1.911	1.324	1.353	-0.019	0.001	0.187	1.991	1.303	1.368
	One-step system GMM estimator based on "SYS2"											
50	3.191	–	–	7.031	–	–	39.284	–	–	39.359	–	–
150	0.964	1.166	1.290	3.988	2.709	2.218	16.367	16.134	16.294	16.565	16.134	16.294
500	0.424	0.345	0.354	2.069	1.337	1.132	5.040	5.143	4.786	5.592	5.152	4.786
	Two-step system GMM estimator based on "SYS2"											
50	2.439	–	–	8.827	–	–	23.867	–	–	28.092	–	–
150	0.794	0.765	0.712	4.082	3.235	2.967	5.031	6.477	6.965	7.463	7.020	7.189
500	0.132	0.196	0.225	1.939	1.282	1.126	0.626	0.935	0.927	2.169	1.528	1.353
	Continuous-updating system GMM estimator based on "SYS2"											
50	0.440	–	–	11.577	–	–	2.911	–	–	13.554	–	–
150	-0.035	-0.206	0.007	4.304	3.642	3.700	-0.044	0.122	0.247	4.277	3.613	3.699
500	-0.077	0.009	0.037	1.960	1.264	1.104	-0.086	0.041	0.008	2.002	1.244	1.125
	One-step system GMM estimator based on "SYS3"											
50	1.348	0.112	3.696	9.151	4.928	3.696	8.854	0.939	33.978	24.104	11.110	33.978
150	-0.058	-0.084	0.109	5.334	3.160	2.355	0.636	-0.287	0.361	15.042	6.706	4.375
500	0.201	0.067	0.074	2.759	1.626	1.320	0.204	0.212	-0.003	8.268	3.607	2.370
	Two-step system GMM estimator based on "SYS3"											
50	2.122	1.041	5.408	9.539	5.333	5.408	7.941	2.428	5.088	15.648	6.707	5.088
150	0.431	0.445	0.417	5.160	3.142	2.469	1.935	0.565	0.597	7.378	3.798	2.782
500	0.446	0.100	0.107	2.690	1.605	1.292	0.877	0.166	0.046	3.667	1.945	1.505
	Continuous-updating system GMM estimator based on "SYS3"											
50	0.886	0.652	0.319	10.074	5.303	0.319	1.752	0.968	-8.940	13.193	6.734	8.940
150	-0.414	0.284	0.281	5.472	3.221	2.431	-0.416	0.132	0.312	7.081	3.797	2.767
500	0.218	0.053	0.062	2.651	1.603	1.297	0.224	-0.041	-0.001	3.553	1.950	1.509

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Table A.9: Size(%) and power(%) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.0, \beta = 0.29, \psi = 0.29$) for ARX(1) model

N/T	size ($H_0 : \delta = 0.29$)			power ($H_1 : \delta = 0.17$)			size ($H_0 : \delta = 0.29$)			power ($H_1 : \delta = 0.17$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	6.1	6.1	6.0	48.6	86.5	97.1	6.1	6.1	6.0	48.6	86.5	97.1
150	6.0	6.1	5.9	86.4	99.9	100.0	6.0	6.1	5.9	86.4	99.9	100.0
500	5.3	4.7	4.4	100.0	100.0	100.0	5.3	4.7	4.4	100.0	100.0	100.0
Iterative transformed likelihood estimator												
50	6.1	6.1	6.0	49.0	86.5	97.1	6.1	6.1	6.0	49.0	86.5	97.1
150	6.0	6.1	5.9	86.6	99.9	100.0	6.0	6.1	5.9	86.6	99.9	100.0
500	5.3	4.7	4.4	100.0	100.0	100.0	5.3	4.7	4.4	100.0	100.0	100.0
One-step first-difference GMM estimator based on "DIF1"												
50	6.1	−	−	49.3	−	−	6.5	−	−	51.6	−	−
150	4.1	7.6	−	77.0	98.9	−	5.0	7.8	−	77.3	99.2	−
500	5.9	4.8	4.6	99.9	100.0	100.0	5.8	5.1	5.2	99.9	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1"												
50	36.7	−	−	67.0	−	−	36.3	−	−	69.9	−	−
150	11.9	55.6	−	81.0	98.7	−	12.6	55.8	−	82.1	98.6	−
500	6.6	13.5	32.8	99.8	100.0	100.0	6.9	13.9	32.5	99.9	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	5.2	−	−	26.4	−	−	5.1	−	−	28.8	−	−
150	5.0	1.0	−	70.4	44.5	−	4.6	0.8	−	70.3	46.4	−
500	4.8	4.6	4.1	99.6	100.0	100.0	5.3	5.5	4.3	99.7	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	51.0	−	−	61.0	−	−	50.6	−	−	60.0	−	−
150	15.0	66.4	−	76.6	93.3	−	15.1	66.4	−	75.1	92.7	−
500	6.4	15.5	36.0	99.5	100.0	100.0	6.9	14.9	36.1	99.6	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors												
50	10.4	−	−	23.3	−	−	10.9	−	−	24.1	−	−
150	4.1	7.3	−	57.2	49.5	−	4.1	7.9	−	57.2	50.0	−
500	4.1	4.6	6.2	99.1	99.9	100.0	4.4	4.8	6.1	99.3	100.0	100.0
One-step first-difference GMM estimator based on "DIF2"												
50	6.1	6.0	−	47.0	72.5	−	8.4	8.6	−	49.5	77.6	−
150	4.2	7.0	6.3	74.5	97.0	99.6	5.3	7.0	6.4	73.1	96.7	99.7
500	5.8	3.8	5.2	99.8	100.0	100.0	4.3	4.5	5.5	99.3	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2"												
50	26.1	75.4	−	62.0	88.7	−	28.1	78.4	−	63.5	89.4	−
150	10.6	20.3	38.3	77.4	97.3	99.5	9.4	22.4	36.5	76.6	96.2	99.6
500	6.3	6.8	9.9	99.6	100.0	100.0	5.8	6.8	10.9	99.4	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	5.8	1.0	−	33.5	3.4	−	6.9	0.8	−	36.4	3.7	−
150	5.3	6.7	3.7	69.9	90.7	91.8	5.2	7.9	3.7	66.6	88.7	91.7
500	4.8	4.1	5.2	99.4	100.0	100.0	4.7	4.6	5.6	99.1	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	34.7	82.4	−	55.8	86.5	−	33.8	82.6	−	50.8	85.9	−
150	11.8	24.6	42.9	73.9	94.2	98.3	10.9	25.3	41.8	67.3	91.9	97.8
500	6.2	6.9	10.0	99.4	100.0	100.0	5.2	7.4	11.2	98.9	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors												
50	7.0	24.7	−	23.5	40.0	−	7.4	26.1	−	26.0	39.2	−
150	4.0	4.3	5.1	59.7	80.9	83.9	3.9	6.1	4.6	52.5	75.2	79.2
500	4.4	3.8	4.6	99.2	100.0	99.9	4.0	4.0	4.2	98.6	99.9	100.0
One-step first-difference GMM estimator based on "DIF3"												
50	5.1	5.1	0.0	20.7	39.0	100.0	5.2	4.4	0.0	20.4	34.6	100.0
150	5.2	6.2	5.9	35.4	77.0	94.5	5.0	5.1	5.0	33.8	66.1	87.5
500	3.6	4.2	5.0	78.4	99.9	100.0	4.5	3.9	5.2	64.7	98.7	100.0
Two-step first-difference GMM estimator based on "DIF3"												
50	6.9	6.1	0.0	22.9	41.1	100.0	6.7	5.8	0.0	22.8	36.6	100.0
150	6.0	5.9	7.0	35.5	76.7	94.6	5.9	5.7	5.3	33.6	67.0	88.0
500	3.5	4.2	5.2	77.8	99.9	100.0	4.2	4.2	5.2	65.0	98.7	100.0
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	5.5	4.5	0.0	19.1	36.8	100.0	5.6	4.1	0.0	20.0	34.0	100.0
150	5.6	5.6	6.1	34.0	75.8	94.3	5.0	5.2	4.8	32.5	66.3	87.7
500	3.4	4.2	5.1	77.7	99.9	100.0	3.8	4.0	4.9	64.3	98.8	100.0
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	7.4	6.1	0.0	22.5	40.0	100.0	7.5	5.8	0.0	22.9	35.5	100.0
150	6.0	5.9	7.1	34.6	76.2	94.5	6.0	5.4	5.2	32.9	66.0	87.7
500	3.8	4.2	5.2	77.5	99.9	100.0	4.2	4.3	5.1	64.0	98.7	100.0
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors												
50	4.8	4.3	0.0	17.2	34.7	100.0	5.6	3.4	0.0	17.7	30.7	100.0
150	5.1	5.4	6.1	32.8	74.6	92.6	4.6	4.9	4.9	31.4	64.3	86.2
500	3.2	4.1	4.7	76.1	97.3	96.6	3.6	3.7	4.9	61.8	98.2	99.0

Table A.9(cont.)

One-step system GMM estimator based on "SYS1"												
50	7.5	—	—	27.2	—	—	18.7	—	—	8.8	—	—
150	5.9	7.6	—	63.7	95.0	—	14.6	37.0	—	7.4	10.4	—
500	5.5	5.0	4.6	99.5	100.0	100.0	10.6	22.5	33.6	43.3	91.6	99.7
Two-step system GMM estimator based on "SYS1"												
50	56.5	—	—	66.5	—	—	72.8	—	—	67.1	—	—
150	15.9	67.6	—	80.3	97.4	—	35.1	80.6	—	56.3	85.5	—
500	7.5	15.3	37.2	99.8	100.0	100.0	10.9	25.3	50.4	98.9	100.0	100.0
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	1.8	—	—	6.9	—	—	1.7	—	—	1.5	—	—
150	4.7	0.1	—	58.8	6.2	—	8.2	0.8	—	28.6	1.0	—
500	5.4	5.1	1.8	99.3	100.0	100.0	5.5	5.5	0.7	97.1	99.9	100.0
Continuous-updating system GMM estimator based on "SYS1"												
50	70.6	—	—	75.2	—	—	72.2	—	—	77.6	—	—
150	19.4	78.6	—	81.6	92.4	—	22.0	81.5	—	82.4	93.1	—
500	7.5	16.7	41.1	99.7	100.0	100.0	8.3	19.1	44.0	99.8	100.0	100.0
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	17.9	—	—	25.7	—	—	17.4	—	—	23.2	—	—
150	4.6	13.7	—	57.1	45.9	—	4.3	12.9	—	57.3	43.5	—
500	4.7	4.9	6.2	99.4	100.0	100.0	4.0	5.2	5.9	99.5	100.0	100.0
One-step system GMM estimator based on "SYS2"												
50	7.9	—	—	24.6	—	—	19.2	—	—	10.5	—	—
150	6.0	7.7	9.4	60.2	90.7	98.7	15.8	46.9	71.3	6.2	6.3	8.5
500	5.4	4.4	5.2	99.4	100.0	100.0	12.4	30.1	46.1	33.6	71.4	92.5
Two-step system GMM estimator based on "SYS2"												
50	42.9	—	—	59.6	—	—	64.3	—	—	56.8	—	—
150	13.8	30.4	50.9	77.3	96.3	99.0	33.0	57.4	75.0	50.3	64.7	76.9
500	7.5	8.9	11.5	99.7	100.0	100.0	11.1	16.0	21.4	98.7	100.0	100.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	2.9	—	—	13.2	—	—	3.9	—	—	2.8	—	—
150	4.4	4.3	1.2	61.0	75.2	52.7	9.3	11.0	4.6	27.7	21.4	9.9
500	5.7	5.2	5.5	99.5	100.0	100.0	5.7	7.1	8.9	96.1	99.8	100.0
Continuous-updating system GMM estimator based on "SYS2"												
50	55.3	—	—	69.7	—	—	59.3	—	—	70.2	—	—
150	16.2	37.7	58.4	79.7	95.5	97.4	17.6	38.0	61.3	80.4	95.9	97.7
500	7.8	8.9	13.6	99.7	100.0	100.0	8.0	9.1	14.3	99.7	100.0	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	13.3	—	—	27.3	—	—	12.3	—	—	22.4	—	—
150	4.0	5.9	7.1	59.2	73.9	67.6	3.6	6.0	5.9	58.5	75.1	69.1
500	4.9	5.1	5.1	99.5	99.9	100.0	4.4	4.8	4.5	99.5	100.0	100.0
One-step system GMM estimator based on "SYS3"												
50	6.5	5.7	0.0	21.6	47.7	0.0	5.6	6.3	0.0	6.4	16.1	0.0
150	5.4	6.2	6.6	43.7	86.9	97.6	5.4	5.1	5.8	9.4	31.2	56.2
500	5.2	3.6	5.2	92.2	100.0	100.0	5.3	5.1	5.0	21.3	76.3	98.6
Two-step system GMM estimator based on "SYS3"												
50	11.4	9.3	0.0	26.0	49.8	0.0	14.3	10.4	0.0	18.4	35.7	0.0
150	5.9	6.7	7.9	48.0	86.3	97.2	7.5	6.4	5.5	28.7	69.2	91.3
500	6.2	4.3	5.2	92.9	100.0	100.0	5.7	4.8	5.8	69.0	99.2	100.0
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	7.0	5.5	0.0	18.6	39.8	0.0	3.8	4.2	0.0	9.3	26.1	0.0
150	4.7	5.9	5.6	43.0	84.1	96.9	4.7	4.8	4.2	22.9	64.8	89.1
500	5.4	4.2	5.0	92.4	100.0	100.0	4.3	4.5	5.2	66.8	99.1	100.0
Continuous-updating system GMM estimator based on "SYS3"												
50	15.5	11.4	0.0	31.1	52.9	100.0	14.0	8.7	0.0	26.5	42.3	100.0
150	6.4	7.1	7.7	51.2	86.8	97.4	8.1	6.6	6.1	37.0	73.7	92.3
500	6.3	4.4	5.0	93.4	100.0	100.0	5.3	4.6	5.6	74.3	99.4	100.0
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	8.8	5.8	0.0	20.4	39.0	0.0	8.2	4.8	0.0	16.7	31.9	0.0
150	5.1	5.4	5.6	44.2	83.4	96.3	5.2	4.8	4.1	31.9	69.2	90.8
500	5.7	4.3	5.0	93.1	99.3	99.5	4.0	4.5	5.3	71.8	99.2	100.0

Table A.10: Size(%) and power(%) of weak instruments robust tests ($\boldsymbol{\theta} = (0.0, 0.29)'$) for ARX(1) model

N/T	size ($H_0 : \boldsymbol{\theta} = (0.0, 0.29)'$)			power ($H_1 : \boldsymbol{\theta} = (-0.1, 0.19)'$)			size ($H_0 : \boldsymbol{\theta} = (0.0, 0.29)'$)			power ($H_1 : \boldsymbol{\theta} = (-0.1, 0.19)'$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
Anderson and Rubin test based on moment conditions "DIF1"												
50	78.1	–	–	83.3	–	–	77.7	–	–	81.6	–	–
150	18.9	100.0	–	45.6	100.0	–	16.9	100.0	–	42.1	100.0	–
500	9.1	56.1	100.0	85.1	99.8	100.0	9.3	55.2	100.0	80.9	99.9	100.0
Anderson and Rubin test based on moment conditions "DIF2"												
50	49.3	100.0	–	56.0	100.0	–	48.7	99.9	–	54.9	100.0	–
150	11.8	55.3	94.3	38.2	89.7	99.7	11.8	54.3	94.5	31.2	82.9	99.4
500	8.3	14.6	23.5	83.9	99.3	100.0	7.9	13.2	22.5	73.8	97.4	99.9
Anderson and Rubin test based on moment conditions "DIF3"												
50	7.6	7.9	9.0	12.7	31.1	52.1	7.7	8.6	9.2	10.8	20.7	33.7
150	5.2	5.6	5.3	24.0	67.4	91.5	6.5	5.5	4.9	14.4	41.6	66.0
500	5.2	5.6	3.5	67.4	99.7	100.0	6.0	4.4	3.8	37.3	93.8	100.0
Anderson and Rubin test based on moment conditions "SYS1"												
50	97.4	–	–	98.5	–	–	97.7	–	–	98.2	–	–
150	35.0	100.0	–	63.2	100.0	–	33.6	100.0	–	63.5	100.0	–
500	12.5	74.9	100.0	91.9	100.0	100.0	11.4	74.9	100.0	89.3	100.0	100.0
Anderson and Rubin test based on moment conditions "SYS2"												
50	84.9	–	–	88.7	–	–	84.9	–	–	89.9	–	–
150	24.7	88.5	99.9	55.0	98.6	100.0	23.6	89.0	100.0	53.4	98.8	100.0
500	10.5	22.0	49.0	90.7	99.9	100.0	10.5	22.4	47.8	89.4	99.9	100.0
Anderson and Rubin test based on moment conditions "SYS3"												
50	15.5	16.4	15.1	21.3	40.2	58.9	13.3	15.2	14.5	16.8	29.7	37.3
150	7.5	7.7	7.7	30.2	73.6	92.9	7.0	6.2	8.0	13.7	38.6	68.5
500	6.6	5.6	3.9	80.0	100.0	100.0	5.8	5.5	4.1	36.9	94.4	100.0
Lagrange Multiplier test based on moment conditions "DIF1"												
50	37.6	–	–	49.1	–	–	37.0	–	–	48.2	–	–
150	10.2	54.1	–	27.9	90.1	–	10.4	53.5	–	22.4	90.9	–
500	6.1	14.3	48.5	73.7	98.3	99.7	6.1	13.5	48.0	62.6	98.0	99.2
Lagrange Multiplier test based on moment conditions "DIF2"												
50	25.1	80.5	–	32.0	81.2	–	27.9	79.8	–	33.0	82.7	–
150	8.4	22.5	54.4	26.5	37.2	88.1	9.1	22.5	54.3	13.1	23.1	81.6
500	6.1	7.8	8.7	71.8	99.0	100.0	6.3	9.6	8.4	33.2	74.8	94.8
Lagrange Multiplier test based on moment conditions "DIF3"												
50	6.7	6.8	7.9	10.3	23.7	43.6	6.9	6.7	7.7	6.4	8.7	13.2
150	5.5	5.9	5.6	22.2	56.9	82.8	6.3	6.2	5.9	6.8	14.4	25.5
500	6.2	3.9	3.3	57.3	98.1	100.0	6.4	5.3	4.3	8.6	30.5	64.5
Lagrange Multiplier test based on moment conditions "SYS1"												
50	53.8	–	–	58.4	–	–	53.3	–	–	54.5	–	–
150	13.1	68.5	–	48.3	86.4	–	12.9	67.4	–	42.2	79.7	–
500	8.2	18.6	34.1	92.6	99.7	100.0	8.1	17.6	35.7	91.3	97.9	95.2
Lagrange Multiplier test based on moment conditions "SYS2"												
50	39.4	–	–	40.7	–	–	42.1	–	–	45.2	–	–
150	11.1	25.5	48.3	47.6	41.8	86.7	11.6	24.0	48.7	44.1	37.0	67.9
500	7.2	9.3	12.4	91.5	99.6	100.0	7.3	9.7	11.7	90.7	99.7	99.8
Lagrange Multiplier test based on moment conditions "SYS3"												
50	11.9	10.3	10.1	17.1	35.5	53.5	9.2	10.5	9.1	12.0	19.4	25.2
150	5.2	6.8	6.9	36.2	73.4	90.8	6.2	7.7	6.7	10.7	25.3	47.7
500	6.3	5.4	2.8	80.4	99.6	100.0	6.3	5.2	4.0	16.9	59.9	92.4
Conditional likelihood ratio test based on moment conditions "DIF1"												
50	45.9	–	–	59.0	–	–	46.7	–	–	60.1	–	–
150	11.0	54.7	–	30.2	90.1	–	11.3	54.0	–	26.2	91.4	–
500	6.2	14.4	69.6	74.8	98.8	99.8	6.1	13.9	69.7	64.4	98.2	99.7
Conditional likelihood ratio test based on moment conditions "DIF2"												
50	40.7	80.4	–	47.6	81.3	–	44.6	79.6	–	49.1	82.7	–
150	8.8	25.9	68.3	27.8	48.7	91.5	10.1	29.0	70.8	16.2	35.9	88.9
500	6.2	7.8	8.7	72.5	99.0	100.0	6.4	9.8	8.6	34.4	76.1	95.5
Conditional likelihood ratio test based on moment conditions "DIF3"												
50	6.9	6.8	8.5	11.3	24.4	44.6	7.3	6.4	7.9	7.4	10.2	15.2
150	5.8	5.6	5.4	22.2	57.1	82.9	6.4	6.2	5.7	7.4	14.7	26.4
500	6.3	3.7	3.2	57.5	97.9	100.0	6.3	5.1	4.4	8.9	31.0	65.1
Conditional likelihood ratio test based on moment conditions "SYS1"												
50	54.8	–	–	59.0	–	–	54.1	–	–	54.8	–	–
150	14.3	68.4	–	51.6	86.3	–	13.9	67.6	–	45.4	79.8	–
500	8.2	19.3	38.8	92.5	99.7	100.0	8.3	18.0	37.3	91.4	98.4	95.3
Conditional likelihood ratio test based on moment conditions "SYS2"												
50	43.1	–	–	45.0	–	–	43.4	–	–	46.4	–	–
150	12.3	35.4	49.1	49.9	54.7	87.5	12.3	26.2	49.1	45.6	38.1	67.8
500	7.3	9.6	12.4	91.8	99.6	100.0	7.4	9.6	11.7	91.0	99.7	99.9
Conditional likelihood ratio test based on moment conditions "SYS3"												
50	13.3	10.9	10.7	20.1	37.1	56.8	13.1	12.1	10.6	16.4	22.5	28.3
150	5.0	6.7	7.1	36.4	74.2	91.5	6.3	7.5	6.2	11.2	25.8	48.3
500	6.3	5.4	3.0	80.5	99.6	100.0	6.1	5.0	3.8	17.1	60.3	93.1

Table A.11: Mean bias($\times100$) and RMSE($\times100$) of γ ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

	bias($\times100$)			RMSE($\times100$)			bias($\times100$)			RMSE($\times100$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	1.785	-0.127	-0.154	14.635	4.993	3.823	1.785	-0.127	-0.154	14.635	4.993	3.823
150	0.939	-0.047	-0.077	10.235	2.992	2.294	0.939	-0.047	-0.077	10.235	2.992	2.294
500	0.943	-0.001	-0.081	7.722	1.673	1.240	0.943	-0.001	-0.081	7.722	1.673	1.240
Iterative transformed likelihood estimator												
50	0.311	-0.128	-0.154	11.080	4.993	3.823	0.612	-0.127	-0.154	11.876	4.993	3.823
150	-0.252	-0.048	-0.078	5.789	2.992	2.294	0.387	-0.047	-0.078	8.343	2.992	2.294
500	0.089	-0.002	-0.081	3.187	1.673	1.240	0.353	-0.001	-0.081	4.915	1.673	1.240
One-step first-difference GMM estimator based on "DIF1"												
50	-11.372	–	–	16.720	–	–	-14.933	–	–	20.499	–	–
150	-4.486	-3.319	–	8.800	5.074	–	-6.523	-3.931	–	11.120	5.705	–
500	-1.398	-0.989	-0.923	4.763	2.399	1.792	-2.165	-1.185	-1.003	5.901	2.701	1.907
Two-step first-difference GMM estimator based on "DIF1"												
50	-11.423	–	–	20.110	–	–	-16.394	–	–	25.541	–	–
150	-4.441	-3.577	–	9.595	7.177	–	-6.616	-4.245	–	12.068	7.869	–
500	-1.375	-0.951	-0.914	4.904	2.702	2.286	-2.187	-1.143	-0.992	6.099	3.005	2.402
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	0.721	–	–	28.462	–	–	-2.103	–	–	36.520	–	–
150	0.314	-0.554	–	9.978	9.540	–	0.677	-0.736	–	12.863	10.544	–
500	0.140	0.093	-0.017	4.878	2.667	2.357	0.123	0.093	-0.012	6.009	2.934	2.468
One-step first-difference GMM estimator based on "DIF2"												
50	-10.235	-5.820	–	16.962	9.264	–	-19.602	-14.542	–	26.246	17.893	–
150	-3.898	-2.227	-1.816	8.960	4.850	3.733	-9.434	-6.601	-5.353	15.275	9.635	7.428
500	-1.170	-0.594	-0.572	4.901	2.446	1.790	-3.155	-2.178	-1.767	8.110	4.580	3.230
Two-step first-difference GMM estimator based on "DIF2"												
50	-10.286	-5.448	–	19.819	17.538	–	-20.841	-15.738	–	31.072	29.511	–
150	-3.836	-1.977	-1.583	9.692	5.541	4.682	-9.183	-6.792	-5.577	16.349	11.105	9.082
500	-1.177	-0.475	-0.415	5.029	2.570	1.917	-3.281	-2.105	-1.667	8.407	4.822	3.455
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	1.422	-2.509	–	24.954	33.205	–	-1.499	-10.374	–	39.907	43.644	–
150	0.461	0.796	0.778	9.757	5.796	5.140	1.667	0.393	-0.078	18.169	10.562	8.678
500	0.211	0.375	0.312	4.999	2.596	1.937	0.290	0.161	0.099	8.292	4.504	3.096
One-step first-difference GMM estimator based on "DIF3"												
50	-2.198	-0.324	-11.989	19.479	8.989	11.989	-6.946	-1.399	42.677	47.284	22.761	42.677
150	-1.105	-0.187	-0.150	10.765	5.249	3.951	-3.086	-0.590	-0.547	29.081	13.309	9.139
500	-0.107	-0.006	-0.154	5.960	2.849	1.993	-0.526	-0.384	-0.364	15.153	7.183	4.614
Two-step first-difference GMM estimator based on "DIF3"												
50	-1.994	-0.014	-9.496	20.140	9.284	9.496	-7.208	-1.199	47.705	50.432	23.468	47.705
150	-0.960	-0.042	-0.066	10.802	5.279	4.011	-3.079	-0.646	-0.404	29.713	13.392	9.157
500	-0.094	0.052	-0.126	6.020	2.879	2.006	-0.474	-0.370	-0.314	15.161	7.197	4.624
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	0.666	0.825	-9.468	22.666	9.554	9.468	-5.197	2.336	60.000	52.598	27.506	60.000
150	-0.020	0.237	0.072	11.051	5.303	4.015	0.262	0.538	0.175	32.417	14.002	9.358
500	0.198	0.136	-0.087	6.061	2.892	2.006	1.000	-0.038	-0.163	16.213	7.312	4.640
One-step system GMM estimator based on "SYS1"												
50	5.753	–	–	11.959	–	–	43.631	–	–	44.362	–	–
150	3.266	1.549	–	7.394	4.102	–	33.213	29.794	–	34.242	30.393	–
500	2.122	0.685	0.314	4.434	2.280	1.550	20.723	15.390	13.196	21.808	16.000	13.606
Two-step system GMM estimator based on "SYS1"												
50	6.469	–	–	15.654	–	–	43.276	–	–	44.760	–	–
150	2.951	1.138	–	7.621	5.541	–	29.338	25.554	–	31.774	26.807	–
500	1.563	0.545	0.298	3.885	2.075	1.755	11.763	7.642	7.186	14.992	8.803	7.929
Continuous-updating system GMM estimator based on "SYS1"												
50	5.586	–	–	23.167	–	–	19.662	–	–	35.396	–	–
150	1.423	0.850	–	7.658	9.090	–	2.855	2.278	–	11.178	13.772	–
500	1.033	0.358	0.190	3.687	2.115	1.928	0.642	0.308	0.188	3.643	2.106	1.931
One-step system GMM estimator based on "SYS2"												
50	6.968	–	–	12.674	–	–	45.209	–	–	45.864	–	–
150	3.749	2.605	2.198	7.683	4.829	3.833	35.187	35.431	34.710	36.124	35.913	35.030
500	2.314	1.035	0.699	4.529	2.492	1.785	22.606	20.183	19.084	23.652	20.791	19.507
Two-step system GMM estimator based on "SYS2"												
50	7.083	–	–	15.167	–	–	44.385	–	–	45.764	–	–
150	2.941	1.835	1.661	7.616	5.172	4.693	31.035	29.198	28.629	33.289	30.403	29.406
500	1.459	0.748	0.495	3.856	2.395	1.906	13.150	9.580	8.870	16.497	10.844	9.731
Continuous-updating system GMM estimator based on "SYS2"												
50	4.996	–	–	21.012	–	–	20.433	–	–	33.170	–	–
150	1.047	0.327	0.277	7.333	5.504	5.882	4.239	0.622	0.624	13.374	5.759	6.820
500	0.841	0.321	0.088	3.659	2.331	1.852	0.523	0.292	0.114	3.619	2.368	1.857
One-step system GMM estimator based on "SYS3"												
50	2.245	0.568	9.567	12.012	6.780	9.567	25.073	6.416	30.912	32.600	16.227	30.912
150	2.121	0.511	0.190	7.441	4.110	3.232	14.453	3.818	1.905	20.754	10.705	7.502
500	2.354	0.579	0.131	4.685	2.357	1.703	12.067	3.609	1.518	15.510	6.645	4.181
Two-step system GMM estimator based on "SYS3"												
50	4.167	2.025	11.732	13.539	7.509	11.732	25.832	9.764	29.743	33.518	17.660	29.743
150	2.777	1.035	0.541	7.737	4.298	3.381	15.620	4.967	2.718	21.331	10.072	6.827
500	2.460	0.758	0.262	4.833	2.460	1.756	10.453	3.073	1.332	13.861	5.729	3.547
Continuous-updating system GMM estimator based on "SYS3"												
50	2.615	1.440	11.036	14.738	7.803	11.036	7.644	1.901	25.596	29.378	15.493	25.596
150	1.997	0.863	0.426	7.930	4.325	3.412	4.462	1.874	1.154	18.212	9.197	6.406
500	2.189	0.692	0.224	4.798	2.454	1.755	5.411	1.859	0.810	11.493	5.224	3.371

Table A.12: Median bias($\times 100$) and MAE($\times 100$) of γ ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

| | median bias($\times 100$) | | | MAE($\times 100$) | | | median bias($\times 100$) | | | MAE($\times 100$) | | |
| | $\tau^2 = 1$ | | | | | | $\tau^2 = 5$ | | | | | |
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	-0.253	-0.081	-0.078	7.477	3.294	2.655	-0.253	-0.081	-0.078	7.477	3.294	2.655
150	-0.184	0.063	-0.039	3.830	2.153	1.631	-0.184	0.063	-0.039	3.830	2.153	1.631
500	0.042	-0.054	-0.107	2.073	1.192	0.827	0.042	-0.054	-0.107	2.073	1.192	0.827
	Iterative transformed likelihood estimator											
50	-0.546	-0.081	-0.079	7.339	3.295	2.655	-0.512	-0.081	-0.078	7.401	3.294	2.655
150	-0.399	0.061	-0.040	3.703	2.155	1.631	-0.268	0.061	-0.040	3.722	2.153	1.630
500	-0.077	-0.056	-0.108	2.061	1.191	0.826	-0.028	-0.056	-0.107	2.067	1.192	0.826
	One-step first-difference GMM estimator based on "DIF1"											
50	-11.473	—	—	12.332	—	—	-15.152	—	—	15.768	—	—
150	-4.556	-3.176	—	6.135	3.404	—	-6.677	-3.818	—	7.980	4.076	—
500	-1.402	-0.977	-0.964	3.213	1.582	1.256	-2.213	-1.125	-1.028	4.048	1.788	1.387
	Two-step first-difference GMM estimator based on "DIF1"											
50	-10.592	—	—	12.732	—	—	-15.454	—	—	16.913	—	—
150	-4.066	-3.592	—	6.506	4.956	—	-6.640	-4.476	—	8.584	5.426	—
500	-1.373	-0.950	-0.860	3.301	1.782	1.553	-2.171	-1.132	-0.958	4.093	1.977	1.625
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	1.593	—	—	17.625	—	—	-0.304	—	—	22.962	—	—
150	0.346	-0.344	—	6.836	6.047	—	0.417	-0.575	—	8.943	6.406	—
500	0.038	0.023	-0.076	3.320	1.704	1.665	-0.016	0.130	-0.014	3.951	1.880	1.727
	One-step first-difference GMM estimator based on "DIF2"											
50	-10.112	-5.709	—	11.943	6.308	—	-19.590	-14.454	—	20.144	14.546	—
150	-4.124	-1.949	-1.962	6.335	3.149	2.733	-9.768	-6.161	-5.505	11.082	6.491	5.669
500	-1.107	-0.648	-0.572	3.260	1.642	1.189	-3.204	-2.047	-1.782	5.366	3.048	2.283
	Two-step first-difference GMM estimator based on "DIF2"											
50	-9.971	-4.891	—	13.030	10.321	—	-20.627	-14.675	—	21.745	19.100	—
150	-3.960	-1.977	-1.417	6.548	3.751	3.232	-9.376	-6.719	-5.362	11.935	7.540	5.995
500	-1.017	-0.440	-0.430	3.441	1.688	1.320	-3.337	-2.049	-1.723	5.584	3.270	2.419
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	1.667	0.468	—	15.557	15.323	—	-2.024	-7.567	—	28.210	24.756	—
150	0.574	0.708	1.017	6.612	3.791	3.648	1.036	1.122	0.586	11.605	6.718	5.766
500	0.323	0.385	0.318	3.352	1.763	1.324	0.184	0.168	-0.031	5.458	2.829	2.058
	One-step first-difference GMM estimator based on "DIF3"											
50	-1.832	-0.304	-11.989	12.333	6.014	11.989	-8.212	-2.910	42.677	26.037	14.717	42.677
150	-1.394	-0.166	-0.082	7.221	3.754	2.792	-4.640	-1.032	-0.895	19.122	8.901	6.049
500	-0.229	-0.103	-0.171	3.880	2.063	1.362	-1.176	-0.494	-0.320	9.630	4.871	3.160
	Two-step first-difference GMM estimator based on "DIF3"											
50	-1.951	-0.022	-9.496	12.557	6.120	9.496	-9.312	-2.274	47.705	25.779	15.685	47.705
150	-0.838	-0.086	0.001	7.070	3.793	2.886	-5.268	-0.983	-0.514	18.965	8.708	5.894
500	-0.212	-0.021	-0.156	3.956	2.094	1.366	-1.006	-0.563	-0.246	9.594	4.936	3.071
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	0.876	0.718	-9.468	13.488	6.169	9.468	-1.157	1.539	60.000	35.683	17.533	60.000
150	0.024	0.212	0.120	7.091	3.781	2.855	-1.766	0.144	0.085	21.747	8.786	6.131
500	0.116	0.047	-0.116	3.953	2.101	1.350	0.143	-0.196	-0.139	10.421	4.877	3.102
	One-step system GMM estimator based on "SYS1"											
50	6.008	—	—	8.634	—	—	44.862	—	—	44.862	—	—
150	3.276	1.647	—	5.229	2.924	—	33.909	30.214	—	33.909	30.214	—
500	2.190	0.659	0.300	2.976	1.511	1.058	21.135	15.382	13.136	21.135	15.382	13.136
	Two-step system GMM estimator based on "SYS1"											
50	6.359	—	—	10.469	—	—	45.130	—	—	45.130	—	—
150	2.911	1.102	—	5.176	3.609	—	30.467	25.842	—	30.467	25.842	—
500	1.328	0.587	0.343	2.621	1.349	1.166	10.542	7.284	6.877	10.666	7.284	6.877
	Continuous-updating system GMM estimator based on "SYS1"											
50	5.675	—	—	15.036	—	—	21.875	—	—	26.686	—	—
150	1.288	1.003	—	4.898	5.701	—	1.463	1.836	—	5.195	6.477	—
500	0.887	0.328	0.227	2.468	1.423	1.296	0.411	0.317	0.171	2.317	1.418	1.260
	One-step system GMM estimator based on "SYS2"											
50	7.035	—	—	9.044	—	—	46.392	—	—	46.392	—	—
150	3.955	2.767	2.331	5.525	3.425	2.810	35.877	35.838	34.855	35.877	35.838	34.855
500	2.369	0.941	0.673	3.042	1.657	1.219	23.131	20.218	18.993	23.131	20.218	18.993
	Two-step system GMM estimator based on "SYS2"											
50	7.098	—	—	10.397	—	—	46.265	—	—	46.265	—	—
150	2.983	1.751	1.573	5.023	3.264	3.150	32.735	29.630	28.742	32.735	29.630	28.742
500	1.346	0.687	0.538	2.576	1.527	1.349	12.167	9.091	8.368	12.200	9.091	8.368
	Continuous-updating system GMM estimator based on "SYS2"											
50	4.770	—	—	13.042	—	—	20.532	—	—	24.622	—	—
150	1.046	0.223	0.355	4.869	3.610	3.788	2.012	0.508	0.290	5.298	3.560	3.836
500	0.706	0.259	0.106	2.324	1.593	1.322	0.505	0.227	0.089	2.352	1.577	1.274
	One-step system GMM estimator based on "SYS3"											
50	3.057	0.555	9.567	8.553	4.759	9.567	26.807	8.390	30.912	27.387	12.579	30.912
150	2.428	0.519	0.162	5.203	2.634	2.281	17.289	4.896	2.769	18.516	8.060	5.245
500	2.291	0.567	0.163	3.350	1.595	1.217	13.665	3.888	1.721	13.961	4.932	3.048
	Two-step system GMM estimator based on "SYS3"											
50	4.617	2.012	11.732	9.010	5.267	11.732	29.143	11.474	29.743	29.977	13.803	29.743
150	3.007	0.967	0.622	5.398	2.859	2.254	17.941	5.628	2.854	18.859	7.244	4.674
500	2.430	0.781	0.300	3.390	1.623	1.267	11.030	3.219	1.361	11.556	4.145	2.511
	Continuous-updating system GMM estimator based on "SYS3"											
50	2.810	1.264	11.036	10.234	5.492	11.036	12.167	2.521	25.596	23.245	11.516	25.596
150	2.136	0.742	0.471	5.351	2.921	2.341	6.881	2.269	1.496	13.545	6.260	4.437
500	2.149	0.675	0.260	3.317	1.602	1.279	5.896	1.789	0.844	8.788	3.717	2.329

Table A.13: Size(%) and power(%) of γ ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

N/T	size ($H_0 : \gamma = 0.4$)			power ($H_1 : \gamma = 0.3$)			size ($H_0 : \gamma = 0.4$)			power ($H_1 : \gamma = 0.3$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	9.1	6.4	5.5	28.1	51.2	75.6	9.1	6.4	5.5	28.1	51.2	75.6
150	7.3	5.2	5.8	46.8	91.4	99.9	7.3	5.2	5.8	46.8	91.4	99.9
500	7.7	5.3	5.8	86.5	100.0	100.0	7.7	5.3	5.8	86.5	100.0	100.0
Iterative transformed likelihood estimator												
50	7.4	6.4	5.5	26.8	51.2	75.6	7.9	6.4	5.5	27.1	51.2	75.6
150	5.9	5.2	5.8	46.5	91.4	99.9	6.8	5.2	5.8	46.9	91.4	99.9
500	6.3	5.3	5.8	86.5	100.0	100.0	6.8	5.3	5.7	86.4	100.0	100.0
One-step first-difference GMM estimator based on "DIF1"												
50	17.8	–	–	42.7	–	–	18.9	–	–	44.5	–	–
150	9.2	14.3	–	47.6	93.6	–	11.8	15.1	–	41.1	92.5	–
500	6.8	6.6	7.8	71.8	99.8	100.0	7.7	7.9	9.1	61.7	99.6	100.0
Two-step first-difference GMM estimator based on "DIF1"												
50	44.6	–	–	66.1	–	–	50.6	–	–	68.0	–	–
150	18.4	61.7	–	53.2	93.6	–	20.5	62.6	–	51.9	94.1	–
500	8.7	16.4	39.0	74.7	99.8	100.0	10.2	17.8	37.9	63.4	99.7	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	6.9	–	–	15.3	–	–	8.2	–	–	17.3	–	–
150	7.0	0.9	–	35.8	19.0	–	8.7	0.8	–	30.6	16.0	–
500	6.6	6.1	3.2	69.6	99.4	99.8	6.9	6.5	4.2	56.9	98.4	99.5
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	54.5	–	–	56.2	–	–	59.3	–	–	60.5	–	–
150	17.7	66.3	–	37.2	83.3	–	19.0	66.8	–	32.1	82.0	–
500	8.8	17.9	41.5	62.9	99.3	99.9	9.2	16.7	39.3	49.8	98.2	99.9
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors												
50	13.7	–	–	16.8	–	–	16.2	–	–	19.9	–	–
150	4.8	8.1	–	18.6	25.1	–	4.8	9.1	–	12.7	22.4	–
500	4.9	5.0	4.8	54.3	96.3	98.9	5.6	5.1	4.7	38.8	92.2	98.2
One-step first-difference GMM estimator based on "DIF2"												
50	14.4	13.2	–	36.7	59.3	–	21.1	29.3	–	41.1	66.8	–
150	7.8	8.6	8.1	41.0	79.4	95.5	12.9	16.4	18.9	36.4	65.2	85.4
500	6.1	5.7	5.3	68.1	99.3	100.0	8.1	8.9	8.5	43.2	86.9	98.3
Two-step first-difference GMM estimator based on "DIF2"												
50	34.2	78.5	–	53.4	85.9	–	45.7	80.8	–	62.1	88.3	–
150	13.9	22.0	37.3	47.3	83.8	95.9	20.5	32.1	46.6	44.0	75.8	90.3
500	7.7	8.0	10.5	69.0	98.8	100.0	11.0	13.4	14.6	45.1	85.9	98.7
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	9.3	1.0	–	18.1	1.4	–	12.2	0.9	–	22.3	1.8	–
150	6.5	5.6	3.6	32.8	59.9	66.3	10.2	10.7	7.3	27.3	44.3	49.5
500	6.3	5.0	4.4	64.2	98.4	100.0	8.1	7.8	7.2	39.1	81.0	96.2
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	43.6	82.0	–	44.6	85.2	–	51.8	85.1	–	52.1	83.4	–
150	12.8	24.4	41.7	31.4	67.3	84.1	19.1	31.0	43.9	26.2	45.5	64.5
500	7.3	9.1	10.2	59.0	97.9	100.0	8.5	11.4	11.6	31.4	74.1	94.0
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors												
50	9.9	21.5	–	14.5	24.7	–	15.5	31.3	–	18.7	35.1	–
150	5.6	5.9	5.5	18.6	35.9	46.5	6.1	7.2	7.2	11.7	17.7	21.4
500	4.8	4.8	4.2	52.7	95.6	99.6	5.1	5.9	4.2	25.4	59.2	86.9
One-step first-difference GMM estimator based on "DIF3"												
50	4.9	4.3	0.0	13.6	21.9	0.0	4.4	5.2	0.0	9.7	11.0	0.0
150	4.9	4.3	4.6	20.8	49.0	73.0	5.8	5.2	6.2	11.9	15.3	22.2
500	6.0	3.8	3.6	43.3	93.1	99.8	5.4	5.6	4.6	14.2	32.7	56.5
Two-step first-difference GMM estimator based on "DIF3"												
50	7.1	6.4	0.0	16.6	23.7	0.0	8.0	8.0	0.0	12.2	13.2	0.0
150	5.1	4.4	5.3	20.6	48.3	72.7	7.3	6.4	6.2	12.6	16.3	22.8
500	6.2	4.2	3.7	43.8	93.0	99.8	5.3	6.0	4.3	14.1	33.3	56.5
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	5.4	4.4	0.0	13.5	20.3	0.0	9.0	6.5	0.0	12.8	12.1	0.0
150	4.4	4.1	5.0	20.1	46.2	71.9	7.4	5.1	5.7	13.1	15.2	22.3
500	5.9	4.3	3.7	43.3	92.7	99.8	5.0	5.5	4.4	14.1	32.9	56.1
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	8.1	6.9	0.0	15.3	21.7	0.0	10.2	10.2	0.0	14.0	13.9	0.0
150	5.7	4.5	5.3	18.9	46.7	71.9	7.9	7.1	6.8	14.0	15.4	21.8
500	6.1	4.6	3.8	42.0	92.4	99.8	6.5	5.9	4.4	13.4	32.3	55.4
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors												
50	6.5	4.8	0.0	12.2	17.7	0.0	8.9	6.3	0.0	12.1	11.6	0.0
150	4.6	3.9	4.5	17.9	43.9	69.9	7.4	5.8	5.7	12.1	13.6	20.2
500	5.7	4.4	3.7	41.0	90.4	97.5	5.2	5.3	4.3	13.3	29.7	54.0

	size ($H_0 : \gamma = 0.4$)			power ($H_1 : \gamma = 0.3$)			size ($H_0 : \gamma = 0.4$)			power ($H_1 : \gamma = 0.3$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
One-step system GMM estimator based on "SYS1"												
50	13.7	—	—	8.4	—	—	96.6	—	—	92.0	—	—
150	9.5	7.8	—	18.2	61.0	—	92.7	99.3	—	77.0	90.0	—
500	10.7	6.8	4.2	55.1	99.2	100.0	82.7	96.1	99.3	47.6	34.2	26.1
Two-step system GMM estimator based on "SYS1"												
50	63.7	—	—	62.3	—	—	99.5	—	—	98.0	—	—
150	28.2	69.4	—	45.0	91.5	—	93.5	99.9	—	85.0	97.3	—
500	14.3	20.2	40.2	78.1	99.8	100.0	71.3	90.1	98.0	54.8	73.0	85.3
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	2.8	—	—	1.9	—	—	40.8	—	—	29.1	—	—
150	5.6	0.0	—	20.0	0.8	—	55.0	29.8	—	29.3	16.0	—
500	7.9	5.2	0.8	69.0	99.6	99.7	40.8	55.6	39.7	19.1	21.7	9.8
Continuous-updating system GMM estimator based on "SYS1"												
50	72.6	—	—	72.4	—	—	88.0	—	—	87.3	—	—
150	26.1	80.2	—	53.7	88.3	—	38.0	88.2	—	63.8	92.2	—
500	12.0	22.4	43.6	83.9	99.8	100.0	14.5	29.3	52.4	83.7	99.9	100.0
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	25.8	—	—	25.9	—	—	42.4	—	—	41.2	—	—
150	7.8	10.4	—	26.5	27.5	—	8.4	11.8	—	27.4	27.7	—
500	6.7	5.5	5.2	73.8	99.3	99.9	5.7	5.9	5.0	74.8	99.3	100.0
One-step system GMM estimator based on "SYS2"												
50	16.1	—	—	7.4	—	—	97.7	—	—	93.6	—	—
150	10.5	12.2	12.5	16.5	47.3	71.4	93.7	99.7	100.0	81.9	97.5	99.4
500	11.1	8.7	5.9	53.2	97.8	100.0	85.6	97.8	99.8	54.5	64.1	71.2
Two-step system GMM estimator based on "SYS2"												
50	55.8	—	—	53.4	—	—	99.4	—	—	98.2	—	—
150	25.3	35.7	57.6	40.5	78.2	90.0	94.6	99.8	100.0	87.0	97.0	98.9
500	13.8	13.2	17.4	77.8	99.1	100.0	73.6	90.2	96.8	56.0	56.9	65.6
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	6.4	—	—	3.8	—	—	60.6	—	—	47.3	—	—
150	7.0	4.1	0.7	21.3	30.7	14.4	62.8	92.9	87.7	38.1	68.5	64.2
500	7.0	7.3	6.1	70.1	98.3	100.0	43.8	74.0	84.6	20.3	24.2	26.0
Continuous-updating system GMM estimator based on "SYS2"												
50	63.9	—	—	65.3	—	—	83.0	—	—	82.8	—	—
150	21.5	37.8	63.3	51.4	84.7	90.8	37.4	54.8	74.4	65.0	89.8	94.4
500	10.7	13.4	14.9	83.1	99.5	100.0	12.2	20.7	24.1	81.8	99.5	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	23.6	—	—	24.6	—	—	40.8	—	—	39.8	—	—
150	7.1	5.4	5.5	29.6	46.4	42.3	13.1	6.0	5.8	33.5	44.1	42.7
500	6.4	6.1	5.3	74.8	98.5	99.9	5.1	6.9	5.5	75.4	98.5	100.0
One-step system GMM estimator based on "SYS3"												
50	7.3	5.2	0.0	8.8	26.8	0.0	45.7	19.0	100.0	32.1	6.0	100.0
150	8.3	6.0	5.4	19.1	64.3	87.2	33.0	14.0	9.4	17.0	2.5	15.3
500	11.4	6.7	4.9	50.6	98.8	100.0	38.1	14.8	9.1	11.9	11.6	59.1
Two-step system GMM estimator based on "SYS3"												
50	17.7	11.8	100.0	17.6	28.8	0.0	61.9	32.8	100.0	45.0	18.4	100.0
150	12.1	8.7	8.4	20.9	63.0	83.5	43.4	18.5	13.2	25.2	14.0	27.8
500	14.7	8.0	6.2	51.4	98.5	100.0	40.0	15.6	8.8	16.4	34.6	78.3
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	11.5	7.0	100.0	10.6	18.0	0.0	32.1	15.2	100.0	21.8	6.0	100.0
150	8.9	7.1	7.1	15.4	58.5	81.7	23.7	12.4	8.8	11.1	8.4	21.7
500	12.2	7.0	5.7	47.6	98.4	100.0	25.9	11.6	7.0	9.4	29.6	74.1
Continuous-updating system GMM estimator based on "SYS3"												
50	20.3	13.7	100.0	23.7	32.5	0.0	42.6	23.5	100.0	36.1	22.0	100.0
150	12.9	9.1	9.1	24.6	64.2	84.8	28.0	13.8	10.8	22.1	21.4	36.6
500	14.4	7.9	6.2	54.6	98.5	100.0	24.0	10.9	6.8	17.4	44.0	83.0
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	14.3	6.8	100.0	14.5	20.8	0.0	29.7	16.9	100.0	24.0	14.2	100.0
150	8.4	6.1	6.6	17.6	57.9	81.1	19.8	10.1	7.6	14.1	15.8	31.0
500	10.9	6.5	5.1	47.1	97.8	99.8	17.8	8.7	5.6	10.2	36.1	78.6

Table A.14: Mean bias(×100) and RMSE(×100) of β ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

	bias(×100)			RMSE(×100)			bias(×100)			RMSE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	-0.048	0.061	0.144	7.508	4.608	3.533	-0.048	0.061	0.144	7.508	4.608	3.533
150	0.009	-0.088	0.098	4.526	2.873	2.132	0.009	-0.088	0.098	4.526	2.873	2.132
500	-0.092	-0.021	-0.009	2.283	1.366	1.095	-0.092	-0.021	-0.009	2.283	1.366	1.095
	Iterative transformed likelihood estimator											
50	-0.027	0.061	0.144	7.429	4.608	3.533	-0.041	0.061	0.144	7.450	4.608	3.533
150	0.017	-0.088	0.098	4.490	2.873	2.132	0.011	-0.088	0.098	4.502	2.873	2.132
500	-0.077	-0.020	-0.009	2.278	1.366	1.095	-0.079	-0.021	-0.009	2.282	1.366	1.095
	One-step first-difference GMM estimator based on "DIF1"											
50	-0.370	—	—	8.214	—	—	-0.103	—	—	8.142	—	—
150	-0.141	-0.205	—	5.036	3.392	—	-0.003	-0.053	—	5.015	3.370	—
500	-0.111	-0.020	-0.002	2.619	1.637	1.295	-0.065	0.034	0.036	2.614	1.631	1.289
	Two-step first-difference GMM estimator based on "DIF1"											
50	-0.253	—	—	10.898	—	—	-0.202	—	—	10.660	—	—
150	-0.160	-0.123	—	5.524	5.123	—	-0.028	0.031	—	5.417	5.153	—
500	-0.117	-0.048	0.018	2.656	1.836	1.765	-0.062	0.007	0.045	2.645	1.844	1.766
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	1.217	—	—	20.576	—	—	0.843	—	—	16.001	—	—
150	0.033	0.049	—	5.993	7.557	—	0.089	0.071	—	5.951	7.680	—
500	-0.062	-0.025	0.079	2.680	1.908	1.970	-0.041	-0.014	0.070	2.681	1.916	1.965
	One-step first-difference GMM estimator based on "DIF2"											
50	-0.597	-0.116	—	8.532	5.679	—	-0.816	-0.732	—	8.370	5.629	—
150	-0.185	-0.183	0.126	5.113	3.634	2.821	-0.345	-0.484	-0.193	5.069	3.638	2.806
500	-0.101	0.004	0.013	2.671	1.704	1.440	-0.151	-0.109	-0.097	2.673	1.722	1.456
	Two-step first-difference GMM estimator based on "DIF2"											
50	-0.862	0.198	—	10.334	13.073	—	-1.244	-0.526	—	10.078	12.888	—
150	-0.290	-0.334	-0.003	5.494	4.250	3.853	-0.429	-0.628	-0.343	5.402	4.310	3.813
500	-0.143	-0.044	-0.015	2.701	1.801	1.554	-0.181	-0.148	-0.123	2.691	1.827	1.568
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	0.000	0.000	—	10.000	130.0	—	0.000	4.42E+03	—	10.000	1.19E+05	—
150	0.000	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	10.000	0.000	0.000
500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	One-step first-difference GMM estimator based on "DIF3"											
50	-1.028	-0.067	-18.757	17.341	8.492	18.757	-2.088	-0.161	3.598	22.720	10.204	3.598
150	-0.692	-0.184	0.114	9.882	5.311	3.819	-0.904	-0.197	0.025	12.586	6.219	4.310
500	-0.025	0.008	0.018	4.948	2.571	1.937	-0.018	-0.056	-0.014	6.144	3.097	2.223
	Two-step first-difference GMM estimator based on "DIF3"											
50	-1.327	-0.056	-19.697	18.086	8.830	19.697	-2.644	-0.179	1.934	24.734	10.496	1.934
150	-0.647	-0.140	0.149	9.965	5.310	3.838	-0.879	-0.205	0.079	13.106	6.234	4.322
500	-0.009	0.019	0.015	4.954	2.585	1.939	0.010	-0.050	0.001	6.175	3.096	2.223
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-0.065	0.229	-19.796	20.977	8.962	19.796	-2.697	0.835	5.709	28.410	11.735	5.709
150	-0.225	-0.036	0.188	10.146	5.320	3.843	0.144	0.146	0.238	13.938	6.360	4.343
500	0.121	0.047	0.026	4.982	2.589	1.939	0.457	0.043	0.042	6.443	3.120	2.226
	One-step system GMM estimator based on "SYS1"											
50	1.950	—	—	9.091	—	—	2.849	—	—	10.876	—	—
150	0.975	0.810	—	5.539	3.648	—	2.540	2.049	—	7.291	4.683	—
500	0.478	0.328	0.267	2.884	1.755	1.401	1.834	1.234	0.902	4.458	2.611	1.929
	Two-step system GMM estimator based on "SYS1"											
50	1.974	—	—	12.582	—	—	0.536	—	—	15.045	—	—
150	0.874	0.590	—	5.730	5.938	—	1.262	1.691	—	7.877	7.832	—
500	0.300	0.194	0.251	2.734	1.859	1.820	0.677	0.636	0.517	3.580	2.678	2.253
	Continuous-updating system GMM estimator based on "SYS1"											
50	—	—	—	300.0	—	—	-6.24E+04	—	—	1.97E+06	—	—
150	—	—	—	—	—	—	—	100.0	—	—	1900.0	—
500	—	—	—	—	—	—	—	—	—	—	—	—
	One-step system GMM estimator based on "SYS2"											
50	1.962	—	—	9.426	—	—	3.623	—	—	11.408	—	—
150	1.056	0.954	1.177	5.710	3.960	3.200	3.461	3.793	4.191	7.758	5.916	5.475
500	0.542	0.390	0.332	2.985	1.862	1.565	2.502	2.402	2.251	4.844	3.434	2.978
	Two-step system GMM estimator based on "SYS2"											
50	1.671	—	—	11.958	—	—	0.546	—	—	14.326	—	—
150	0.663	0.398	0.649	5.789	4.520	4.511	1.478	0.965	1.143	7.870	6.350	6.152
500	0.278	0.185	0.193	2.797	1.863	1.606	0.821	0.378	0.346	3.665	2.354	1.942
	Continuous-updating system GMM estimator based on "SYS2"											
50	0.795	—	—	19.038	—	—	-2.567	—	—	129.392	—	—
150	-0.057	-0.284	0.127	6.157	5.182	5.630	-0.029	-0.223	0.107	6.505	5.216	5.645
500	0.064	0.015	0.028	2.801	1.876	1.623	-0.057	-0.010	0.009	2.790	1.859	1.625
	One-step system GMM estimator based on "SYS3"											
50	0.641	0.068	3.563	12.318	7.264	3.563	5.354	0.367	14.742	20.232	13.796	14.742
150	0.413	0.046	0.247	7.556	4.615	3.379	2.185	0.409	0.497	15.352	9.139	6.198
500	0.804	0.200	0.109	3.992	2.196	1.746	2.800	0.860	0.400	9.383	4.816	3.207
	Two-step system GMM estimator based on "SYS3"											
50	1.537	0.550	1.105	12.600	7.413	1.105	4.976	2.419	0.801	16.864	9.117	0.801
150	0.965	0.408	0.437	7.309	4.581	3.421	4.102	1.382	0.956	10.123	5.487	3.938
500	1.108	0.307	0.189	3.944	2.189	1.742	3.142	0.905	0.467	5.849	2.806	2.039
	Continuous-updating system GMM estimator based on "SYS3"											
50	0.274	0.042	-1.724	14.006	7.713	1.724	1.910	0.451	-3.081	18.109	8.975	3.081
150	0.426	0.266	0.347	7.543	4.631	3.437	1.133	0.544	0.516	9.923	5.362	3.854
500	0.954	0.258	0.164	3.962	2.189	1.742	1.709	0.569	0.326	5.386	2.718	2.009

Table A.15: Median bias(×100) and MAE(×100) of β ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

	median bias(×100)			MAE(×100)			median bias(×100)			MAE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	0.040	0.144	0.028	5.340	3.025	2.389	0.040	0.144	0.028	5.340	3.025	2.389
150	-0.024	-0.115	0.219	3.073	1.988	1.454	-0.024	-0.115	0.219	3.073	1.988	1.454
500	-0.056	-0.066	0.040	1.488	0.951	0.760	-0.056	-0.066	0.040	1.488	0.951	0.760
Iterative transformed likelihood estimator												
50	0.064	0.144	0.028	5.234	3.025	2.389	0.040	0.144	0.028	5.256	3.025	2.389
150	-0.037	-0.115	0.219	3.063	1.988	1.455	-0.043	-0.115	0.219	3.072	1.988	1.454
500	-0.030	-0.066	0.040	1.503	0.951	0.760	-0.030	-0.066	0.040	1.513	0.952	0.760
One-step first-difference GMM estimator based on "DIF1"												
50	-0.364	−	−	5.371	−	−	-0.084	−	−	5.335	−	−
150	-0.256	-0.150	−	3.578	2.239	−	-0.118	-0.037	−	3.458	2.184	−
500	-0.078	0.002	0.047	1.778	1.079	0.858	-0.045	0.064	0.067	1.706	1.032	0.843
Two-step first-difference GMM estimator based on "DIF1"												
50	0.325	−	−	7.059	−	−	-0.009	−	−	6.930	−	−
150	-0.368	-0.131	−	3.725	3.490	−	-0.214	0.026	−	3.747	3.446	−
500	-0.113	-0.021	0.062	1.852	1.235	1.184	-0.097	0.018	0.085	1.832	1.210	1.177
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	1.321	−	−	10.450	−	−	1.277	−	−	10.462	−	−
150	-0.128	0.149	−	3.984	4.706	−	-0.084	0.269	−	4.016	4.765	−
500	-0.074	0.018	0.120	1.861	1.261	1.290	-0.061	0.067	0.090	1.868	1.260	1.317
One-step first-difference GMM estimator based on "DIF2"												
50	-0.771	-0.237	−	5.609	3.860	−	-1.007	-0.872	−	5.488	3.802	−
150	-0.276	-0.072	-0.009	3.644	2.369	1.895	-0.449	-0.384	-0.308	3.577	2.418	1.901
500	-0.120	0.009	-0.014	1.818	1.162	0.941	-0.181	-0.120	-0.131	1.806	1.150	0.948
Two-step first-difference GMM estimator based on "DIF2"												
50	-0.812	0.133	−	7.084	8.056	−	-1.242	-0.922	−	6.848	8.060	−
150	-0.489	-0.205	0.027	3.742	2.923	2.897	-0.702	-0.468	-0.231	3.798	2.876	2.787
500	-0.177	-0.028	-0.094	1.865	1.178	1.064	-0.266	-0.136	-0.214	1.835	1.229	1.052
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	0.034	0.389	−	8.147	12.689	−	0.148	0.073	−	8.647	13.161	−
150	-0.341	-0.120	0.103	3.965	3.084	3.138	-0.045	-0.042	0.122	3.903	3.135	3.104
500	-0.128	-0.014	-0.082	1.880	1.192	1.044	-0.050	0.015	-0.086	1.884	1.203	1.058
One-step first-difference GMM estimator based on "DIF3"												
50	-1.759	-0.022	-18.757	11.522	5.886	18.757	-1.391	-0.175	3.598	12.906	6.466	3.598
150	-0.840	-0.161	-0.040	6.451	3.631	2.490	-1.628	-0.524	-0.035	7.776	4.212	2.729
500	0.116	-0.046	0.035	3.478	1.745	1.326	0.190	-0.145	0.031	4.124	2.146	1.508
Two-step first-difference GMM estimator based on "DIF3"												
50	-1.665	0.036	-19.697	11.775	5.976	19.697	-1.681	0.054	1.934	13.581	6.590	1.934
150	-0.669	-0.082	-0.009	6.508	3.583	2.521	-1.238	-0.586	0.007	7.784	4.253	2.886
500	0.113	-0.023	0.021	3.464	1.739	1.318	0.168	-0.114	0.029	4.087	2.168	1.524
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	-0.324	0.330	-19.796	12.470	5.972	19.796	0.383	1.130	5.709	15.073	7.254	5.709
150	-0.263	0.021	0.052	6.739	3.616	2.520	-0.220	-0.256	0.217	8.378	4.273	2.912
500	0.270	-0.001	0.026	3.508	1.745	1.312	0.651	-0.019	0.062	4.242	2.179	1.526
One-step system GMM estimator based on "SYS1"												
50	2.250	−	−	6.273	−	−	3.283	−	−	7.408	−	−
150	0.944	0.814	−	3.686	2.482	−	2.651	1.974	−	4.949	3.232	−
500	0.515	0.278	0.324	1.863	1.222	0.969	1.845	1.128	0.912	2.942	1.776	1.358
Two-step system GMM estimator based on "SYS1"												
50	1.994	−	−	8.308	−	−	0.065	−	−	9.972	−	−
150	0.916	0.684	−	3.903	4.003	−	1.419	1.608	−	5.340	5.085	−
500	0.345	0.264	0.291	1.815	1.210	1.224	0.764	0.645	0.578	2.244	1.759	1.527
Continuous-updating system GMM estimator based on "SYS1"												
50	2.336	−	−	13.242	−	−	0.856	−	−	15.292	−	−
150	0.251	0.081	−	4.020	5.869	−	0.050	0.322	−	4.369	6.465	−
500	0.128	0.062	0.188	1.835	1.280	1.335	-0.076	0.028	0.105	1.890	1.291	1.335
One-step system GMM estimator based on "SYS2"												
50	2.031	−	−	6.408	−	−	4.064	−	−	7.800	−	−
150	1.011	0.986	1.056	3.775	2.667	2.013	3.751	3.780	4.187	5.286	4.359	4.253
500	0.523	0.350	0.379	1.954	1.271	1.105	2.549	2.368	2.277	3.330	2.472	2.327
Two-step system GMM estimator based on "SYS2"												
50	1.628	−	−	7.767	−	−	0.404	−	−	9.568	−	−
150	0.671	0.609	0.730	4.043	3.129	2.961	1.644	1.032	0.972	5.407	4.291	3.967
500	0.233	0.143	0.164	1.879	1.257	1.089	0.778	0.336	0.277	2.305	1.543	1.266
Continuous-updating system GMM estimator based on "SYS2"												
50	0.777	−	−	10.612	−	−	1.865	−	−	12.618	−	−
150	0.003	-0.171	0.156	4.190	3.512	3.631	0.020	-0.099	0.119	4.369	3.594	3.659
500	0.018	-0.028	-0.011	1.855	1.240	1.116	-0.108	-0.050	-0.042	1.887	1.207	1.109
One-step system GMM estimator based on "SYS3"												
50	1.065	0.148	3.563	8.587	4.821	3.563	6.178	1.017	14.742	13.820	9.144	14.742
150	0.629	0.008	0.132	5.051	3.031	2.234	2.475	0.458	0.727	10.685	5.820	4.158
500	0.903	0.200	0.144	2.635	1.521	1.237	2.817	0.992	0.382	6.406	3.446	2.220
Two-step system GMM estimator based on "SYS3"												
50	1.607	0.679	1.105	8.619	4.996	1.105	5.616	2.705	0.801	11.154	6.107	0.801
150	0.898	0.422	0.415	5.055	3.008	2.274	4.041	1.245	0.991	6.599	3.626	2.654
500	1.270	0.270	0.214	2.662	1.457	1.217	3.353	0.847	0.362	4.318	1.865	1.396
Continuous-updating system GMM estimator based on "SYS3"												
50	0.552	0.046	-1.724	9.219	5.100	1.724	2.113	0.732	-3.081	11.428	5.973	3.081
150	0.306	0.307	0.370	5.218	3.057	2.245	1.089	0.563	0.474	6.587	3.570	2.652
500	1.116	0.252	0.190	2.666	1.487	1.211	1.885	0.522	0.276	3.838	1.817	1.399

Table A.16: Size(%) and power(%) of β ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

	size ($H_0 : \beta = 0.26$)			power ($H_1 : \beta = 0.16$)			size ($H_0 : \beta = 0.26$)			power ($H_1 : \beta = 0.16$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	5.7	6.6	5.9	30.2	58.9	80.4	5.7	6.6	5.9	30.2	58.9	80.4
150	6.0	6.7	5.3	62.9	95.4	99.9	6.0	6.7	5.3	62.9	95.4	99.9
500	4.9	4.0	5.1	99.1	100.0	100.0	4.9	4.0	5.1	99.1	100.0	100.0
	Iterative transformed likelihood estimator											
50	5.7	6.6	5.9	30.2	58.9	80.4	5.8	6.6	5.9	30.2	58.9	80.4
150	5.9	6.7	5.3	63.4	95.4	99.9	6.0	6.7	5.3	63.4	95.4	99.9
500	4.8	4.0	5.1	99.2	100.0	100.0	4.8	4.0	5.1	99.2	100.0	100.0
	One-step first-difference GMM estimator based on "DIF1"											
50	5.1	–	–	28.8	–	–	4.8	–	–	27.1	–	–
150	5.1	6.7	–	55.6	87.8	–	5.1	7.2	–	54.6	86.5	–
500	5.0	4.9	5.0	96.8	100.0	100.0	5.3	4.7	5.4	96.4	100.0	100.0
	Two-step first-difference GMM estimator based on "DIF1"											
50	35.7	–	–	52.1	–	–	33.9	–	–	51.8	–	–
150	12.3	53.8	–	62.6	91.5	–	12.0	53.2	–	63.0	91.2	–
500	6.7	12.8	32.3	97.1	100.0	100.0	6.1	12.9	32.3	97.3	100.0	100.0
	Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors											
50	5.3	–	–	12.8	–	–	5.0	–	–	13.0	–	–
150	5.4	0.9	–	47.3	18.6	–	4.9	0.6	–	46.6	18.5	–
500	4.9	4.9	3.8	95.9	100.0	100.0	4.5	5.0	3.8	96.4	100.0	100.0
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	51.9	–	–	56.3	–	–	50.3	–	–	56.6	–	–
150	14.3	64.0	–	60.1	86.2	–	14.2	67.0	–	60.4	86.9	–
500	6.9	14.5	37.0	96.7	100.0	100.0	6.4	14.1	36.6	97.0	100.0	100.0
	Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors											
50	10.6	–	–	14.9	–	–	9.7	–	–	17.2	–	–
150	4.9	7.6	–	36.1	30.5	–	4.2	8.0	–	34.7	30.7	–
500	3.7	4.2	6.2	95.2	99.9	99.7	4.1	4.1	6.2	95.1	99.9	99.9
	One-step first-difference GMM estimator based on "DIF2"											
50	5.8	5.5	–	27.5	44.9	–	6.7	6.0	–	29.8	50.1	–
150	5.1	7.3	6.1	52.2	83.2	94.0	4.9	7.8	5.6	53.2	85.3	95.5
500	5.5	3.8	4.8	95.9	100.0	100.0	5.5	4.0	5.2	95.8	100.0	100.0
	Two-step first-difference GMM estimator based on "DIF2"											
50	25.3	75.3	–	47.5	83.8	–	25.9	76.1	–	49.2	86.1	–
150	9.8	21.5	36.9	59.0	88.0	95.2	9.3	20.9	35.7	60.8	89.9	96.6
500	6.0	6.9	10.3	96.4	100.0	100.0	5.7	7.2	9.8	96.1	100.0	100.0
	Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors											
50	6.5	0.9	–	18.5	2.0	–	5.1	1.2	–	19.8	1.4	–
150	4.8	6.0	3.5	49.3	69.6	67.7	4.3	6.6	2.8	49.7	71.6	70.7
500	4.8	4.1	5.3	95.5	100.0	100.0	4.5	4.4	5.7	95.3	100.0	100.0
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	35.1	84.5	–	49.7	86.4	–	34.3	84.3	–	46.7	87.7	–
150	12.1	25.4	41.3	56.2	85.2	92.5	11.3	24.7	39.4	54.2	83.9	91.5
500	6.1	7.3	10.1	95.8	100.0	100.0	5.6	7.0	10.3	95.2	100.0	100.0
	Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors											
50	8.1	29.9	–	15.1	36.7	–	7.3	29.5	–	16.4	36.4	–
150	3.7	4.8	5.1	40.0	58.9	61.2	3.1	5.2	4.3	35.9	57.0	59.7
500	4.4	3.6	4.6	94.1	100.0	99.8	4.3	3.6	4.7	93.5	100.0	100.0
	One-step first-difference GMM estimator based on "DIF3"											
50	3.8	4.6	0.0	12.5	24.1	100.0	3.0	3.1	0.0	9.1	19.4	0.0
150	4.9	5.4	5.9	21.1	51.7	75.4	4.0	5.1	5.4	15.6	42.7	64.7
500	3.1	4.1	5.5	50.4	96.2	99.9	3.6	3.7	4.9	37.9	89.4	99.3
	Two-step first-difference GMM estimator based on "DIF3"											
50	6.7	6.6	0.0	14.9	26.5	100.0	6.1	5.5	0.0	12.2	21.2	0.0
150	5.2	5.4	6.8	21.7	51.1	75.2	5.9	5.5	5.5	16.2	43.4	64.5
500	3.6	4.3	5.6	50.5	95.8	99.9	3.5	4.2	5.3	37.1	89.4	99.5
	Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors											
50	5.1	4.9	0.0	12.6	23.8	100.0	5.0	4.0	0.0	9.9	18.2	0.0
150	5.0	5.1	6.5	20.5	49.2	74.6	4.9	5.1	4.9	16.1	42.3	62.9
500	3.3	4.1	5.5	49.9	95.6	99.9	3.1	3.9	5.1	37.4	89.4	99.4
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	8.2	7.1	0.0	15.8	26.2	100.0	7.1	6.7	0.0	13.7	20.1	0.0
150	5.5	5.3	6.8	20.8	49.9	74.9	5.8	5.9	6.2	16.2	41.5	62.8
500	3.7	4.2	5.6	49.1	95.6	99.9	3.8	4.2	5.3	35.8	88.8	99.2
	Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors											
50	4.7	4.6	0.0	11.0	20.4	100.0	4.9	3.7	0.0	9.2	16.4	0.0
150	4.7	5.0	6.1	18.6	47.8	73.0	4.0	5.0	4.8	13.8	38.0	60.8
500	3.2	4.1	5.5	47.8	94.2	97.6	3.7	4.0	5.2	33.7	88.2	98.7

Table A.16(cont.)

N/T	size ($H_0 : \beta = 0.26$) $\tau^2 = 1$			power ($H_1 : \beta = 0.16$) $\tau^2 = 1$			size ($H_0 : \beta = 0.26$) $\tau^2 = 5$			power ($H_1 : \beta = 0.16$) $\tau^2 = 5$		
	5	10	15	5	10	15	5	10	15	5	10	15
One-step system GMM estimator based on "SYS1"												
50	6.8	–	–	16.4	–	–	6.2	–	–	10.5	–	–
150	5.9	7.9	–	38.3	75.8	–	5.8	8.6	–	17.8	48.8	–
500	6.2	4.8	5.1	91.9	100.0	100.0	8.4	7.8	8.8	51.4	96.5	100.0
Two-step system GMM estimator based on "SYS1"												
50	53.5	–	–	61.5	–	–	54.7	–	–	64.9	–	–
150	17.5	67.7	–	57.0	91.1	–	27.1	77.0	–	49.2	87.1	–
500	7.9	15.6	37.7	96.0	100.0	100.0	14.0	32.1	50.1	89.0	99.4	100.0
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	2.2	–	–	4.4	–	–	0.5	–	–	1.5	–	–
150	5.3	0.1	–	35.0	2.3	–	5.4	0.2	–	19.2	1.3	–
500	5.4	5.1	2.1	93.4	100.0	99.7	6.9	8.4	1.4	81.6	95.0	95.8
Continuous-updating system GMM estimator based on "SYS1"												
50	69.3	–	–	72.2	–	–	73.6	–	–	76.8	–	–
150	20.6	78.7	–	62.2	90.6	–	23.4	84.3	–	63.2	91.8	–
500	8.2	17.7	41.9	96.4	100.0	99.9	8.2	19.1	45.3	96.8	100.0	100.0
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	21.9	–	–	24.7	–	–	21.4	–	–	23.9	–	–
150	3.9	14.2	–	32.1	31.9	–	4.4	15.1	–	32.6	30.5	–
500	4.3	3.9	6.1	93.0	100.0	99.3	3.9	4.2	5.6	94.3	99.9	99.6
One-step system GMM estimator based on "SYS2"												
50	7.5	–	–	15.8	–	–	7.0	–	–	9.2	–	–
150	6.1	8.4	9.7	35.4	69.6	84.7	7.7	15.4	23.0	14.3	27.4	38.4
500	6.1	4.7	5.4	90.5	100.0	100.0	10.4	16.5	23.4	44.8	86.9	98.1
Two-step system GMM estimator based on "SYS2"												
50	42.8	–	–	52.4	–	–	43.6	–	–	52.7	–	–
150	15.5	30.6	51.8	54.2	86.9	93.5	23.0	41.8	60.1	42.7	74.0	85.1
500	7.2	9.4	13.0	95.1	100.0	100.0	13.5	15.0	18.7	85.6	99.5	100.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	3.5	–	–	7.8	–	–	2.1	–	–	2.8	–	–
150	5.0	4.3	0.9	36.8	49.7	25.3	5.3	4.7	1.2	18.9	24.9	8.0
500	5.5	5.1	4.8	93.1	100.0	100.0	6.3	6.6	7.3	78.3	98.2	99.9
Continuous-updating system GMM estimator based on "SYS2"												
50	54.2	–	–	62.7	–	–	60.8	–	–	65.2	–	–
150	17.6	36.4	60.1	59.4	86.5	91.1	18.6	41.0	63.0	59.1	88.7	91.5
500	7.6	9.6	13.6	95.8	100.0	100.0	8.1	10.8	15.1	96.4	100.0	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	13.9	–	–	20.7	–	–	14.4	–	–	19.2	–	–
150	4.5	5.8	6.8	36.3	51.7	45.0	4.7	5.4	6.8	35.0	51.1	45.8
500	4.5	4.3	4.4	93.1	99.9	100.0	3.9	4.2	4.7	93.5	100.0	100.0
One-step system GMM estimator based on "SYS3"												
50	6.6	5.6	0.0	11.5	27.9	0.0	8.0	6.7	0.0	4.8	10.5	0.0
150	5.3	6.7	5.6	23.8	62.2	83.6	7.4	6.6	6.6	5.6	14.7	33.4
500	5.5	3.7	5.3	65.9	99.4	100.0	7.8	6.0	6.1	7.7	47.7	87.4
Two-step system GMM estimator based on "SYS3"												
50	12.2	8.9	0.0	19.1	34.8	0.0	13.7	11.6	0.0	14.5	22.0	0.0
150	7.0	8.1	7.1	25.2	63.2	84.2	10.8	8.4	7.0	12.1	43.6	69.1
500	6.7	4.1	5.5	67.0	99.1	100.0	12.2	7.3	7.0	32.3	93.6	99.8
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	7.4	5.4	0.0	12.1	25.4	0.0	6.1	4.5	0.0	5.2	11.4	0.0
150	5.5	6.6	5.9	22.1	58.8	81.5	6.5	5.3	5.2	7.1	37.1	65.6
500	6.3	3.9	5.1	64.9	99.0	100.0	8.5	6.4	6.3	27.1	92.0	99.8
Continuous-updating system GMM estimator based on "SYS3"												
50	15.0	9.8	0.0	25.0	37.0	0.0	16.7	10.5	0.0	20.4	29.3	0.0
150	7.7	8.3	7.4	28.6	64.0	85.1	9.4	7.9	6.5	19.9	49.9	73.5
500	7.0	4.0	5.5	68.1	99.1	100.0	8.8	6.3	6.7	42.3	94.8	99.9
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	8.4	5.6	0.0	14.3	25.8	0.0	7.4	5.1	0.0	10.4	17.7	0.0
150	5.3	6.0	6.1	22.1	58.2	81.9	6.2	5.1	4.7	14.5	43.3	68.6
500	6.4	3.8	4.8	63.6	98.8	99.8	6.8	4.9	5.9	36.2	93.6	99.8

Table A.17: Mean bias(×100) and RMSE(×100) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

	bias(×100)			RMSE(×100)			bias(×100)			RMSE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	579.1	0.2	0.3	4008.9	8.2	6.2	579.1	0.2	0.3	4008.9	8.2	6.2
150	456.6	-0.1	0.2	3384.1	5.1	3.8	456.6	-0.1	0.2	3384.1	5.1	3.8
500	239	0	-0.1	2380.4	2.5	1.9	239	0	-0.1	2380.4	2.5	1.9
	Iterative transformed likelihood estimator											
50	2.18	0.24	0.26	57.42	8.25	6.24	6.32	0.24	0.26	141.64	8.25	6.24
150	0.25	-0.09	0.16	8.65	5.10	3.78	-8.56	-0.09	0.16	187.46	5.10	3.78
500	0.06	-0.01	-0.06	4.44	2.51	1.92	4.40	-0.01	-0.06	162.29	2.51	1.92
	One-step first-difference GMM estimator based on "DIF1"											
50	-5.95	–	–	16.22	–	–	-7.11	–	–	16.80	–	–
150	-2.59	-2.43	–	10.04	6.52	–	-3.44	-2.57	–	10.51	6.49	–
500	-0.91	-0.68	-0.63	5.58	3.23	2.47	-1.26	-0.72	-0.63	5.97	3.22	2.44
	Two-step first-difference GMM estimator based on "DIF1"											
50	-4.68	–	–	21.68	–	–	-7.34	–	–	39.80	–	–
150	-2.42	-2.20	–	11.13	9.54	–	-3.35	-2.39	–	11.40	9.45	–
500	-0.88	-0.68	-0.57	5.76	3.64	3.29	-1.24	-0.71	-0.58	6.18	3.63	3.27
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	–	–	–	–	–	–	–	–	–	–	–	–
150	1.78	0.90	–	14.51	15.48	–	3.39	0.86	–	20.10	15.44	–
500	0.32	0.12	0.19	6.03	3.83	3.73	0.49	0.14	0.18	6.65	3.81	3.68
	One-step first-difference GMM estimator based on "DIF2"											
50	-5.31	-3.47	–	17.33	10.68	–	-9.36	-8.56	–	18.80	13.18	–
150	-2.16	-1.62	-0.93	10.48	6.88	5.34	-4.99	-4.51	-3.54	12.35	8.61	6.76
500	-0.70	-0.34	-0.35	5.85	3.43	2.73	-1.74	-1.48	-1.30	7.39	4.52	3.49
	Two-step first-difference GMM estimator based on "DIF2"											
50	-4.49	0.68	–	22.20	31.15	–	-4.56	-1.30	–	90.31	76.22	–
150	-2.12	-1.59	-0.87	11.41	8.09	7.23	-4.57	-4.50	-3.64	13.50	10.28	8.65
500	-0.76	-0.33	-0.28	5.97	3.61	2.94	-1.82	-1.47	-1.25	7.56	4.79	3.72
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	–	–	–	–	–	–	–	–	–	–	–	–
150	1.63	0.74	1.02	13.97	9.28	8.60	–	1.98	1.20	–	13.95	10.82
500	0.37	0.35	0.29	6.22	3.72	3.01	1.18	0.41	0.22	8.70	5.02	3.72
	One-step first-difference GMM estimator based on "DIF3"											
50	9.24	1.46	-33.27	106.26	18.59	33.27	-2.33	1.93	127.50	781.60	271.81	127.50
150	1.32	0.18	0.41	25.09	11.05	7.86	10.06	3.69	1.35	269.62	24.56	13.10
500	0.73	0.19	-0.01	11.29	5.47	3.87	8.94	0.71	0.13	73.65	10.05	6.31
	Two-step first-difference GMM estimator based on "DIF3"											
50	-3.20	1.90	-34.30	294.70	19.70	34.30	28.30	15.90	183.80	2903.50	151.10	183.80
150	1.70	0.40	0.50	27.40	11.10	8.00	-129.00	3.60	1.60	4590.10	24.60	13.30
500	0.80	0.30	0.00	11.40	5.50	3.90	14.70	0.70	0.20	213.40	10.10	6.30
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	–	3.20	-34.40	–	21.11	34.40	–	–	–	–	–	–
150	3.70	0.75	0.71	34.73	11.20	8.00	–	6.03	2.38	–	29.14	13.90
500	1.23	0.36	0.06	11.58	5.55	3.89	–	1.18	0.38	–	10.37	6.39
	One-step system GMM estimator based on "SYS1"											
50	10.20	–	–	22.80	–	–	235.20	–	–	1565.20	–	–
150	4.90	2.70	–	12.50	7.40	–	74.80	53.20	–	90.30	58.50	–
500	2.60	1.10	0.70	6.50	3.60	2.70	29.80	18.40	14.50	34.50	20.20	15.50
	Two-step system GMM estimator based on "SYS1"											
50	13.00	–	–	34.00	–	–	784.00	–	–	18387.00	–	–
150	5.00	2.00	–	13.00	11.00	–	63.00	42.00	–	90.00	53.00	–
500	2.00	1.00	1.00	6.00	4.00	3.00	15.00	8.00	7.00	22.00	11.00	9.00
	Continuous-updating system GMM estimator based on "SYS1"											
50	–	–	–	–	–	–	–	–	–	–	–	–
150	2.11	2.05	–	13.06	20.40	–	6.42	–	–	29.45	–	–
500	1.08	0.33	0.44	5.65	3.62	3.77	0.57	0.24	0.38	5.53	3.66	3.78
	One-step system GMM estimator based on "SYS2"											
50	11.60	–	–	24.70	–	–	207.20	–	–	1203.10	–	–
150	5.50	3.90	3.80	13.20	8.50	7.00	90.50	85.00	80.50	109.70	92.70	85.50
500	2.90	1.50	1.10	6.80	3.90	3.10	35.80	29.30	26.50	41.00	31.80	28.10
	Two-step system GMM estimator based on "SYS2"											
50	12.70	–	–	32.20	–	–	22.90	–	–	6383.70	–	–
150	4.10	2.40	2.60	12.70	9.10	8.80	71.70	51.20	47.30	102.30	62.50	55.60
500	1.70	0.90	0.70	6.00	3.70	3.10	17.30	9.60	8.50	25.60	12.30	10.30
	Continuous-updating system GMM estimator based on "SYS2"											
50	–	–	–	–	–	–	–	–	–	–	–	–
150	1.37	0.18	0.88	12.34	10.10	10.83	8.36	0.72	1.68	30.99	13.17	15.89
500	0.90	0.32	0.15	5.68	3.58	3.00	0.46	0.26	0.14	5.58	3.56	2.99
	One-step system GMM estimator based on "SYS3"											
50	5.60	1.20	15.30	26.50	13.80	15.30	85.10	11.80	96.70	1573.00	37.70	96.70
150	3.30	0.70	0.70	15.80	8.80	6.50	27.30	6.00	3.40	54.60	21.80	14.10
500	3.50	0.80	0.30	8.90	4.40	3.30	20.20	5.00	2.10	32.40	12.00	7.40
	Two-step system GMM estimator based on "SYS3"											
50	9.63	3.23	12.82	30.13	14.76	12.82	53.64	17.01	45.24	952.41	81.47	45.24
150	4.83	1.74	1.32	15.96	8.93	6.71	34.04	8.30	4.57	58.40	17.43	10.93
500	4.12	1.17	0.55	9.08	4.47	3.33	18.36	4.47	1.99	26.18	8.83	5.36
	Continuous-updating system GMM estimator based on "SYS3"											
50	7.17	2.03	6.24	33.15	15.26	6.24	–	7.12	23.28	–	26.39	23.28
150	3.43	1.38	1.09	16.26	9.01	6.72	13.72	4.05	2.51	35.70	14.94	9.90
500	3.66	1.04	0.48	9.02	4.46	3.33	10.20	2.88	1.35	20.18	7.97	5.09

Table A.18: Median bias(×100) and MAE(×100) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

	median bias(×100)			MAE(×100)			median bias(×100)			MAE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	0.377	0.235	0.124	9.888	5.432	4.140	0.377	0.235	0.124	9.888	5.432	4.140
150	0.191	-0.290	0.233	5.841	3.469	2.612	0.191	-0.290	0.233	5.841	3.469	2.612
500	0.063	-0.034	-0.004	3.012	1.629	1.284	0.063	-0.034	-0.004	3.012	1.629	1.284
	Iterative transformed likelihood estimator											
50	0.021	0.235	0.124	9.556	5.433	4.140	0.093	0.235	0.124	9.645	5.432	4.140
150	-0.096	-0.290	0.233	5.716	3.469	2.611	-0.173	-0.289	0.233	5.778	3.469	2.611
500	-0.051	-0.034	-0.005	2.947	1.629	1.283	0.023	-0.035	-0.005	2.974	1.629	1.284
	One-step first-difference GMM estimator based on "DIF1"											
50	-7.386	—	—	11.594	—	—	-8.960	—	—	11.919	—	—
150	-3.126	-2.666	—	7.282	4.506	—	-4.110	-2.633	—	7.525	4.346	—
500	-1.229	-0.679	-0.622	3.746	2.111	1.615	-1.680	-0.798	-0.597	3.850	2.008	1.587
	Two-step first-difference GMM estimator based on "DIF1"											
50	-7.008	—	—	13.598	—	—	-9.928	—	—	14.651	—	—
150	-3.195	-2.323	—	7.706	6.407	—	-4.189	-2.610	—	7.777	6.530	—
500	-1.260	-0.918	-0.596	3.820	2.520	2.207	-1.532	-0.823	-0.556	4.113	2.444	2.155
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	2.620	—	—	22.123	—	—	1.272	—	—	23.971	—	—
150	0.353	-0.587	—	8.454	9.000	—	0.649	-0.181	—	9.022	9.274	—
500	-0.246	-0.033	0.161	3.833	2.514	2.506	0.258	0.010	0.224	4.014	2.481	2.422
	One-step first-difference GMM estimator based on "DIF2"											
50	-6.884	-4.054	—	12.110	7.472	—	-12.065	-9.475	—	14.317	10.363	—
150	-3.202	-1.975	-1.036	7.422	4.798	3.614	-6.767	-5.147	-3.885	9.424	6.485	5.120
500	-0.923	-0.446	-0.395	3.947	2.358	1.801	-2.641	-1.878	-1.556	5.342	3.269	2.497
	Two-step first-difference GMM estimator based on "DIF2"											
50	-7.605	-3.065	—	14.284	15.278	—	-12.690	-9.404	—	17.038	17.141	—
150	-3.200	-1.995	-1.177	7.928	5.327	5.368	-6.699	-5.380	-4.119	10.081	7.565	6.366
500	-1.054	-0.554	-0.377	4.037	2.451	1.971	-2.581	-1.780	-1.533	5.424	3.377	2.531
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	1.529	1.308	—	19.550	24.136	—	-0.843	-5.265	—	23.800	27.693	—
150	-0.119	0.391	0.492	8.335	5.889	5.995	1.034	0.035	0.063	11.095	8.059	7.274
500	-0.032	0.179	0.155	4.152	2.309	1.940	0.013	-0.045	-0.108	5.619	3.227	2.407
	One-step first-difference GMM estimator based on "DIF3"											
50	-4.811	-0.278	-33.270	23.437	11.621	33.270	-14.130	-2.832	127.504	30.148	18.841	127.504
150	-2.455	-0.465	0.123	14.318	7.287	4.984	-7.317	-1.538	-0.190	22.128	11.807	8.376
500	-0.063	-0.025	0.047	7.505	3.588	2.622	-0.893	-0.660	-0.221	12.479	6.398	4.153
	Two-step first-difference GMM estimator based on "DIF3"											
50	-4.923	0.459	-34.263	25.021	11.997	34.263	-15.955	-2.719	183.833	32.115	18.525	183.833
150	-2.094	-0.228	0.261	14.613	7.274	5.069	-7.019	-1.413	0.030	21.994	11.594	8.293
500	0.061	0.058	0.028	7.528	3.704	2.658	-1.038	-0.448	-0.094	12.326	6.419	4.156
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-0.660	1.409	-34.402	26.892	12.221	34.402	2.285	1.580	—	43.702	20.708	—
150	-0.974	0.196	0.489	14.773	7.205	5.087	-1.687	0.201	0.607	25.457	11.879	8.463
500	0.545	0.184	0.069	7.632	3.749	2.645	0.337	-0.209	0.117	13.261	6.554	4.153
	One-step system GMM estimator based on "SYS1"											
50	8.129	—	—	13.790	—	—	141.592	—	—	142.642	—	—
150	3.948	2.471	—	7.677	4.668	—	65.973	49.981	—	65.973	49.981	—
500	2.240	1.089	0.680	4.055	2.300	1.783	27.300	17.667	14.041	27.300	17.667	14.041
	Two-step system GMM estimator based on "SYS1"											
50	11.153	—	—	19.224	—	—	132.334	—	—	142.026	—	—
150	4.258	2.273	—	8.537	7.268	—	47.990	37.086	—	47.990	37.086	—
500	1.602	0.684	0.707	3.819	2.376	2.193	10.055	7.090	6.692	10.173	7.161	6.708
	Continuous-updating system GMM estimator based on "SYS1"											
50	7.045	—	—	27.597	—	—	23.430	—	—	50.757	—	—
150	1.303	0.753	—	8.256	11.517	—	1.507	1.501	—	8.881	12.102	—
500	0.831	0.245	0.452	3.629	2.388	2.444	0.280	0.222	0.276	3.647	2.411	2.327
	One-step system GMM estimator based on "SYS2"											
50	9.537	—	—	14.891	—	—	164.819	—	—	169.044	—	—
150	4.494	3.528	3.544	8.091	5.477	4.662	78.661	78.708	76.670	78.661	78.708	76.670
500	2.561	1.348	1.158	4.363	2.524	2.046	32.785	28.001	25.654	32.785	28.001	25.654
	Two-step system GMM estimator based on "SYS2"											
50	9.365	—	—	17.963	—	—	139.951	—	—	152.543	—	—
150	3.627	2.058	2.251	8.313	5.985	5.398	57.888	45.341	42.731	57.888	45.341	42.731
500	1.516	0.759	0.568	3.718	2.454	2.144	12.072	8.457	7.785	12.205	8.457	7.785
	Continuous-updating system GMM estimator based on "SYS2"											
50	3.299	—	—	22.443	—	—	21.393	—	—	40.675	—	—
150	0.478	-0.202	0.523	8.003	6.777	6.774	2.152	0.061	0.394	8.748	6.286	6.869
500	0.656	0.213	0.074	3.708	2.331	2.018	0.251	0.174	0.029	3.608	2.252	2.035
	One-step system GMM estimator based on "SYS3"											
50	4.293	0.854	15.284	17.607	8.954	15.284	45.311	8.485	96.721	59.385	22.047	96.721
150	2.536	0.410	0.568	10.142	5.652	4.245	22.851	4.531	2.988	31.684	13.304	9.521
500	2.992	0.674	0.230	5.592	2.873	2.251	18.636	4.524	2.255	20.880	7.974	4.902
	Two-step system GMM estimator based on "SYS3"											
50	7.711	2.664	12.820	18.452	10.053	12.820	51.757	13.870	45.236	61.909	18.801	45.236
150	3.970	1.623	1.202	10.165	5.948	4.410	27.927	6.880	4.233	28.791	10.196	7.133
500	3.523	1.085	0.374	5.885	2.948	2.350	17.009	4.187	1.638	17.227	5.654	3.562
	Continuous-updating system GMM estimator based on "SYS3"											
50	3.710	1.974	6.244	19.223	10.394	6.244	15.801	2.895	23.277	34.556	14.757	23.277
150	2.074	1.142	0.946	10.669	5.888	4.362	7.213	2.528	2.044	19.246	9.335	6.649
500	3.126	0.912	0.314	5.695	2.973	2.341	7.660	2.749	1.086	11.767	5.028	3.305

Table A.19: Size(%) and power(%) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.4, \beta = 0.26, \psi = 0.43$) for ARX(1) model

| N/T | size ($H_0 : \psi = 0.43$) | | | power ($H_1 : \psi = 0.23$) | | | size ($H_0 : \psi = 0.43$) | | | power ($H_1 : \psi = 0.23$) | | |
| | $\tau^2 = 1$ | | | | | | $\tau^2 = 5$ | | | | | |
	5	10	15	5	10	15	5	10	15	5	10	15
					Transformed likelihood estimator							
50	5.2	6.8	6.2	54.2	90.2	98.7	5.2	6.8	6.2	54.2	90.2	98.7
150	6.1	6.1	5.9	84.1	99.9	100.0	6.1	6.1	5.9	84.1	99.9	100.0
500	4.8	5.1	4.0	98.6	100.0	100.0	4.8	5.1	4.0	98.6	100.0	100.0
					Iterative transformed likelihood estimator							
50	5.4	6.8	6.2	55.5	90.2	98.7	5.4	6.8	6.2	55.2	90.2	98.7
150	6.1	6.1	5.9	86.0	99.9	100.0	6.4	6.1	5.9	85.1	99.9	100.0
500	4.8	5.1	4.0	100.0	100.0	100.0	5.0	5.1	4.0	99.6	100.0	100.0
					One-step first-difference GMM estimator based on "DIF1"							
50	14.5	—	—	68.5	—	—	17.0	—	—	74.7	—	—
150	9.0	9.7	—	82.3	99.7	—	11.3	10.4	—	84.4	99.6	—
500	6.5	6.1	5.6	98.7	100.0	100.0	7.6	6.2	5.7	98.0	100.0	100.0
					Two-step first-difference GMM estimator based on "DIF1"							
50	40.0	—	—	79.0	—	—	43.5	—	—	80.1	—	—
150	15.5	54.3	—	86.3	99.1	—	18.2	55.8	—	86.1	99.1	—
500	7.7	14.6	32.2	98.9	100.0	100.0	8.7	15.2	32.9	98.5	100.0	100.0
					Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors							
50	7.5	—	—	42.8	—	—	10.3	—	—	48.8	—	—
150	8.5	1.5	—	76.8	61.1	—	10.5	1.8	—	76.7	64.4	—
500	5.8	6.1	3.8	98.6	100.0	100.0	6.8	6.7	3.8	97.7	100.0	100.0
					Continuous-updating first-difference GMM estimator based on "DIF1"							
50	40.3	—	—	55.5	—	—	39.3	—	—	55.4	—	—
150	13.7	63.4	—	71.7	93.2	—	12.9	66.3	—	66.2	93.0	—
500	6.3	14.9	36.5	98.3	100.0	100.0	7.6	14.9	35.8	95.3	100.0	100.0
					Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors							
50	9.4	—	—	29.8	—	—	11.5	—	—	33.2	—	—
150	4.9	7.2	—	54.7	53.1	—	4.5	8.1	—	51.0	53.5	—
500	4.5	4.7	4.9	97.4	99.9	99.9	5.6	4.8	5.1	93.8	100.0	100.0
					One-step first-difference GMM estimator based on "DIF2"							
50	15.7	11.3	—	64.5	84.3	—	25.8	23.8	—	72.4	90.8	—
150	7.9	7.3	7.6	77.7	98.3	99.8	16.2	16.9	16.4	76.3	96.6	99.8
500	6.2	4.5	5.1	98.4	100.0	100.0	9.1	8.9	7.9	91.1	100.0	100.0
					Two-step first-difference GMM estimator based on "DIF2"							
50	30.6	76.5	—	71.2	89.7	—	42.4	79.6	—	78.6	91.2	—
150	13.5	22.7	37.0	80.5	98.1	99.9	20.6	31.9	41.8	79.2	95.2	99.6
500	7.6	7.1	10.3	98.4	100.0	100.0	11.5	12.0	13.8	92.4	99.8	100.0
					Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors							
50	10.9	1.2	—	49.3	7.8	—	19.7	2.0	—	57.4	11.6	—
150	8.3	7.5	4.0	73.8	93.1	95.1	15.1	14.2	10.5	71.1	88.2	92.6
500	6.5	4.5	4.9	98.1	100.0	100.0	9.7	8.0	8.4	91.1	99.8	100.0
					Continuous-updating first-difference GMM estimator based on "DIF2"							
50	26.2	79.4	—	52.5	84.1	—	28.6	75.7	—	50.9	80.3	—
150	10.5	24.4	41.7	68.4	93.5	98.1	12.0	26.5	41.4	53.1	81.3	92.3
500	6.5	7.3	10.7	97.9	100.0	100.0	6.8	9.2	9.8	83.3	99.3	100.0
					Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors							
50	9.0	21.7	—	32.1	37.9	—	14.7	26.5	—	34.8	45.5	—
150	4.9	4.5	4.6	56.6	81.3	84.2	7.3	5.9	6.7	41.7	60.5	70.2
500	4.7	3.8	4.5	97.4	100.0	99.8	5.0	4.4	4.2	79.3	99.0	100.0
					One-step first-difference GMM estimator based on "DIF3"							
50	8.6	5.3	100.0	28.3	41.9	100.0	15.4	9.0	0.0	32.5	37.2	0.0
150	5.0	5.0	6.8	39.6	71.5	92.7	11.2	6.9	5.7	36.4	47.1	60.9
500	4.5	4.2	3.8	67.7	98.9	100.0	7.5	5.3	4.1	43.3	76.3	96.2
					Two-step first-difference GMM estimator based on "DIF3"							
50	10.3	6.0	100.0	30.3	44.4	100.0	17.9	10.5	0.0	35.8	37.2	0.0
150	5.6	4.9	7.0	39.9	72.4	91.7	12.2	7.8	5.8	36.6	47.9	60.8
500	4.0	4.6	4.0	68.1	99.1	100.0	7.5	5.5	4.3	42.8	76.3	96.2
					Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors							
50	9.1	4.4	100.0	28.2	40.4	100.0	16.9	9.4	0.0	33.9	35.2	0.0
150	5.6	4.5	6.8	38.3	71.1	91.6	11.9	6.8	5.5	35.8	45.9	60.2
500	3.8	4.4	3.8	67.7	99.2	100.0	7.7	5.4	4.2	42.7	75.7	96.1
					Continuous-updating first-difference GMM estimator based on "DIF3"							
50	10.7	5.9	100.0	28.0	41.1	100.0	20.0	10.9	0.0	32.7	34.2	0.0
150	5.2	4.7	7.1	37.2	70.7	91.6	12.7	6.9	5.6	34.5	44.2	58.6
500	4.1	4.5	3.8	67.1	99.0	100.0	7.3	5.3	4.3	39.7	74.3	95.6
					Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors							
50	8.2	3.7	0.0	23.7	36.0	100.0	16.8	9.1	0.0	29.1	30.4	0.0
150	4.4	4.4	6.3	35.8	69.1	90.5	11.0	6.4	4.8	30.5	41.6	57.1
500	3.9	4.2	3.6	64.5	97.8	97.7	6.4	5.0	4.0	37.4	73.9	95.1

N/T	size ($H_0 : \psi = 0.43$)			power ($H_1 : \psi = 0.23$)			size ($H_0 : \psi = 0.43$)			power ($H_1 : \psi = 0.23$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
One-step system GMM estimator based on "SYS1"												
50	7.0	–	–	26.0	–	–	15.9	–	–	8.1	–	–
150	5.1	8.4	–	59.0	94.8	–	30.5	75.9	–	7.9	15.5	–
500	7.7	5.9	5.4	97.7	100.0	100.0	41.6	66.7	82.9	6.2	35.8	74.2
Two-step system GMM estimator based on "SYS1"												
50	59.7	–	–	62.5	–	–	75.5	–	–	66.6	–	–
150	18.1	70.6	–	74.1	96.7	–	68.3	93.5	–	44.9	81.1	–
500	10.1	16.4	38.5	98.9	100.0	100.0	43.6	64.1	78.9	68.5	96.3	99.8
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	1.1	–	–	8.6	–	–	1.1	–	–	0.7	–	–
150	3.4	0.0	–	53.7	10.3	–	7.4	3.6	–	5.1	1.0	–
500	5.0	5.0	1.6	98.6	100.0	100.0	9.9	21.6	10.9	49.9	84.5	88.5
Continuous-updating system GMM estimator based on "SYS1"												
50	69.4	–	–	73.9	–	–	73.7	–	–	74.0	–	–
150	20.3	78.4	–	79.9	93.3	–	26.3	83.6	–	81.7	94.9	–
500	9.4	18.6	42.3	99.3	100.0	100.0	9.1	20.2	46.1	99.3	100.0	100.0
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	17.6	–	–	30.2	–	–	14.6	–	–	21.3	–	–
150	3.4	13.4	–	57.5	49.9	–	4.5	12.7	–	57.6	48.2	–
500	4.3	4.5	5.6	98.5	100.0	100.0	4.2	5.5	5.7	98.3	100.0	100.0
One-step system GMM estimator based on "SYS2"												
50	6.5	–	–	23.1	–	–	14.5	–	–	7.5	–	–
150	5.4	8.9	10.8	55.0	88.8	98.3	31.9	85.4	97.9	9.5	35.1	53.5
500	6.9	6.1	6.0	96.5	100.0	100.0	46.2	81.8	94.3	5.3	8.8	11.6
Two-step system GMM estimator based on "SYS2"												
50	45.8	–	–	55.9	–	–	64.2	–	–	56.1	–	–
150	15.0	32.2	51.6	72.7	96.1	99.0	66.5	88.5	95.6	41.2	59.8	72.2
500	9.1	10.3	12.4	98.8	100.0	100.0	44.3	59.4	72.0	61.7	91.5	97.6
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	1.9	–	–	14.8	–	–	2.6	–	–	1.5	–	–
150	3.2	3.6	0.9	56.0	76.1	56.9	8.0	28.4	19.1	5.7	7.7	3.5
500	5.0	5.8	5.5	98.6	100.0	100.0	11.1	35.2	46.6	43.4	82.7	93.7
Continuous-updating system GMM estimator based on "SYS2"												
50	56.5	–	–	70.2	–	–	61.4	–	–	67.1	–	–
150	17.4	39.2	60.9	80.3	96.3	97.7	24.5	42.6	64.6	78.6	97.1	97.8
500	8.3	9.9	14.2	99.3	100.0	100.0	8.2	10.7	16.4	99.6	100.0	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	12.9	–	–	31.2	–	–	12.2	–	–	21.7	–	–
150	3.5	5.9	6.6	61.0	78.6	71.5	4.5	5.2	5.6	56.2	79.9	74.3
500	4.8	5.0	4.6	98.7	99.9	100.0	4.6	5.8	4.7	98.6	100.0	100.0
One-step system GMM estimator based on "SYS3"												
50	5.7	4.5	0.0	22.7	52.2	0.0	5.7	5.2	100.0	3.3	12.0	0.0
150	5.4	6.4	6.7	41.9	89.2	98.2	6.4	6.2	6.6	4.8	22.2	48.5
500	7.2	4.9	4.9	85.0	100.0	100.0	11.5	6.7	5.7	6.7	57.8	95.1
Two-step system GMM estimator based on "SYS3"												
50	11.9	7.9	0.0	27.0	53.7	0.0	14.1	10.0	0.0	13.1	21.0	0.0
150	6.3	6.1	7.5	42.6	88.4	97.6	12.7	8.3	7.3	12.9	42.4	70.3
500	7.7	6.2	4.8	84.2	100.0	100.0	20.2	8.5	7.8	22.7	88.3	100.0
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	6.6	3.9	0.0	20.3	44.3	0.0	3.3	3.8	0.0	5.2	14.6	0.0
150	5.0	5.2	6.3	37.3	86.3	96.9	4.3	5.1	4.6	7.0	37.0	65.0
500	7.0	5.8	4.7	82.7	100.0	100.0	9.6	6.7	6.1	16.1	86.8	100.0
Continuous-updating system GMM estimator based on "SYS3"												
50	16.2	10.2	0.0	33.0	57.4	0.0	18.9	11.9	0.0	28.5	38.3	0.0
150	7.7	6.6	7.8	47.7	88.8	97.9	13.3	8.2	7.0	30.2	54.3	78.1
500	8.2	6.1	5.0	85.2	100.0	100.0	13.4	7.1	6.7	39.4	91.5	100.0
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	8.6	4.9	0.0	23.8	45.2	0.0	11.6	7.1	0.0	21.7	28.5	0.0
150	5.7	5.0	6.1	39.4	85.1	96.8	9.8	5.4	4.7	24.4	48.8	73.8
500	6.3	5.7	4.6	81.8	99.7	99.8	7.9	5.3	5.2	32.9	89.5	99.9

Table A.20: Size(%) and power(%) of weak instruments robust tests ($\theta = (0.4, 0.26)'$) for ARX(1) model

	size ($H_0: \theta = (0.4,0.26)'$)			power ($H_1: \theta = (0.3,0.16)'$)			size ($H_0: \theta = (0.4,0.26)'$)			power ($H_1: \theta = (0.3,0.16)'$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Anderson and Rubin test based on moment conditions "DIF1"												
50	77.9	–	–	81.5	–	–	77.8	–	–	81.9	–	–
150	17.7	100.0	–	37.6	100.0	–	17.9	100.0	–	36.4	100.0	–
500	9.5	55.9	100.0	72.4	99.5	100.0	9.7	55.4	100.0	70.6	99.8	100.0
Anderson and Rubin test based on moment conditions "DIF2"												
50	49.9	100.0	–	56.4	100.0	–	49.7	100.0	–	55.1	100.0	–
150	10.7	53.3	95.1	30.5	85.2	99.5	11.4	53.8	95.0	25.8	78.3	98.8
500	8.9	15.1	22.9	72.6	98.5	100.0	8.3	14.2	22.5	62.8	91.2	99.3
Anderson and Rubin test based on moment conditions "DIF3"												
50	8.2	8.3	8.6	11.4	23.0	36.7	8.3	8.6	8.7	9.5	17.0	24.6
150	5.3	5.4	5.8	14.3	46.6	72.8	6.2	5.4	6.1	10.8	26.1	43.3
500	5.8	5.1	4.1	37.5	95.3	100.0	5.9	4.5	3.6	25.7	76.2	95.7
Anderson and Rubin test based on moment conditions "SYS1"												
50	97.4	–	–	98.2	–	–	97.3	–	–	98.3	–	–
150	34.3	100.0	–	55.8	100.0	–	34.4	100.0	–	54.8	100.0	–
500	13.4	74.4	100.0	80.2	99.9	100.0	14.1	75.1	100.0	80.1	99.9	100.0
Anderson and Rubin test based on moment conditions "SYS2"												
50	84.2	–	–	89.5	–	–	85.6	–	–	88.4	–	–
150	23.7	88.3	99.9	47.5	98.0	100.0	25.0	89.1	100.0	48.3	98.6	100.0
500	11.8	22.3	50.0	79.2	99.6	100.0	13.6	23.2	49.0	80.8	99.6	100.0
Anderson and Rubin test based on moment conditions "SYS3"												
50	15.9	16.0	13.6	21.4	37.7	53.1	13.6	15.0	14.8	15.4	23.1	30.2
150	7.9	6.8	9.2	21.3	62.1	87.3	9.6	6.3	8.4	11.6	24.7	47.2
500	9.0	6.1	4.5	58.4	99.6	100.0	10.7	7.0	4.4	22.7	75.2	97.3
Lagrange Multiplier test based on moment conditions "DIF1"												
50	45.5	–	–	56.8	–	–	46.4	–	–	56.8	–	–
150	9.8	60.7	–	12.4	89.3	–	10.9	61.0	–	11.1	90.6	–
500	6.3	14.3	63.5	35.5	88.1	97.9	6.9	13.2	62.6	26.6	87.6	97.6
Lagrange Multiplier test based on moment conditions "DIF2"												
50	33.7	77.8	–	40.5	82.7	–	35.9	81.9	–	43.2	82.9	–
150	7.4	26.3	70.1	12.2	29.3	86.2	8.4	28.8	73.1	8.1	29.3	84.4
500	6.7	7.1	8.4	30.8	88.8	98.7	6.6	8.6	8.7	8.2	16.4	40.7
Lagrange Multiplier test based on moment conditions "DIF3"												
50	7.3	6.6	7.8	8.5	13.8	21.7	6.2	7.4	7.3	8.4	8.6	8.2
150	6.5	5.1	5.0	9.4	24.1	49.9	6.4	6.8	6.1	6.8	9.4	7.4
500	5.7	3.4	4.6	13.9	58.1	92.0	5.3	4.1	4.5	13.0	12.6	9.5
Lagrange Multiplier test based on moment conditions "SYS1"												
50	55.1	–	–	55.0	–	–	51.6	–	–	55.2	–	–
150	13.3	65.7	–	30.7	80.4	–	12.4	67.8	–	25.6	75.6	–
500	8.3	16.6	35.4	64.6	98.7	99.1	8.0	16.6	37.7	60.7	92.5	81.0
Lagrange Multiplier test based on moment conditions "SYS2"												
50	40.7	–	–	41.9	–	–	40.5	–	–	43.4	–	–
150	11.9	28.8	52.4	31.1	40.0	74.5	10.7	26.4	48.4	29.2	34.2	57.1
500	7.9	10.3	11.4	67.1	98.0	99.8	6.6	11.4	11.3	58.9	96.7	98.7
Lagrange Multiplier test based on moment conditions "SYS3"												
50	12.0	9.4	9.5	15.2	29.9	45.6	11.1	11.1	10.7	12.8	13.4	15.6
150	6.8	6.9	7.3	19.7	59.6	81.5	5.6	7.3	7.0	5.2	8.9	16.6
500	8.1	6.3	5.2	42.1	97.4	100.0	8.6	6.0	5.3	7.3	8.2	29.4
Conditional likelihood ratio test based on moment conditions "DIF1"												
50	55.8	–	–	68.1	–	–	55.9	–	–	67.7	–	–
150	11.9	61.7	–	16.3	89.8	–	14.7	61.7	–	16.8	90.8	–
500	6.4	14.4	77.4	37.0	89.1	98.6	6.9	13.8	77.4	28.0	89.6	98.3
Conditional likelihood ratio test based on moment conditions "DIF2"												
50	50.9	78.0	–	56.0	82.9	–	51.5	82.0	–	55.9	83.2	–
150	9.0	30.0	80.8	15.1	38.8	90.6	11.9	40.8	86.9	13.8	47.3	92.0
500	6.4	7.2	8.1	31.4	89.3	98.8	6.7	8.6	8.8	9.8	19.2	42.9
Conditional likelihood ratio test based on moment conditions "DIF3"												
50	8.8	6.9	8.0	9.9	14.1	22.8	7.4	8.2	7.6	9.8	10.8	10.2
150	6.5	4.8	5.0	9.9	24.5	50.4	6.6	6.9	6.1	8.0	9.8	8.1
500	5.6	3.5	4.6	14.0	58.2	92.3	5.4	4.0	4.3	13.4	13.2	10.1
Conditional likelihood ratio test based on moment conditions "SYS1"												
50	55.8	–	–	55.9	–	–	52.2	–	–	54.9	–	–
150	15.4	65.8	–	34.4	80.5	–	14.2	68.0	–	28.7	75.7	–
500	8.1	17.2	39.5	65.6	98.8	99.2	8.0	17.0	38.2	61.6	93.1	81.1
Conditional likelihood ratio test based on moment conditions "SYS2"												
50	44.8	–	–	45.2	–	–	41.0	–	–	44.3	–	–
150	12.6	35.5	52.9	33.4	44.5	75.1	11.6	27.1	48.6	31.0	35.4	57.4
500	8.1	10.2	11.6	67.4	98.1	99.8	6.8	11.9	11.6	60.4	96.8	98.8
Conditional likelihood ratio test based on moment conditions "SYS3"												
50	15.1	10.4	10.4	17.5	31.4	48.2	14.5	14.2	11.4	16.1	15.9	17.1
150	6.8	7.0	7.5	20.0	60.2	81.7	6.2	7.3	7.0	5.5	9.5	16.8
500	8.3	6.5	4.9	42.3	97.5	100.0	9.1	5.9	5.3	7.6	8.5	30.4

Table A.21: Mean bias(×100) and RMSE(×100) of γ ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

	bias(×100)			RMSE(×100)			bias(×100)			RMSE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	-0.411	0.258	0.114	8.399	4.535	2.733	-0.406	0.239	0.110	8.349	4.503	2.726
150	0.103	0.118	-0.048	5.989	2.573	1.553	0.113	0.114	-0.048	5.955	2.558	1.545
500	0.104	-0.016	-0.054	3.187	1.236	0.787	0.102	-0.016	-0.054	3.162	1.230	0.784
	Iterative transformed likelihood estimator											
50	1.080	0.236	0.093	11.105	4.619	2.687	1.176	0.230	0.089	11.159	4.611	2.677
150	0.772	0.106	-0.051	7.044	2.548	1.551	1.048	0.109	-0.049	7.392	2.538	1.544
500	0.824	-0.012	-0.054	4.254	1.237	0.787	0.465	-0.010	-0.054	3.652	1.235	0.784
	One-step first-difference GMM estimator based on "DIF1"											
50	-12.031	—	—	16.113	—	—	-13.286	—	—	17.484	—	—
150	-4.978	-4.628	—	8.631	5.715	—	-5.627	-4.904	—	9.345	5.996	—
500	-1.628	-1.405	-1.476	3.968	2.274	1.913	-1.897	-1.496	-1.506	4.272	2.389	1.943
	Two-step first-difference GMM estimator based on "DIF1"											
50	-12.313	—	—	19.435	—	—	-13.845	—	—	21.176	—	—
150	-4.847	-4.578	—	9.265	7.268	—	-5.544	-4.828	—	10.016	7.520	—
500	-1.604	-1.334	-1.420	4.030	2.432	2.219	-1.885	-1.421	-1.457	4.347	2.551	2.250
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	-7.448	—	—	22.789	—	—	-9.659	—	—	27.148	—	—
150	-0.361	-0.781	—	8.200	8.614	—	-0.408	-1.069	—	8.501	8.890	—
500	-0.121	0.029	-0.093	3.804	2.190	2.033	-0.192	0.032	-0.105	4.046	2.290	2.037
	One-step first-difference GMM estimator based on "DIF2"											
50	-10.083	-6.675	—	15.207	9.048	—	-12.059	-7.927	—	17.378	10.399	—
150	-3.932	-2.645	-2.384	8.351	4.605	3.645	-4.843	-3.228	-2.833	9.473	5.235	4.078
500	-1.311	-0.715	-0.687	3.987	2.074	1.545	-1.647	-0.874	-0.827	4.422	2.308	1.725
	Two-step first-difference GMM estimator based on "DIF2"											
50	-10.073	-7.031	—	17.841	15.850	—	-12.483	-8.529	—	20.488	17.761	—
150	-3.883	-2.677	-2.288	8.941	5.249	4.362	-4.791	-3.219	-2.699	10.108	5.886	4.834
500	-1.330	-0.663	-0.676	4.050	2.131	1.645	-1.677	-0.792	-0.814	4.499	2.369	1.816
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	-5.599	-11.217	—	19.936	34.402	—	-7.175	-14.822	—	22.592	39.921	—
150	-0.231	-0.042	-0.012	7.778	4.935	4.289	-0.360	-0.139	-0.140	8.556	5.429	4.718
500	-0.156	0.111	-0.035	3.895	2.074	1.543	-0.247	0.117	-0.064	4.269	2.298	1.679
	One-step first-difference GMM estimator based on "DIF3"											
50	-23.758	-12.554	-43.314	121.740	46.059	43.314	-13.486	-11.002	50.239	54.061	44.265	50.239
150	-17.752	-3.980	-3.517	58.236	37.511	21.203	-6.146	-3.106	-2.384	37.332	28.319	24.192
500	-8.291	-1.001	-0.777	42.651	16.383	8.042	-2.558	-1.245	-0.492	17.498	14.814	13.412
	Two-step first-difference GMM estimator based on "DIF3"											
50	-25.361	-13.638	14.202	122.234	51.747	14.202	-14.262	-11.899	49.589	59.474	48.762	49.589
150	-18.710	-4.692	-4.026	61.423	38.726	22.620	-6.892	-3.374	-2.529	38.461	30.049	25.173
500	-7.545	-0.805	-0.744	41.553	17.346	8.112	-2.580	-1.241	-0.529	17.535	15.004	13.392
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-41.105	-30.158	-16.400	75.901	64.197	16.400	-31.993	-26.602	10.000	65.466	58.505	10.000
150	-32.808	-13.612	-6.694	64.256	37.862	25.427	-13.791	-10.187	-7.868	37.660	28.049	23.482
500	-17.079	-3.482	-0.721	41.928	14.410	7.651	-3.922	-2.913	-2.118	16.227	12.928	11.865
	One-step system GMM estimator based on "SYS1"											
50	5.342	—	—	6.062	—	—	9.120	—	—	9.161	—	—
150	4.977	3.982	—	5.519	4.299	—	8.935	8.735	—	8.962	8.751	—
500	4.498	2.983	2.292	4.777	3.205	2.480	8.696	8.159	7.927	8.710	8.173	7.939
	Two-step system GMM estimator based on "SYS1"											
50	5.632	—	—	6.725	—	—	9.169	—	—	9.241	—	—
150	5.419	4.203	—	6.004	4.776	—	9.067	8.747	—	9.096	8.774	—
500	4.905	3.281	2.428	5.138	3.549	2.713	8.853	8.224	7.943	8.866	8.239	7.958
	Continuous-updating system GMM estimator based on "SYS1"											
50	1.980	—	—	11.138	—	—	4.257	—	—	14.909	—	—
150	3.689	1.929	—	6.926	6.225	—	7.208	5.965	—	8.767	8.092	—
500	3.976	1.916	0.971	5.026	3.111	2.305	8.106	3.894	1.791	8.482	5.752	3.814
	One-step system GMM estimator based on "SYS2"											
50	5.544	—	—	6.235	—	—	9.139	—	—	9.181	—	—
150	5.109	4.531	4.199	5.634	4.818	4.381	8.943	8.807	8.753	8.970	8.823	8.763
500	4.567	3.307	2.838	4.845	3.515	3.003	8.694	8.232	8.106	8.708	8.244	8.117
	Two-step system GMM estimator based on "SYS2"											
50	5.776	—	—	6.846	—	—	9.185	—	—	9.256	—	—
150	5.420	4.620	4.360	6.048	5.034	4.695	9.061	8.816	8.769	9.093	8.838	8.787
500	4.791	3.449	2.848	5.055	3.716	3.100	8.830	8.257	8.039	8.844	8.274	8.055
	Continuous-updating system GMM estimator based on "SYS2"											
50	2.805	—	—	9.445	—	—	6.375	—	—	9.710	—	—
150	3.795	2.364	2.095	6.849	5.401	4.963	7.295	5.926	5.796	8.741	7.754	7.500
500	3.841	1.787	0.847	4.884	2.963	1.995	7.965	4.153	1.415	8.396	5.903	3.381
	One-step system GMM estimator based on "SYS3"											
50	4.233	2.598	16.437	7.337	5.626	16.437	8.544	7.711	11.677	8.763	8.096	11.677
150	4.399	2.709	1.648	5.747	4.121	3.106	8.428	7.269	6.277	8.522	7.465	6.597
500	4.515	2.814	1.815	4.800	3.151	2.237	8.310	7.202	6.228	8.329	7.241	6.302
	Two-step system GMM estimator based on "SYS3"											
50	4.347	3.522	20.695	8.515	6.201	20.695	8.698	8.176	13.923	8.981	8.463	13.923
150	4.691	3.169	2.134	6.215	4.238	3.271	8.562	7.586	6.851	8.640	7.711	7.019
500	4.626	3.007	1.991	4.879	3.310	2.372	8.331	7.297	6.426	8.348	7.331	6.476
	Continuous-updating system GMM estimator based on "SYS3"											
50	-1.054	0.663	10.000	17.408	9.363	10.000	2.353	2.498	10.000	22.352	17.295	10.000
150	2.686	2.153	1.325	9.485	5.206	3.867	6.557	5.398	4.438	12.574	9.374	8.230
500	4.429	2.830	1.835	4.988	3.250	2.311	8.196	6.965	6.078	8.233	7.216	6.207

Table A.22: Median bias($\times100$) and MAE($\times100$) of γ ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

N/T	median bias($\times100$)			MAE($\times100$)			median bias($\times100$)			MAE($\times100$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	-0.061	-0.128	0.108	7.251	3.003	1.646	-0.076	-0.126	0.084	7.117	2.970	1.637
150	-0.030	0.017	-0.092	4.284	1.728	1.027	-0.017	0.037	-0.090	4.237	1.732	1.024
500	0.115	-0.009	-0.020	2.091	0.842	0.520	0.091	-0.023	-0.022	2.091	0.846	0.515
	Iterative transformed likelihood estimator											
50	-0.125	-0.134	0.107	6.538	2.956	1.641	-0.102	-0.130	0.083	6.617	2.939	1.635
150	0.081	0.012	-0.094	4.275	1.728	1.028	0.287	0.038	-0.090	4.375	1.723	1.023
500	0.392	-0.011	-0.020	2.292	0.835	0.521	0.262	-0.014	-0.021	2.183	0.845	0.515
	One-step first-difference GMM estimator based on "DIF1"											
50	-11.909	—	—	12.040	—	—	-13.322	—	—	13.446	—	—
150	-4.874	-4.763	—	5.957	4.773	—	-5.498	-4.889	—	6.446	4.935	—
500	-1.819	-1.455	-1.432	2.922	1.623	1.455	-1.982	-1.550	-1.470	3.072	1.700	1.480
	Two-step first-difference GMM estimator based on "DIF1"											
50	-11.710	—	—	13.360	—	—	-13.202	—	—	14.430	—	—
150	-4.692	-4.531	—	6.064	5.029	—	-5.357	-4.679	—	6.596	5.077	—
500	-1.761	-1.363	-1.438	2.912	1.693	1.603	-2.028	-1.464	-1.452	3.084	1.783	1.648
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	-2.312	—	—	10.000	—	—	-3.019	—	—	10.000	—	—
150	0.386	0.069	—	6.207	6.104	—	0.627	-0.207	—	6.379	6.030	—
500	-0.246	-0.019	-0.187	2.667	1.372	1.302	-0.346	0.033	-0.205	2.847	1.443	1.386
	One-step first-difference GMM estimator based on "DIF2"											
50	-10.001	-6.630	—	10.747	6.855	—	-11.931	-7.690	—	12.431	7.816	—
150	-3.894	-2.761	-2.402	5.916	3.267	2.605	-4.955	-3.239	-2.657	6.481	3.696	2.774
500	-1.536	-0.767	-0.714	2.909	1.462	1.075	-1.831	-0.890	-0.867	3.007	1.678	1.188
	Two-step first-difference GMM estimator based on "DIF2"											
50	-9.897	-6.349	—	12.021	9.887	—	-12.018	-7.456	—	13.878	11.366	—
150	-3.967	-2.619	-2.348	5.941	3.469	2.925	-4.700	-3.059	-2.658	6.574	3.975	3.415
500	-1.541	-0.713	-0.697	2.958	1.471	1.112	-1.708	-0.814	-0.831	3.102	1.664	1.242
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	-0.839	-2.426	—	10.000	10.000	—	-1.429	-4.316	—	10.000	10.000	—
150	0.219	-0.106	-0.054	5.646	3.487	2.892	0.568	0.089	-0.140	6.560	3.829	2.843
500	-0.390	0.109	-0.056	2.680	1.423	1.011	-0.433	0.102	-0.099	2.804	1.532	1.078
	One-step first-difference GMM estimator based on "DIF3"											
50	-19.669	-9.528	-43.314	32.121	21.542	43.314	-14.046	-10.158	50.239	27.281	21.338	50.239
150	-17.854	-4.540	-2.598	31.215	16.206	10.161	-7.053	-5.383	-3.453	20.268	14.723	14.127
500	-10.840	-1.749	-0.783	21.322	9.061	4.764	-2.393	-1.975	-1.000	10.517	9.348	8.541
	Two-step first-difference GMM estimator based on "DIF3"											
50	-18.623	-8.339	14.202	31.662	21.208	14.202	-14.721	-8.617	49.589	27.069	21.623	49.589
150	-17.172	-4.930	-2.461	31.271	15.686	9.926	-6.849	-5.057	-3.197	20.082	14.827	13.754
500	-10.453	-1.671	-0.854	21.156	9.066	4.761	-2.177	-2.035	-1.216	10.698	9.371	8.201
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-14.830	-5.529	-16.400	14.830	10.000	16.400	-9.059	-5.591	10.000	10.000	10.000	10.000
150	-11.209	-0.758	-0.392	11.209	10.000	10.000	-0.609	-1.829	-0.045	10.000	10.000	10.000
500	-4.660	0.043	-0.376	10.000	10.000	4.896	-0.068	-0.697	-0.058	10.000	10.000	10.000
	One-step system GMM estimator based on "SYS1"											
50	5.490	—	—	5.527	—	—	9.139	—	—	9.139	—	—
150	5.219	4.086	—	5.225	4.086	—	8.963	8.754	—	8.963	8.754	—
500	4.564	3.049	2.333	4.564	3.049	2.333	8.718	8.193	7.949	8.718	8.193	7.949
	Two-step system GMM estimator based on "SYS1"											
50	5.851	—	—	5.895	—	—	9.250	—	—	9.250	—	—
150	5.647	4.417	—	5.651	4.425	—	9.103	8.809	—	9.103	8.809	—
500	5.074	3.434	2.503	5.074	3.434	2.503	8.899	8.276	7.982	8.899	8.276	7.982
	Continuous-updating system GMM estimator based on "SYS1"											
50	5.473	—	—	7.001	—	—	8.893	—	—	9.266	—	—
150	5.529	3.420	—	6.226	4.921	—	8.919	8.399	—	8.989	8.537	—
500	4.732	2.247	0.772	4.789	2.519	1.448	8.680	3.834	0.691	8.680	3.945	1.463
	One-step system GMM estimator based on "SYS2"											
50	5.682	—	—	5.686	—	—	9.155	—	—	9.155	—	—
150	5.343	4.594	4.197	5.343	4.594	4.197	8.992	8.827	8.765	8.992	8.827	8.765
500	4.625	3.349	2.875	4.625	3.349	2.875	8.717	8.260	8.122	8.717	8.260	8.122
	Two-step system GMM estimator based on "SYS2"											
50	6.087	—	—	6.152	—	—	9.262	—	—	9.262	—	—
150	5.702	4.776	4.426	5.707	4.782	4.426	9.119	8.861	8.819	9.119	8.861	8.819
500	4.922	3.540	2.885	4.922	3.540	2.885	8.863	8.306	8.065	8.863	8.306	8.065
	Continuous-updating system GMM estimator based on "SYS2"											
50	5.774	—	—	7.277	—	—	9.053	—	—	9.264	—	—
150	5.421	3.247	2.541	6.200	4.431	3.967	8.904	8.080	7.947	8.981	8.160	8.011
500	4.456	1.983	0.678	4.554	2.314	1.294	8.593	6.628	0.548	8.593	6.628	1.351
	One-step system GMM estimator based on "SYS3"											
50	4.753	3.312	16.437	5.285	4.052	16.437	8.683	7.892	11.677	8.683	7.896	11.677
150	4.904	3.134	2.134	5.003	3.400	2.482	8.568	7.534	6.605	8.568	7.537	6.609
500	4.654	2.968	1.856	4.654	2.974	1.878	8.384	7.311	6.374	8.384	7.311	6.374
	Two-step system GMM estimator based on "SYS3"											
50	5.198	4.119	20.695	5.763	4.499	20.695	8.811	8.301	13.923	8.811	8.301	13.923
150	5.228	3.568	2.453	5.323	3.665	2.659	8.660	7.733	7.075	8.660	7.734	7.075
500	4.731	3.111	2.074	4.731	3.119	2.086	8.393	7.412	6.544	8.393	7.412	6.544
	Continuous-updating system GMM estimator based on "SYS3"											
50	4.669	3.244	10.000	7.473	5.297	10.000	8.525	7.589	10.000	9.054	8.180	10.000
150	4.976	3.256	2.005	5.670	3.716	2.698	8.494	7.339	6.319	8.557	7.469	6.543
500	4.655	3.003	1.951	4.670	3.028	1.995	8.321	7.235	6.330	8.321	7.240	6.332

Table A.23: Size(%) and power(%) of γ ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

N/T	size ($H_0 : \gamma = 0.9$) $\tau^2 = 1$			power ($H_1 : \gamma = 0.8$) $\tau^2 = 1$			size ($H_0 : \gamma = 0.9$) $\tau^2 = 5$			power ($H_1 : \gamma = 0.8$) $\tau^2 = 5$		
	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	5.9	5.6	5.2	26.3	62.1	90.0	5.7	5.4	5.2	26.7	62.4	90.1
150	4.8	5.9	5.2	40.3	93.1	99.9	4.9	5.8	4.9	40.2	93.4	99.9
500	5.5	4.1	5.1	83.1	100.0	100.0	5.2	4.3	5.2	83.5	100.0	100.0
Iterative transformed likelihood estimator												
50	12.7	6.6	5.1	29.4	62.3	90.0	12.8	6.5	5.1	29.0	62.8	90.1
150	7.1	5.9	5.1	39.1	93.4	99.9	7.3	5.9	4.9	39.5	93.2	99.9
500	5.5	4.1	4.9	77.6	100.0	100.0	5.4	4.3	5.2	80.2	100.0	100.0
One-step first-difference GMM estimator based on "DIF1"												
50	23.4	–	–	58.0	–	–	23.9	–	–	58.2	–	–
150	11.9	30.0	–	59.6	99.2	–	12.6	31.8	–	57.2	99.4	–
500	5.3	12.1	20.6	85.8	100.0	100.0	6.8	12.4	21.4	84.7	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1"												
50	51.7	–	–	73.0	–	–	53.2	–	–	74.4	–	–
150	19.8	67.2	–	64.1	98.3	–	21.2	66.4	–	62.7	98.2	–
500	8.2	21.1	46.9	86.6	100.0	100.0	8.5	22.2	46.7	85.4	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	10.9	–	–	25.4	–	–	11.4	–	–	26.9	–	–
150	9.9	1.6	–	46.1	40.3	–	10.7	1.9	–	43.2	40.2	–
500	6.0	9.6	8.8	83.6	100.0	100.0	5.8	9.7	8.9	82.3	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	32.3	–	–	48.7	–	–	33.2	–	–	48.6	–	–
150	10.5	70.0	–	41.7	76.1	–	9.8	70.1	–	37.3	76.7	–
500	6.0	17.1	40.8	77.2	99.8	100.0	5.7	16.1	39.2	74.4	99.9	100.0
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors												
50	11.3	–	–	21.8	–	–	12.6	–	–	20.8	–	–
150	3.9	7.4	–	22.1	33.1	–	4.3	17.6	–	19.8	38.3	–
500	2.8	5.2	5.0	71.1	98.9	99.1	2.4	5.4	12.1	65.7	96.4	87.2
One-step first-difference GMM estimator based on "DIF2"												
50	17.9	22.2	–	46.6	81.1	–	18.5	25.1	–	47.3	81.3	–
150	9.9	11.2	13.9	51.2	90.6	99.4	10.0	13.4	15.2	48.5	88.4	99.2
500	5.8	5.9	6.5	82.0	100.0	100.0	6.6	6.7	6.7	77.9	99.9	100.0
Two-step first-difference GMM estimator based on "DIF2"												
50	38.0	79.0	–	62.5	90.8	–	42.7	82.0	–	64.0	91.2	–
150	15.2	27.2	40.1	56.3	92.9	99.0	16.5	29.3	42.0	52.2	91.7	98.7
500	6.9	8.6	10.9	82.5	100.0	100.0	7.6	9.4	12.0	80.3	99.9	100.0
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	10.6	0.9	–	28.5	3.2	–	11.2	0.6	–	27.3	2.5	–
150	8.3	8.2	6.7	42.7	79.2	85.6	10.6	8.9	7.2	38.4	75.9	83.5
500	5.3	4.8	6.2	79.8	99.9	100.0	5.8	5.6	6.7	77.6	99.8	100.0
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	23.5	78.2	–	41.4	70.4	–	24.9	79.3	–	40.0	71.9	–
150	7.7	23.6	36.6	36.0	78.3	91.3	8.3	24.7	36.9	32.3	74.3	88.8
500	5.3	8.1	9.1	75.1	99.9	100.0	5.2	8.4	9.4	69.6	99.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors												
50	8.6	17.8	–	18.0	31.5	–	9.7	21.4	–	17.9	35.0	–
150	2.5	4.3	4.3	22.8	49.2	62.8	2.8	3.5	4.6	18.7	45.4	57.7
500	3.8	3.9	4.0	69.8	99.5	100.0	2.5	4.1	4.2	61.6	97.9	100.0
One-step first-difference GMM estimator based on "DIF3"												
50	2.7	1.9	0.0	6.5	5.2	0.0	3.6	1.8	0.0	8.2	6.1	0.0
150	4.6	1.4	1.5	9.0	7.2	10.4	3.5	1.7	2.3	10.4	8.9	7.9
500	4.5	2.6	2.4	10.8	14.6	30.8	3.6	2.6	2.3	16.2	17.1	14.7
Two-step first-difference GMM estimator based on "DIF3"												
50	7.3	7.4	0.0	11.8	13.4	0.0	7.6	7.5	0.0	13.1	13.2	0.0
150	6.7	5.6	4.0	11.6	12.3	14.5	5.9	5.0	4.7	14.1	13.4	12.1
500	5.7	3.5	3.4	12.2	15.6	30.8	5.0	3.6	3.4	16.8	17.0	15.7
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	8.7	7.6	0.0	11.3	10.1	0.0	11.5	10.9	100.0	14.8	15.6	100.0
150	9.6	9.0	6.8	12.9	11.7	14.4	9.8	9.3	10.3	15.3	15.0	14.4
500	10.8	7.4	4.3	15.3	17.6	31.2	8.1	6.5	6.3	17.6	19.0	16.6
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	8.5	8.2	0.0	13.8	13.8	0.0	9.4	10.7	0.0	15.0	16.9	0.0
150	9.3	7.7	5.3	14.5	14.3	15.5	7.7	8.4	7.2	15.5	16.2	14.7
500	8.9	5.5	2.9	15.0	16.9	29.4	5.1	4.9	4.6	15.8	18.0	16.7
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors												
50	12.0	9.0	0.0	15.4	13.1	0.0	10.2	9.9	0.0	14.7	15.7	0.0
150	10.3	6.1	3.4	14.7	11.4	12.8	5.1	6.6	7.0	10.7	14.3	14.9
500	7.7	3.9	1.8	13.4	14.9	27.6	3.2	3.8	3.9	13.8	14.7	15.5

Table A.23(cont.)

N/T	size ($H_0 : \gamma = 0.9$)			power ($H_1 : \gamma = 0.8$)			size ($H_0 : \gamma = 0.9$)			power ($H_1 : \gamma = 0.8$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
One-step system GMM estimator based on "SYS1"												
50	56.4	—	—	41.1	—	—	99.8	—	—	17.1	—	—
150	60.7	71.3	—	60.8	98.8	—	100.0	100.0	—	32.5	73.7	—
500	78.8	71.5	67.8	95.9	100.0	100.0	100.0	100.0	100.0	79.7	99.6	100.0
Two-step system GMM estimator based on "SYS1"												
50	89.0	—	—	82.0	—	—	100.0	—	—	71.1	—	—
150	84.4	95.7	—	82.7	99.7	—	100.0	100.0	—	65.0	97.4	—
500	91.9	90.5	91.0	98.9	100.0	100.0	100.0	100.0	100.0	90.6	100.0	100.0
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	16.3	—	—	7.1	—	—	80.0	—	—	2.1	—	—
150	57.4	1.5	—	40.0	2.1	—	94.2	84.7	—	20.5	1.9	—
500	77.0	52.8	19.5	89.6	99.4	99.7	99.3	99.7	100.0	69.8	47.3	23.9
Continuous-updating system GMM estimator based on "SYS1"												
50	87.6	—	—	73.3	—	—	98.4	—	—	67.3	—	—
150	81.5	91.6	—	76.1	92.7	—	97.6	98.2	—	67.1	85.5	—
500	82.8	69.9	70.6	96.4	100.0	100.0	97.3	86.6	86.1	90.5	99.8	99.9
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	38.8	—	—	40.7	—	—	58.5	—	—	24.1	—	—
150	46.9	42.0	—	46.1	68.5	—	72.1	62.9	—	27.9	47.4	—
500	63.0	33.7	18.7	78.1	94.9	96.3	92.4	48.9	28.2	64.6	82.8	81.0
One-step system GMM estimator based on "SYS2"												
50	58.3	—	—	37.9	—	—	99.8	—	—	16.5	—	—
150	62.4	79.1	88.0	57.8	94.5	99.7	100.0	100.0	100.0	31.9	68.0	88.1
500	79.4	78.0	80.9	94.7	100.0	100.0	100.0	100.0	100.0	79.3	99.2	100.0
Two-step system GMM estimator based on "SYS2"												
50	84.7	—	—	75.7	—	—	99.9	—	—	62.5	—	—
150	82.2	91.9	96.1	78.8	99.0	99.8	100.0	100.0	100.0	56.0	89.3	97.0
500	89.9	87.8	88.2	98.4	100.0	100.0	100.0	100.0	100.0	87.0	99.8	100.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	28.2	—	—	9.8	—	—	89.4	—	—	4.5	—	—
150	57.6	47.7	20.7	39.7	56.8	34.6	94.8	97.4	97.5	20.1	22.4	9.3
500	74.1	60.7	52.3	90.7	99.6	100.0	99.2	99.7	100.0	63.3	52.0	24.9
Continuous-updating system GMM estimator based on "SYS2"												
50	83.6	—	—	66.7	—	—	98.5	—	—	59.1	—	—
150	77.1	79.9	85.9	72.7	91.7	94.9	97.6	96.9	97.6	63.4	81.7	85.9
500	77.6	60.9	47.3	96.2	100.0	100.0	97.7	82.9	71.9	88.8	99.5	99.9
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	35.0	—	—	34.1	—	—	56.8	—	—	18.7	—	—
150	44.0	39.9	36.2	42.0	66.1	73.1	71.5	63.2	60.5	24.9	41.9	49.1
500	57.1	27.4	13.3	75.4	93.5	98.1	91.3	52.8	19.5	59.1	81.0	93.6
One-step system GMM estimator based on "SYS3"												
50	28.2	19.9	0.0	18.7	36.9	0.0	90.6	81.5	100.0	10.1	18.4	0.0
150	47.9	33.3	21.9	47.0	83.3	96.8	96.3	90.7	81.8	33.8	65.2	74.5
500	78.8	57.9	37.4	95.8	100.0	100.0	100.0	99.1	97.4	94.0	99.6	99.6
Two-step system GMM estimator based on "SYS3"												
50	40.2	35.0	100.0	33.7	48.6	0.0	94.1	91.5	100.0	22.1	30.9	100.0
150	55.9	42.6	29.8	51.3	83.9	96.5	98.1	94.9	91.0	40.1	67.0	73.0
500	80.7	64.7	43.9	95.9	100.0	100.0	100.0	99.4	98.5	93.4	99.0	99.1
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	31.9	27.6	100.0	17.1	29.6	0.0	80.0	73.5	100.0	10.0	11.1	100.0
150	51.8	39.0	26.9	40.7	73.8	89.7	92.0	84.7	76.1	27.2	48.2	51.8
500	79.7	61.8	42.2	94.9	99.8	100.0	99.9	98.2	96.7	91.2	96.5	96.0
Continuous-updating system GMM estimator based on "SYS3"												
50	44.7	40.1	0.0	41.9	58.0	0.0	84.3	80.5	100.0	31.4	46.4	0.0
150	56.7	42.7	30.3	58.4	88.3	98.1	92.9	86.7	79.8	50.6	80.5	89.5
500	79.5	61.8	41.9	95.9	100.0	100.0	99.7	98.4	96.7	95.5	99.9	99.9
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	22.7	22.4	0.0	24.4	40.8	0.0	55.8	59.2	0.0	12.2	20.8	0.0
150	44.0	35.8	23.6	39.3	72.7	88.6	82.3	79.1	71.0	27.2	52.9	65.2
500	74.7	56.9	38.5	91.3	99.5	99.5	99.0	96.8	95.2	88.0	97.4	97.8

Table A.24: Mean bias($\times100$) and RMSE($\times100$) of β ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

	bias($\times100$)			RMSE($\times100$)			bias($\times100$)			RMSE($\times100$)		
		$\tau^2 = 1$						$\tau^2 = 5$				
N/T	5	10	15	5	10	15	5	10	15	5	10	15

Transformed likelihood estimator

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	0.039	0.204	0.214	7.644	4.638	3.523	0.038	0.199	0.214	7.650	4.637	3.522
150	0.106	-0.033	0.113	4.688	2.872	2.128	0.108	-0.034	0.113	4.686	2.871	2.128
500	-0.043	-0.014	-0.012	2.329	1.373	1.085	-0.043	-0.014	-0.012	2.329	1.373	1.085

Iterative transformed likelihood estimator

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	0.363	0.202	0.212	7.940	4.643	3.521	0.377	0.199	0.211	7.930	4.642	3.521
150	0.246	-0.035	0.113	4.813	2.871	2.128	0.311	-0.035	0.113	4.824	2.871	2.128
500	0.099	-0.014	-0.012	2.399	1.373	1.085	0.024	-0.013	-0.012	2.346	1.373	1.085

One-step first-difference GMM estimator based on "DIF1"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-2.993	–	–	9.136	–	–	-2.891	–	–	9.072	–	–
150	-1.247	-1.685	–	5.457	3.900	–	-1.223	-1.517	–	5.444	3.807	–
500	-0.496	-0.496	-0.576	2.802	1.810	1.456	-0.492	-0.443	-0.505	2.801	1.784	1.420

Two-step first-difference GMM estimator based on "DIF1"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-3.073	–	–	11.999	–	–	-3.130	–	–	11.951	–	–
150	-1.241	-1.519	–	5.945	5.692	–	-1.241	-1.339	–	5.903	5.567	–
500	-0.496	-0.498	-0.550	2.875	2.020	1.889	-0.502	-0.451	-0.489	2.871	2.009	1.864

Continuous-updating first-difference GMM estimator based on "DIF1"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-1.311	–	–	16.638	–	–	-1.527	–	–	17.391	–	–
150	-0.021	0.351	–	6.216	8.019	–	-0.040	0.299	–	6.183	7.931	–
500	-0.091	0.018	0.039	2.870	2.063	2.066	-0.100	0.022	0.043	2.870	2.058	2.050

One-step first-difference GMM estimator based on "DIF2"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-2.818	-2.117	–	9.457	6.380	–	-3.108	-2.528	–	9.553	6.538	–
150	-1.066	-1.009	-0.730	5.565	3.953	3.056	-1.239	-1.205	-0.938	5.648	4.026	3.123
500	-0.411	-0.230	-0.240	2.879	1.886	1.528	-0.474	-0.287	-0.307	2.921	1.911	1.561

Two-step first-difference GMM estimator based on "DIF2"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-2.808	-2.389	–	11.373	14.063	–	-3.232	-2.706	–	11.488	14.593	–
150	-1.156	-1.129	-0.793	5.985	4.638	4.084	-1.355	-1.305	-0.994	6.064	4.717	4.168
500	-0.459	-0.255	-0.270	2.933	1.991	1.654	-0.527	-0.306	-0.339	2.977	2.034	1.686

Continuous-updating first-difference GMM estimator based on "DIF2"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	–	1.3E+04	–	10.000	3.8E+05	–	–	-20.000	–	10.000	2.8E+02	–
150	–	–	–	10.000	–	–	–	–	–	10.000	–	–
500	–	–	–	–	–	–	–	–	–	–	–	–

One-step first-difference GMM estimator based on "DIF3"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-23.103	-12.361	-52.469	107.582	48.105	52.469	-12.301	-10.330	34.959	54.255	44.165	34.959
150	-17.264	-3.913	-3.378	61.776	40.061	22.654	-5.402	-2.944	-2.035	34.986	27.575	23.499
500	-8.052	-0.895	-0.712	43.828	17.001	8.364	-2.200	-1.083	-0.341	16.652	14.158	13.041

Two-step first-difference GMM estimator based on "DIF3"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-25.046	-13.794	5.584	110.761	54.894	5.584	-13.297	-11.475	33.455	60.153	48.844	33.455
150	-18.543	-4.699	-3.921	65.234	41.497	24.153	-6.241	-3.272	-2.143	36.308	29.372	24.506
500	-7.366	-0.700	-0.677	42.892	18.042	8.431	-2.218	-1.075	-0.377	16.685	14.328	13.023

Continuous-updating first-difference GMM estimator based on "DIF3"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-43	-31	-28	85	70	28	-731	-26	-5	22138	61	5
150	-33	-14	-7	68	41	27	-13	-10	-7	36	28	23
500	-17	-3	-1	44	15	8	-3	-3	-2	16	12	12

One-step system GMM estimator based on "SYS1"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	1.850	–	–	8.368	–	–	2.049	–	–	8.686	–	–
150	2.434	1.949	–	5.629	3.860	–	3.348	2.996	–	6.298	4.580	–
500	2.592	1.878	1.396	3.659	2.516	1.925	3.960	3.735	3.403	4.819	4.111	3.667

Two-step system GMM estimator based on "SYS1"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	1.469	–	–	11.595	–	–	1.266	–	–	11.993	–	–
150	2.157	1.602	–	5.733	5.812	–	2.379	2.056	–	6.154	6.035	–
500	2.412	1.739	1.342	3.482	2.478	2.189	3.095	3.096	2.804	4.113	3.631	3.323

Continuous-updating system GMM estimator based on "SYS1"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-6.6E+09	–	–	2.1E+11	–	–	0.000	–	–	0.000	–	–
150	0.000	0.000	–	0.000	0.000	–	0.000	0.000	–	0.000	0.000	–
500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

One-step system GMM estimator based on "SYS2"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	1.773	–	–	8.629	–	–	2.098	–	–	8.969	–	–
150	2.525	2.034	2.005	5.761	4.098	3.430	3.579	3.221	3.329	6.519	4.909	4.405
500	2.707	1.985	1.553	3.786	2.637	2.115	4.222	3.976	3.658	5.077	4.363	3.954

Two-step system GMM estimator based on "SYS2"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	1.186	–	–	10.975	–	–	1.121	–	–	11.356	–	–
150	1.977	1.266	1.265	5.839	4.436	4.318	2.282	1.623	1.517	6.281	4.834	4.602
500	2.314	1.596	1.183	3.485	2.398	1.920	3.038	2.841	2.456	4.140	3.447	2.963

Continuous-updating system GMM estimator based on "SYS2"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	1.983	–	–	19.414	–	–	2.412	–	–	20.477	–	–
150	1.609	0.898	0.866	6.228	5.086	5.492	2.421	1.786	1.979	6.700	5.636	6.124
500	2.100	1.201	0.725	3.480	2.332	1.783	3.103	1.917	0.824	4.330	3.183	2.193

One-step system GMM estimator based on "SYS3"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	3.219	2.155	10.814	10.969	7.550	10.814	6.238	6.339	3.965	12.751	9.683	3.965
150	3.999	2.496	1.769	7.374	4.976	3.832	7.327	6.448	5.881	9.900	7.956	6.969
500	4.423	2.765	1.845	5.309	3.387	2.482	7.792	6.777	5.932	8.496	7.111	6.231

Two-step system GMM estimator based on "SYS3"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	3.200	2.615	8.009	11.900	7.741	8.009	5.594	6.051	-1.735	13.000	9.431	1.735
150	4.095	2.845	2.126	7.521	5.054	3.932	6.810	6.530	6.269	9.525	7.892	7.134
500	4.501	2.870	1.972	5.362	3.465	2.565	7.567	6.691	6.061	8.258	7.006	6.302

Continuous-updating system GMM estimator based on "SYS3"

N/T	5	10	15	5	10	15	5	10	15	5	10	15
50	-1.041	0.239	4.154	18.983	10.040	4.154	1.704	1.397	4.499	25.672	17.929	4.499
150	2.504	1.991	1.475	10.026	5.809	4.300	5.807	4.854	4.313	13.304	9.636	8.301
500	4.410	2.770	1.878	5.474	3.443	2.536	7.745	6.558	5.859	8.448	7.060	6.170

Table A.25: Median bias(×100) and MAE(×100) of β ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

	median bias(×100)			MAE(×100)			median bias(×100)			MAE(×100)		
			$\tau^2 = 1$						$\tau^2 = 5$			
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	0.157	0.229	0.118	5.203	3.085	2.368	0.101	0.246	0.107	5.210	3.085	2.353
150	0.043	-0.104	0.177	3.122	1.985	1.482	0.039	-0.108	0.181	3.125	1.984	1.481
500	-0.007	-0.020	0.042	1.520	0.912	0.771	-0.002	-0.019	0.041	1.506	0.910	0.771
	Iterative transformed likelihood estimator											
50	0.330	0.260	0.116	5.246	3.086	2.370	0.443	0.258	0.107	5.289	3.087	2.354
150	0.145	-0.104	0.178	3.164	1.988	1.482	0.151	-0.112	0.181	3.159	1.987	1.481
500	0.063	-0.020	0.042	1.561	0.912	0.771	0.058	-0.019	0.041	1.497	0.909	0.771
	One-step first-difference GMM estimator based on "DIF1"											
50	-3.062	—	—	5.841	—	—	-2.930	—	—	5.874	—	—
150	-1.422	-1.666	—	3.819	2.621	—	-1.364	-1.515	—	3.782	2.576	—
500	-0.490	-0.463	-0.555	1.954	1.221	0.937	-0.484	-0.408	-0.475	1.942	1.189	0.897
	Two-step first-difference GMM estimator based on "DIF1"											
50	-2.813	—	—	7.948	—	—	-2.963	—	—	8.179	—	—
150	-1.369	-1.495	—	4.079	3.762	—	-1.457	-1.236	—	4.199	3.550	—
500	-0.451	-0.496	-0.457	1.999	1.344	1.216	-0.519	-0.479	-0.395	1.926	1.351	1.183
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	-1.580	—	—	10.364	—	—	-1.415	—	—	10.573	—	—
150	-0.296	0.156	—	4.242	5.369	—	-0.273	0.260	—	4.263	5.230	—
500	-0.066	-0.021	0.071	1.940	1.339	1.425	-0.094	-0.011	0.078	1.941	1.335	1.392
	One-step first-difference GMM estimator based on "DIF2"											
50	-2.939	-2.221	—	6.203	4.424	—	-3.399	-2.628	—	6.400	4.721	—
150	-1.259	-1.079	-0.788	3.918	2.674	2.111	-1.434	-1.274	-0.983	3.971	2.691	2.143
500	-0.421	-0.233	-0.223	1.931	1.310	0.984	-0.487	-0.306	-0.302	1.935	1.302	1.039
	Two-step first-difference GMM estimator based on "DIF2"											
50	-2.886	-2.819	—	7.650	9.122	—	-3.371	-2.940	—	7.676	9.509	—
150	-1.230	-1.080	-0.753	4.106	3.092	2.833	-1.478	-1.299	-0.961	4.220	3.264	2.795
500	-0.550	-0.286	-0.323	1.932	1.346	1.116	-0.479	-0.321	-0.386	1.919	1.366	1.127
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	-1.116	-0.706	—	9.095	12.773	—	-1.276	-1.906	—	8.648	12.104	—
150	-0.153	-0.358	0.245	4.192	3.138	3.142	-0.373	-0.275	0.114	4.206	3.205	3.247
500	-0.177	0.032	-0.063	1.934	1.333	1.082	-0.131	0.001	-0.065	1.931	1.342	1.125
	One-step first-difference GMM estimator based on "DIF3"											
50	-19.593	-8.978	-52.469	32.869	22.645	52.469	-12.279	-8.081	34.959	25.895	20.406	34.959
150	-16.329	-5.254	-2.519	29.651	16.828	10.712	-6.933	-4.745	-3.466	19.113	14.416	13.577
500	-10.377	-1.822	-0.721	21.269	9.167	5.025	-1.842	-1.921	-0.791	10.289	8.831	7.894
	Two-step first-difference GMM estimator based on "DIF3"											
50	-17.601	-8.194	5.584	33.757	22.283	5.584	-12.223	-7.697	33.455	25.777	20.843	33.455
150	-17.132	-5.234	-2.158	29.546	16.639	10.615	-6.715	-5.275	-3.394	19.162	14.691	13.380
500	-10.160	-1.704	-0.751	20.267	9.296	4.997	-1.932	-2.083	-0.966	10.436	8.677	7.858
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-16.623	-6.251	-27.511	26.869	17.340	27.511	-11.418	-5.674	-4.958	21.709	15.558	4.958
150	-10.513	-1.720	-0.171	19.199	11.607	9.409	-2.981	-2.217	-0.220	12.995	10.991	10.684
500	-5.757	-0.294	-0.279	13.103	8.671	5.169	-0.062	-0.874	0.178	8.703	7.846	8.369
	One-step system GMM estimator based on "SYS1"											
50	1.968	—	—	5.786	—	—	2.060	—	—	5.927	—	—
150	2.637	1.923	—	3.928	2.636	—	3.463	2.991	—	4.511	3.280	—
500	2.663	1.932	1.417	2.788	1.976	1.489	4.036	3.728	3.420	4.037	3.728	3.420
	Two-step system GMM estimator based on "SYS1"											
50	1.463	—	—	7.764	—	—	1.066	—	—	7.968	—	—
150	2.107	1.644	—	3.993	4.046	—	2.239	2.004	—	4.226	4.307	—
500	2.475	1.686	1.308	2.591	1.771	1.562	3.131	3.159	2.772	3.191	3.159	2.779
	Continuous-updating system GMM estimator based on "SYS1"											
50	2.008	—	—	11.458	—	—	2.324	—	—	12.750	—	—
150	1.890	1.376	—	4.374	6.137	—	2.620	2.187	—	4.505	6.264	—
500	2.375	1.190	0.793	2.631	1.752	1.619	3.321	1.749	0.849	3.515	2.286	1.755
	One-step system GMM estimator based on "SYS2"											
50	1.766	—	—	5.821	—	—	2.145	—	—	6.054	—	—
150	2.598	2.013	1.978	4.026	2.841	2.406	3.743	3.276	3.229	4.692	3.593	3.349
500	2.755	1.996	1.572	2.870	2.039	1.648	4.285	3.963	3.723	4.290	3.963	3.723
	Two-step system GMM estimator based on "SYS2"											
50	0.997	—	—	7.347	—	—	0.819	—	—	7.832	—	—
150	2.031	1.308	1.288	4.088	2.957	2.921	2.241	1.682	1.481	4.267	3.260	3.017
500	2.351	1.606	1.170	2.514	1.743	1.377	3.037	2.864	2.371	3.192	2.870	2.375
	Continuous-updating system GMM estimator based on "SYS2"											
50	1.524	—	—	9.211	—	—	2.309	—	—	10.035	—	—
150	1.688	1.023	0.874	4.559	3.498	3.654	2.588	1.787	2.045	4.805	3.892	4.197
500	2.246	1.289	0.709	2.518	1.659	1.198	3.238	1.976	0.706	3.364	2.318	1.350
	One-step system GMM estimator based on "SYS3"											
50	3.635	2.379	10.814	7.392	4.796	10.814	6.250	6.159	3.965	8.682	6.788	3.965
150	4.202	2.615	1.916	5.255	3.506	2.768	7.124	6.485	5.968	7.245	6.544	5.990
500	4.505	2.750	1.897	4.527	2.781	1.955	7.909	6.782	5.938	7.909	6.782	5.938
	Two-step system GMM estimator based on "SYS3"											
50	3.534	2.903	8.009	7.703	4.874	8.009	5.602	6.018	-1.735	8.414	6.574	1.735
150	4.283	2.989	2.274	5.253	3.561	2.828	6.604	6.585	6.176	7.024	6.595	6.176
500	4.559	2.908	2.011	4.593	2.927	2.043	7.700	6.643	6.083	7.700	6.643	6.083
	Continuous-updating system GMM estimator based on "SYS3"											
50	1.198	1.583	4.154	8.823	5.272	4.154	5.197	4.491	4.499	10.219	7.060	4.499
150	4.037	2.606	1.931	5.686	3.761	2.924	6.620	6.137	5.541	7.303	6.656	5.871
500	4.553	2.829	1.946	4.632	2.853	1.991	7.858	6.583	5.904	7.858	6.596	5.907

Table A.26: Size(%) and power(%) of β ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

N/T	size ($H_0 : \beta = 0.56$)			power ($H_1 : \beta = 0.46$)			size ($H_0 : \beta = 0.56$)			power ($H_1 : \beta = 0.46$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	5.3	6.6	6.0	27.5	57.2	80.5	5.2	6.6	5.9	27.5	57.3	80.5
150	5.3	6.3	5.5	57.6	94.6	99.8	5.4	6.3	5.5	57.6	94.6	99.8
500	4.9	4.6	4.9	98.4	100.0	100.0	4.9	4.6	4.9	98.4	100.0	100.0
Iterative transformed likelihood estimator												
50	6.0	6.6	5.9	27.0	58.2	80.7	5.9	6.6	5.8	27.0	58.3	80.6
150	5.7	6.3	5.5	56.3	94.7	99.8	5.6	6.3	5.5	55.4	94.7	99.8
500	4.7	4.6	4.9	95.8	100.0	100.0	5.0	4.5	4.9	96.8	100.0	100.0
One-step first-difference GMM estimator based on "DIF1"												
50	8.2	–	–	37.9	–	–	7.8	–	–	37.2	–	–
150	6.5	9.9	–	58.8	92.6	–	6.3	9.7	–	59.5	91.9	–
500	5.2	6.0	6.7	96.3	100.0	100.0	5.5	6.3	6.4	96.6	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1"												
50	38.5	–	–	60.3	–	–	39.1	–	–	60.1	–	–
150	13.9	55.9	–	65.8	94.4	–	13.2	53.7	–	66.5	93.3	–
500	6.7	15.0	32.0	96.1	100.0	100.0	6.9	15.0	31.5	96.5	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	5.8	–	–	18.2	–	–	5.4	–	–	17.1	–	–
150	6.2	0.3	–	50.3	23.8	–	6.0	0.4	–	51.6	23.6	–
500	4.7	5.8	4.1	95.3	100.0	100.0	5.0	6.2	3.7	95.6	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	49.2	–	–	60.4	–	–	49.8	–	–	60.1	–	–
150	14.6	65.5	–	57.0	83.5	–	14.5	65.7	–	57.0	83.1	–
500	6.3	15.3	38.6	95.0	100.0	100.0	6.2	15.4	38.1	95.1	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors												
50	9.9	–	–	17.6	–	–	10.2	–	–	17.5	–	–
150	3.5	7.2	–	31.0	27.8	–	3.8	16.1	–	32.0	34.3	–
500	3.9	4.4	5.0	92.5	99.6	99.5	3.9	6.0	12.3	91.9	98.1	87.7
One-step first-difference GMM estimator based on "DIF2"												
50	9.2	8.7	–	35.2	54.9	–	9.4	9.1	–	36.3	57.0	–
150	6.3	7.7	6.4	53.9	83.8	95.1	5.6	8.0	7.0	53.9	84.5	95.5
500	5.4	4.7	4.6	94.8	100.0	100.0	6.0	4.5	5.6	94.6	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2"												
50	27.7	78.9	–	53.7	87.8	–	28.7	79.8	–	56.3	87.2	–
150	11.1	22.1	34.9	60.5	88.6	96.1	10.6	22.7	35.3	60.8	88.2	96.1
500	6.7	7.9	9.7	95.3	100.0	100.0	6.9	8.3	10.1	95.3	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	7.1	1.0	–	23.4	1.6	–	7.5	0.9	–	25.0	1.7	–
150	5.8	6.7	3.8	48.3	72.2	70.4	5.6	6.0	4.1	49.9	72.4	69.8
500	5.4	4.6	4.9	94.4	99.9	100.0	5.6	5.4	4.9	94.3	99.9	100.0
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	35.5	83.0	–	50.4	86.2	–	34.7	83.0	–	50.1	87.2	–
150	10.8	24.6	39.7	52.9	81.1	90.0	10.6	24.9	39.5	53.1	80.1	89.0
500	5.9	7.0	9.3	93.9	100.0	100.0	6.0	8.4	9.8	94.0	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors												
50	7.5	24.8	–	17.7	33.9	–	8.5	27.3	–	17.3	35.3	–
150	2.7	5.1	5.1	30.9	53.8	55.5	2.6	4.9	5.2	31.2	53.5	52.7
500	4.1	4.3	4.5	91.5	99.8	100.0	4.7	4.3	4.4	91.1	99.7	100.0
One-step first-difference GMM estimator based on "DIF3"												
50	1.6	1.5	0.0	4.9	5.2	0.0	2.4	1.3	0.0	6.6	5.1	0.0
150	2.4	1.6	1.0	7.2	5.5	8.7	2.9	1.2	2.3	8.9	8.2	7.3
500	3.8	2.3	1.9	9.8	13.9	28.5	3.5	2.6	2.6	16.9	16.9	14.6
Two-step first-difference GMM estimator based on "DIF3"												
50	6.1	6.3	0.0	11.2	12.2	0.0	6.3	5.5	0.0	11.6	11.9	0.0
150	5.2	5.0	3.9	12.2	10.1	12.7	5.8	3.6	4.5	12.8	12.9	11.8
500	5.8	3.4	2.9	11.7	14.3	28.0	5.1	3.6	3.1	16.7	17.5	16.2
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	6.8	6.0	0.0	9.1	8.9	0.0	8.1	8.5	0.0	10.4	12.0	0.0
150	6.5	7.1	6.3	11.3	9.9	11.9	7.8	7.9	9.3	13.0	13.9	13.6
500	9.9	6.7	3.7	13.1	16.2	28.2	7.1	6.4	6.4	18.2	19.7	17.1
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	7.6	7.3	0.0	11.5	13.8	0.0	8.3	8.3	0.0	13.8	14.5	0.0
150	7.9	6.9	5.1	13.7	12.8	12.9	6.6	6.6	6.7	13.4	15.2	14.5
500	8.2	5.1	2.5	14.6	15.8	27.2	4.7	4.3	4.5	16.5	18.1	17.8
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors												
50	9.0	7.1	0.0	13.6	12.0	100.0	8.3	7.1	0.0	12.1	13.3	0.0
150	8.2	4.9	3.0	12.5	9.7	10.9	4.1	4.3	5.6	8.2	12.9	13.6
500	6.8	3.3	1.5	11.0	13.8	24.6	3.0	3.5	4.1	13.2	15.1	15.7

Table A.26(cont.)

N/T	size ($H_0 : \beta = 0.56$)			power ($H_1 : \beta = 0.46$)			size ($H_0 : \beta = 0.56$)			power ($H_1 : \beta = 0.46$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
	5	10	15	5	10	15	5	10	15	5	10	15
One-step system GMM estimator based on "SYS1"												
50	5.7	—	—	17.8	—	—	6.2	—	—	17.1	—	—
150	9.7	10.8	—	34.1	70.7	—	11.4	17.0	—	26.2	56.1	—
500	17.4	18.4	18.2	82.4	99.6	100.0	30.1	57.2	71.3	59.3	94.7	99.8
Two-step system GMM estimator based on "SYS1"												
50	53.0	—	—	63.0	—	—	53.7	—	—	62.4	—	—
150	21.4	71.5	—	52.5	88.8	—	21.9	72.7	—	49.0	87.3	—
500	20.1	34.5	51.2	90.1	100.0	100.0	27.6	59.6	77.5	79.7	99.1	99.9
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	1.4	—	—	3.7	—	—	1.3	—	—	2.6	—	—
150	6.5	0.1	—	29.9	1.2	—	7.5	0.2	—	23.8	1.0	—
500	14.6	15.1	4.0	86.0	99.3	99.1	20.4	29.0	13.6	71.4	88.3	86.4
Continuous-updating system GMM estimator based on "SYS1"												
50	66.4	—	—	69.0	—	—	69.5	—	—	70.1	—	—
150	24.4	80.4	—	54.9	85.8	—	26.4	82.0	—	49.4	85.8	—
500	20.4	34.0	53.2	89.9	100.0	99.9	32.1	44.9	58.3	76.1	98.9	99.8
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	13.7	—	—	19.1	—	—	19.0	—	—	20.1	—	—
150	5.8	16.0	—	23.2	33.2	—	7.5	35.3	—	17.4	42.9	—
500	13.9	12.4	8.3	81.7	96.7	97.3	23.2	25.7	24.4	64.8	87.6	79.2
One-step system GMM estimator based on "SYS2"												
50	6.4	—	—	17.3	—	—	7.2	—	—	16.1	—	—
150	9.3	10.6	12.8	31.2	64.2	82.8	11.7	17.4	23.4	23.1	47.5	67.6
500	18.2	19.0	18.1	77.9	99.3	100.0	32.1	56.2	69.2	53.5	89.9	98.9
Two-step system GMM estimator based on "SYS2"												
50	41.0	—	—	54.2	—	—	42.5	—	—	53.4	—	—
150	17.9	31.8	53.3	49.5	84.2	93.1	19.1	34.4	54.7	45.5	81.9	91.1
500	17.6	22.6	24.8	88.1	99.6	100.0	24.8	44.1	50.7	75.5	98.0	100.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	3.0	—	—	6.6	—	—	2.6	—	—	5.6	—	—
150	6.9	5.0	1.0	30.9	45.4	23.9	7.8	5.1	1.5	24.5	35.0	13.6
500	12.9	12.1	10.7	84.7	99.2	100.0	19.6	26.8	27.0	68.3	93.2	99.3
Continuous-updating system GMM estimator based on "SYS2"												
50	50.7	—	—	59.9	—	—	53.3	—	—	59.8	—	—
150	19.9	38.3	61.0	50.6	83.3	89.7	21.5	43.4	66.0	45.4	75.8	85.3
500	17.0	19.7	20.7	88.7	99.5	100.0	28.0	34.6	27.2	72.6	97.9	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	9.1	—	—	14.2	—	—	9.9	—	—	14.4	—	—
150	5.8	7.6	8.0	25.2	42.4	44.5	7.2	8.0	11.4	17.8	31.6	36.3
500	11.1	9.5	6.7	80.6	98.4	99.9	19.7	21.0	10.7	61.6	91.9	99.2
One-step system GMM estimator based on "SYS3"												
50	5.9	6.4	0.0	8.8	14.9	0.0	7.7	13.5	0.0	6.8	7.1	0.0
150	10.4	10.9	9.2	14.0	40.7	69.8	16.2	31.6	38.2	7.1	12.7	14.1
500	32.3	28.4	23.0	45.0	95.8	100.0	61.6	86.0	83.9	10.4	29.1	55.9
Two-step system GMM estimator based on "SYS3"												
50	12.7	11.4	0.0	16.2	24.3	0.0	14.3	20.6	0.0	13.7	13.8	0.0
150	12.6	13.7	11.4	17.5	43.9	71.4	19.0	36.1	46.3	9.9	16.4	20.1
500	35.5	31.2	25.8	45.8	96.0	100.0	61.9	88.7	91.1	10.5	34.1	60.5
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	6.6	6.5	0.0	8.0	13.5	0.0	7.1	10.9	0.0	6.3	7.1	0.0
150	9.9	12.1	9.2	13.6	37.0	62.6	16.3	31.4	39.3	8.1	12.5	13.5
500	33.1	29.8	25.0	44.2	95.7	100.0	61.3	87.0	88.3	10.3	32.7	57.9
Continuous-updating system GMM estimator based on "SYS3"												
50	17.9	13.8	0.0	22.6	30.4	0.0	19.7	20.8	0.0	18.2	19.8	0.0
150	14.9	15.6	12.4	21.3	47.5	75.5	21.6	36.3	41.8	12.1	20.3	26.6
500	35.5	31.1	24.9	45.4	96.3	100.0	63.7	87.1	88.1	10.1	34.5	62.9
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	7.7	7.3	0.0	10.3	17.7	0.0	8.3	11.0	0.0	6.8	8.8	0.0
150	9.9	11.7	9.1	14.3	38.7	64.8	16.3	30.2	36.7	7.1	13.7	17.3
500	31.4	28.3	23.3	42.4	95.5	99.4	61.2	85.0	86.5	9.3	32.4	60.8

Table A.27: Mean bias(×100) and RMSE(×100) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

	bias(×100)			RMSE(×100)			bias(×100)			RMSE(×100)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	13302	2951	630	27881	12526	5757	13297	2796	633	27928	12182	5761
150	6564	61	13	19307	273	103	6516	59	13	19243	254	102
500	384	8	0	4027	78	47	321	8	0	3364	77	47
Iterative transformed likelihood estimator												
50	-511	236	-11	5751	5619	1162	-320	109	51	16837	3280	1346
150	50	55	13	22125	221	102	-66	54	13	4798	220	102
500	1623	8	0	56014	78	47	292	9	0	3476	78	47
One-step first-difference GMM estimator based on "DIF1"												
50	-327	—	—	1820.3	—	—	-189.9	—	—	1956.7	—	—
150	-117.3	-164.3	—	2241.2	204.2	—	-123.6	-170	—	2444	208.3	—
500	-1.1	-59.6	-71.2	385.9	110.2	93.2	-11.3	-62.2	-71.9	420	113.7	92.9
Two-step first-difference GMM estimator based on "DIF1"												
50	-247	—	—	1973	—	—	-336	—	—	2583	—	—
150	-161	-738	—	14434	24604	—	-114	-101	—	2797	2886	—
500	6	-51	-62	379	123	108	7	-54	-63	479	127	107
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	—	—	—	—	—	—	—	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	—	—	—
500	—	37.5358	23.8486	—	181.909	153.2613	—	41.8167	22.4484	—	196.5216	148.7605
One-step first-difference GMM estimator based on "DIF2"												
50	-300	-160	—	4270	820	—	360	-110	—	22950	1930	—
150	-260	-50	-90	7730	570	160	4080	-80	-100	126640	310	170
500	40	-20	-30	600	120	90	10	-20	-30	1430	130	90
Two-step first-difference GMM estimator based on "DIF2"												
50	-100	-390	—	2720	4250	—	-630	5980	—	7160	197410	—
150	-480	-220	-20	8440	7740	740	-70	-30	-50	3850	940	820
500	360	-10	-30	10430	130	90	30	-20	-30	490	140	100
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	—	—	—	—	—	—	—	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	—	—	—
500	—	38.1924	13.5476	—	167.0672	108.7835	—	47.7293	14.8715	—	199.3623	120.7337
One-step first-difference GMM estimator based on "DIF3"												
50	-570	160	-560	3140	27710	560	-1480	-1900	-790	21090	53710	790
150	-640	-120	-980	3970	6120	28830	-570	-360	-19750	6790	3950	513750
500	-810	-250	-2280	9820	11710	55610	-290	10	-270	3150	20330	11160
Two-step first-difference GMM estimator based on "DIF3"												
50	-1430	-950	-2030	37360	9750	2030	-640	-1100	-790	3340	18870	790
150	570	-180	-850	25960	17780	26350	-9110	-580	40	274650	4630	17730
500	-670	-2940	-110	7630	82530	9830	-640	570	-480	12400	47450	7210
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	—	—	-453.4652	—	—	453.4652	—	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	—	—	—
500	—	—	—	—	—	—	—	—	—	—	—	—
One-step system GMM estimator based on "SYS1"												
50	1310	—	—	16620	—	—	-7160	—	—	457880	—	—
150	2200	490	—	41860	610	—	5210	6110	—	67520	22210	—
500	620	290	200	760	330	220	4930	2910	2440	6370	3060	2530
Two-step system GMM estimator based on "SYS1"												
50	9430	—	—	259990	—	—	21010	—	—	684180	—	—
150	760	570	—	7280	1610	—	0	5710	—	183810	13280	—
500	700	340	220	860	380	250	1700	3020	2470	126400	3170	2580
Continuous-updating system GMM estimator based on "SYS1"												
50	—	—	—	—	—	—	—	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	—	—	—
500	—	225.5802	113.6776	—	354.4067	235.5096	—	—	—	—	—	—
One-step system GMM estimator based on "SYS2"												
50	-5470	—	—	155300	—	—	9620	—	—	358850	—	—
150	930	640	500	4660	1030	570	3910	6120	4920	53300	19100	8540
500	640	340	260	800	380	290	4960	3090	2770	6330	3280	2880
Two-step system GMM estimator based on "SYS2"												
50	930	—	—	10830	—	—	3920	—	—	114190	—	—
150	1410	690	510	47280	1330	2550	14200	4320	5670	260570	23400	15000
500	690	360	260	910	410	300	6100	3150	2650	18650	3380	2810
Continuous-updating system GMM estimator based on "SYS2"												
50	—	—	—	—	—	—	—	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	—	—	—
500	—	209.2	89.5	—	346.9	181.1	—	—	369.8	—	—	1059.7
One-step system GMM estimator based on "SYS3"												
50	1140	450	-1600	11100	7160	1600	-1290	6490	-4150	92790	308340	4150
150	1260	390	200	21360	770	330	4430	2130	1350	39420	4790	1630
500	660	290	170	820	340	210	3680	1840	1180	4030	1940	1250
Two-step system GMM estimator based on "SYS3"												
50	440	840	-1160	13080	10080	1160	1840	6340	-1950	131300	115790	1950
150	-60	-400	260	21890	28590	1170	5420	1880	3200	40770	14770	40940
500	670	320	180	790	370	220	3770	1910	1260	5220	2000	1320
Continuous-updating system GMM estimator based on "SYS3"												
50	—	—	—	—	—	—	—	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	—	—	—
500	665.3	300.5	171.3	827.7	357	216.7	—	1745.8	1133.7	—	1857.7	1205.4

Table A.28: Median bias($\times100$) and MAE($\times100$) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

N/T	median bias($\times100$) $\tau^2=1$			MAE($\times100$) $\tau^2=1$			median bias($\times100$) $\tau^2=5$			MAE($\times100$) $\tau^2=5$		
	5	10	15	5	10	15	5	10	15	5	10	15
	Transformed likelihood estimator											
50	-12.2	-6.3	7.4	313.7	160.0	98.2	-9.9	-5.5	6.3	311.8	159.9	99.1
150	-11.0	2.8	-3.3	222.7	97.1	54.4	-9.4	1.3	-2.7	222.1	96.9	55.1
500	3.5	0.1	-1.6	121.6	50.1	29.0	2.4	0.4	-2.0	120.5	49.9	29.2
	Iterative transformed likelihood estimator											
50	-191.9	-22.3	5.0	306.3	159.1	98.0	-189.2	-22.1	5.2	303.8	158.9	99.2
150	-70.5	2.4	-3.3	225.7	97.2	54.3	-66.9	1.8	-2.8	232.1	96.3	55.0
500	4.3	0.5	-1.6	129.1	50.2	28.9	6.6	1.1	-2.0	122.9	50.2	29.1
	One-step first-difference GMM estimator based on "DIF1"											
50	-325.2	–	–	341.7	–	–	-339.9	–	–	353.8	–	–
150	-201.8	-190.6	–	246.5	193.1	–	-211.9	-194.0	–	259.9	196.5	–
500	-91.0	-76.3	-76.4	150.6	89.3	78.4	-97.7	-77.9	-77.3	154.7	93.7	79.2
	Two-step first-difference GMM estimator based on "DIF1"											
50	-346.4	–	–	366.0	–	–	-358.7	–	–	382.0	–	–
150	-206.2	-188.5	–	256.5	216.8	–	-216.7	-190.6	–	264.9	222.8	–
500	-84.6	-70.2	-78.2	152.7	97.3	88.7	-98.3	-73.5	-75.5	160.0	95.4	87.1
	Continuous-updating first-difference GMM estimator based on "DIF1"											
50	-77.9	–	–	456.1	–	–	-126.9	–	–	451.7	–	–
150	19.2	0.5	–	297.5	289.3	–	44.4	-2.3	–	308.1	288.3	–
500	-18.1	-0.6	-10.1	145.3	83.8	79.0	-24.8	0.2	-9.6	152.9	87.3	79.7
	One-step first-difference GMM estimator based on "DIF2"											
50	-304.7	-238.9	–	338.4	254.5	–	-332.2	-261.3	–	352.3	269.9	–
150	-186.2	-129.7	-114.8	249.6	167.8	131.7	-209.9	-148.5	-124.1	271.9	180.7	138.8
500	-74.5	-40.9	-42.4	147.8	86.1	62.3	-92.6	-48.8	-48.2	155.8	94.9	69.6
	Two-step first-difference GMM estimator based on "DIF2"											
50	-334.9	-298.5	–	368.4	351.0	–	-363.7	-321.9	–	388.4	372.5	–
150	-187.1	-124.0	-109.3	261.2	174.3	152.1	-213.2	-141.5	-126.2	271.4	192.2	166.0
500	-74.7	-41.8	-37.5	150.2	85.9	65.9	-87.7	-44.6	-46.6	161.5	95.9	71.8
	Continuous-updating first-difference GMM estimator based on "DIF2"											
50	-51.4	-118.4	–	450.8	423.9	–	-79.3	-178.9	–	450.2	429.8	–
150	11.8	-6.6	0.0	286.4	198.4	166.1	33.8	-6.9	-12.1	312.5	211.3	167.8
500	-15.7	2.9	-1.3	148.2	87.9	61.5	-20.5	8.4	-5.5	156.8	94.0	66.5
	One-step first-difference GMM estimator based on "DIF3"											
50	-539.2	-505.2	-555.2	554.3	541.0	555.2	-519.3	-489.9	-788.8	535.5	515.8	788.8
150	-533.1	-447.5	-342.1	548.7	497.8	412.9	-469.4	-426.4	-420.6	499.6	473.2	461.6
500	-485.8	-300.2	-115.4	510.7	380.0	266.7	-347.5	-308.1	-279.6	426.3	391.1	377.2
	Two-step first-difference GMM estimator based on "DIF3"											
50	-548.1	-507.5	-2033.3	555.3	544.8	2033.3	-523.8	-499.7	-788.7	539.7	526.5	788.7
150	-533.3	-446.4	-331.7	548.9	504.2	421.6	-474.6	-429.3	-411.0	499.0	474.1	460.9
500	-487.4	-300.9	-114.9	511.9	387.0	265.1	-350.0	-307.8	-273.9	427.1	392.4	374.7
	Continuous-updating first-difference GMM estimator based on "DIF3"											
50	-392.5	-238.2	-453.5	618.4	617.2	453.5	-318.4	-223.9	–	608.8	601.0	–
150	-337.3	-52.0	-21.7	609.1	572.6	478.8	-43.1	-98.0	-0.9	564.7	534.6	524.3
500	-211.8	7.0	-24.8	564.9	434.8	272.5	-4.7	-39.3	-5.2	459.3	422.2	426.2
	One-step system GMM estimator based on "SYS1"											
50	655.5	–	–	725.0	–	–	4674.7	–	–	5985.8	–	–
150	639.5	420.9	–	649.0	420.9	–	4660.9	4154.0	–	5159.6	4175.6	–
500	528.7	269.6	188.2	528.7	269.6	188.2	4169.4	2763.8	2351.0	4170.2	2763.8	2351.0
	Two-step system GMM estimator based on "SYS1"											
50	670.4	–	–	871.5	–	–	4278.3	–	–	5983.5	–	–
150	731.6	479.6	–	770.5	483.7	–	5252.8	4222.7	–	5898.9	4318.4	–
500	623.1	323.0	207.4	623.1	323.0	207.4	4804.3	2897.3	2371.9	4825.8	2897.3	2371.9
	Continuous-updating system GMM estimator based on "SYS1"											
50	684.8	–	–	732.4	–	–	4893.9	–	–	4966.6	–	–
150	752.4	325.4	–	752.4	358.4	–	4939.5	3142.3	–	4939.5	3160.9	–
500	552.5	173.2	53.9	552.5	179.7	92.9	3992.9	373.3	46.1	3992.9	373.3	87.7
	One-step system GMM estimator based on "SYS2"											
50	679.6	–	–	781.2	–	–	4634.4	–	–	6124.6	–	–
150	665.6	520.8	448.4	685.2	520.8	448.4	4727.2	4429.9	4249.7	5246.2	4479.1	4253.1
500	534.5	313.1	244.5	534.5	313.1	244.5	4167.1	2904.9	2624.7	4177.6	2904.9	2624.7
	Two-step system GMM estimator based on "SYS2"											
50	635.1	–	–	898.2	–	–	3883.1	–	–	5996.5	–	–
150	723.0	544.6	478.2	771.8	545.2	478.9	5211.8	4381.1	4211.1	5927.9	4540.3	4255.5
500	598.2	333.0	248.7	598.2	333.0	248.7	4629.5	2935.1	2483.7	4661.4	2935.1	2483.7
	Continuous-updating system GMM estimator based on "SYS2"											
50	816.2	–	–	840.3	–	–	5779.8	–	–	5779.8	–	–
150	718.3	291.5	229.3	718.3	304.7	264.3	4851.4	2549.9	2355.8	4851.4	2549.9	2355.8
500	505.1	155.6	50.3	505.1	161.9	77.5	3692.3	1225.7	37.3	3692.3	1225.7	80.8
	One-step system GMM estimator based on "SYS3"											
50	436.7	266.1	-1603.6	600.1	337.6	1603.6	3022.2	1969.7	-4152.3	3857.5	2342.3	4152.3
150	588.5	308.2	175.8	623.7	314.1	192.2	3617.7	1998.6	1270.3	3802.9	2013.9	1276.0
500	583.4	275.6	156.1	583.4	275.6	156.1	3393.9	1789.2	1162.0	3393.9	1789.2	1162.0
	Two-step system GMM estimator based on "SYS3"											
50	453.4	370.1	-1162.8	724.9	442.0	1162.8	3134.1	2418.6	-1951.0	4147.6	2960.7	1951.0
150	652.8	353.5	219.4	698.2	355.2	227.1	3784.9	2194.6	1561.0	4070.3	2223.8	1587.1
500	601.7	297.0	173.1	601.7	297.0	173.1	3397.6	1872.5	1248.5	3397.6	1872.5	1248.5
	Continuous-updating system GMM estimator based on "SYS3"											
50	606.7	329.9	–	611.5	425.2	–	3893.0	2104.7	–	3893.0	2104.7	–
150	656.1	316.2	173.8	656.1	337.4	212.8	3642.5	1867.0	1151.0	3642.5	1867.0	1151.0
500	584.2	281.9	162.4	584.2	282.0	162.5	3230.6	1716.1	1134.9	3230.6	1716.1	1134.9

Table A.29: Size(%) and power(%) of $\psi = \beta/(1-\gamma)$ ($\gamma = 0.9, \beta = 0.56, \psi = 5.6$) for ARX(1) model

	size ($H_0 : \psi = 5.6$)			power ($H_1 : \psi = 2.3$)			size ($H_0 : \psi = 5.6$)			power ($H_1 : \psi = 2.3$)		
	$\tau^2 = 1$						$\tau^2 = 5$					
N/T	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
50	19.2	12.7	8.1	100.0	100.0	100.0	19.0	12.7	8.2	100.0	100.0	100.0
150	15.6	8.8	6.6	100.0	100.0	100.0	15.4	8.8	6.6	100.0	100.0	100.0
500	9.7	5.9	6.4	100.0	100.0	100.0	9.5	5.9	6.2	100.0	100.0	100.0
Iterative transformed likelihood estimator												
50	25.0	13.0	8.1	100.0	100.0	100.0	25.2	13.1	8.2	100.0	100.0	100.0
150	15.5	8.8	6.6	100.0	100.0	100.0	16.2	8.8	6.6	100.0	100.0	100.0
500	9.4	5.8	6.4	100.0	100.0	100.0	9.1	5.8	6.2	100.0	100.0	100.0
One-step first-difference GMM estimator based on "DIF1"												
50	57.8	–	–	100.0	–	–	60.1	–	–	100.0	–	–
150	34.8	51.8	–	100.0	100.0	–	36.9	53.2	–	100.0	100.0	–
500	18.2	22.5	30.1	100.0	100.0	100.0	20.8	23.7	30.0	100.0	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1"												
50	63.0	–	–	100.0	–	–	65.8	–	–	100.0	–	–
150	38.9	64.4	–	100.0	100.0	–	39.4	64.9	–	100.0	100.0	–
500	20.5	28.8	51.4	100.0	100.0	100.0	22.5	29.3	50.2	100.0	100.0	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	44.7	–	–	100.0	–	–	46.9	–	–	100.0	–	–
150	31.6	22.5	–	100.0	100.0	–	33.1	23.8	–	100.0	100.0	–
500	18.3	17.8	18.9	100.0	100.0	100.0	19.8	18.4	19.5	100.0	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1"												
50	39.6	–	–	70.6	–	–	41.9	–	–	71.6	–	–
150	21.0	38.7	–	84.9	87.3	–	21.6	39.2	–	82.1	87.3	–
500	10.9	12.1	38.1	99.5	100.0	100.0	12.5	12.4	36.3	99.1	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors												
50	29.1	–	–	70.6	–	–	30.8	–	–	71.6	–	–
150	15.3	18.4	–	84.9	87.3	–	15.6	22.6	–	82.1	87.3	–
500	7.9	5.7	7.4	99.5	100.0	100.0	10.1	6.9	14.5	99.1	100.0	100.0
One-step first-difference GMM estimator based on "DIF2"												
50	48.4	47.8	–	100.0	100.0	–	51.8	53.3	–	100.0	100.0	–
150	30.0	27.7	27.5	100.0	100.0	100.0	33.7	32.1	30.9	100.0	100.0	100.0
500	16.6	12.5	11.3	100.0	100.0	100.0	18.9	14.1	13.7	100.0	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2"												
50	55.7	70.7	–	100.0	100.0	–	59.7	71.7	–	100.0	100.0	–
150	34.2	36.6	43.6	100.0	100.0	100.0	34.6	41.2	45.3	100.0	100.0	100.0
500	18.1	14.5	15.8	100.0	100.0	100.0	20.2	16.4	17.9	100.0	100.0	100.0
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	42.6	10.2	–	100.0	100.0	–	47.6	10.9	–	100.0	100.0	–
150	27.9	25.5	20.0	100.0	100.0	100.0	30.2	28.1	21.3	100.0	100.0	100.0
500	16.6	11.6	9.9	100.0	100.0	100.0	18.8	13.2	12.6	100.0	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2"												
50	35.3	50.0	–	70.5	77.3	–	35.9	53.0	–	70.6	79.8	–
150	18.9	22.1	24.7	85.6	97.3	98.8	19.7	22.6	24.1	82.9	96.0	97.6
500	11.4	7.5	7.9	99.6	100.0	100.0	12.6	7.8	8.4	99.1	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors												
50	25.6	32.1	–	70.5	77.3	–	28.0	35.7	–	70.6	79.8	–
150	14.7	11.1	10.2	85.6	97.3	98.8	14.5	11.6	11.7	82.9	96.0	97.6
500	9.7	5.2	5.1	99.6	100.0	100.0	11.4	5.9	5.4	99.1	100.0	100.0
One-step first-difference GMM estimator based on "DIF3"												
50	56.6	47.3	100.0	100.0	100.0	100.0	52.6	48.1	100.0	100.0	100.0	100.0
150	54.7	38.3	27.3	100.0	100.0	100.0	45.4	36.0	36.2	100.0	100.0	100.0
500	48.4	27.6	15.0	100.0	100.0	100.0	31.0	26.9	23.2	100.0	100.0	100.0
Two-step first-difference GMM estimator based on "DIF3"												
50	57.2	47.2	0.0	100.0	100.0	100.0	54.7	48.1	100.0	100.0	100.0	100.0
150	55.1	38.0	27.2	100.0	100.0	100.0	45.0	36.5	33.7	100.0	100.0	100.0
500	46.4	27.3	15.2	100.0	100.0	100.0	31.8	27.0	22.5	100.0	100.0	100.0
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	56.9	48.0	0.0	100.0	100.0	100.0	54.5	48.7	100.0	100.0	100.0	100.0
150	57.4	40.2	29.8	100.0	100.0	100.0	48.0	39.6	38.0	100.0	100.0	100.0
500	49.8	29.4	15.4	100.0	100.0	100.0	33.1	28.4	24.2	100.0	100.0	100.0
Continuous-updating first-difference GMM estimator based on "DIF3"												
50	46.1	40.9	0.0	65.7	65.2	100.0	42.5	41.4	0.0	64.5	63.8	0.0
150	45.6	30.5	23.6	62.9	64.4	73.5	33.0	30.4	30.5	63.7	66.9	64.6
500	36.5	23.5	13.2	63.9	75.6	90.0	23.7	23.7	21.8	72.3	74.5	73.8
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors												
50	44.7	40.2	100.0	65.7	65.2	100.0	40.4	39.8	0.0	64.5	63.8	0.0
150	43.7	29.7	21.7	62.9	64.4	73.5	31.7	28.9	29.8	63.7	66.9	64.6
500	34.7	21.8	12.6	63.9	75.6	90.0	22.0	21.6	20.6	72.3	74.5	73.8

N/T	size ($H_0 : \psi = 5.6$) $\tau^2 = 1$			power ($H_1 : \psi = 2.3$) $\tau^2 = 1$			size ($H_0 : \psi = 5.6$) $\tau^2 = 5$			power ($H_1 : \psi = 2.3$) $\tau^2 = 5$		
	5	10	15	5	10	15	5	10	15	5	10	15
Transformed likelihood estimator												
One-step system GMM estimator based on "SYS1"												
50	0.5	—	—	100.0	—	—	9.9	—	—	100.0	—	—
150	0.6	16.2	—	100.0	100.0	—	21.9	66.8	—	100.0	100.0	—
500	14.6	48.2	52.2	100.0	100.0	100.0	75.0	99.4	100.0	100.0	100.0	100.0
Two-step system GMM estimator based on "SYS1"												
50	60.5	—	—	100.0	—	—	70.7	—	—	100.0	—	—
150	38.7	95.4	—	100.0	100.0	—	61.5	97.4	—	100.0	100.0	—
500	76.5	89.6	91.5	100.0	100.0	100.0	89.7	100.0	100.0	100.0	100.0	100.0
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors												
50	1.1	—	—	100.0	—	—	1.6	—	—	100.0	—	—
150	4.1	0.3	—	100.0	100.0	—	13.7	0.9	—	100.0	100.0	—
500	30.9	23.1	1.4	100.0	100.0	100.0	61.9	43.4	11.7	100.0	100.0	100.0
Continuous-updating system GMM estimator based on "SYS1"												
50	55.9	—	—	82.8	—	—	62.8	—	—	77.9	—	—
150	43.8	84.2	—	89.1	94.3	—	62.7	83.4	—	83.9	88.3	—
500	71.1	68.9	70.6	99.8	100.0	100.0	87.1	85.2	84.5	97.8	99.9	99.9
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors												
50	16.6	—	—	82.9	—	—	21.4	—	—	77.9	—	—
150	12.5	25.6	—	89.1	94.3	—	16.2	36.1	—	83.9	88.3	—
500	20.6	20.0	13.6	99.8	100.0	100.0	51.7	33.2	22.3	97.8	99.9	99.9
One-step system GMM estimator based on "SYS2"												
50	0.3	—	—	100.0	—	—	9.6	—	—	100.0	—	—
150	0.6	14.7	47.9	100.0	100.0	100.0	21.7	60.7	83.8	100.0	100.0	100.0
500	13.4	51.6	65.9	100.0	100.0	100.0	74.4	98.8	100.0	100.0	100.0	100.0
Two-step system GMM estimator based on "SYS2"												
50	41.1	—	—	100.0	—	—	60.9	—	—	100.0	—	—
150	25.5	86.5	96.5	100.0	100.0	100.0	53.1	89.1	96.9	100.0	100.0	100.0
500	64.2	83.0	85.9	100.0	100.0	100.0	85.1	99.8	100.0	100.0	100.0	100.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors												
50	1.1	—	—	100.0	—	—	3.2	—	—	100.0	—	—
150	2.9	2.1	0.3	100.0	100.0	100.0	13.8	12.8	5.3	100.0	100.0	100.0
500	22.2	23.9	17.3	100.0	100.0	100.0	55.6	47.6	18.2	100.0	100.0	100.0
Continuous-updating system GMM estimator based on "SYS2"												
50	42.9	—	—	79.7	—	—	54.2	—	—	74.2	—	—
150	31.0	68.9	82.8	90.0	96.8	97.5	59.1	77.2	82.8	83.1	88.2	89.2
500	59.5	57.3	44.9	99.5	100.0	100.0	85.2	81.4	68.9	97.4	99.7	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors												
50	13.6	—	—	79.7	—	—	15.8	—	—	74.2	—	—
150	8.7	14.0	17.4	90.0	96.8	97.5	16.1	22.5	25.2	83.1	88.2	89.2
500	12.4	11.1	7.1	99.5	100.0	100.0	45.5	31.9	12.1	97.4	99.7	100.0
One-step system GMM estimator based on "SYS3"												
50	0.6	1.1	0.0	100.0	100.0	100.0	6.2	7.6	0.0	100.0	100.0	100.0
150	2.3	3.7	2.6	100.0	100.0	100.0	23.6	36.6	38.5	100.0	100.0	100.0
500	29.6	33.1	22.7	100.0	100.0	100.0	88.7	91.3	85.1	100.0	100.0	100.0
Two-step system GMM estimator based on "SYS3"												
50	6.1	5.6	100.0	100.0	100.0	100.0	15.3	17.0	100.0	100.0	100.0	100.0
150	4.9	6.6	6.4	100.0	100.0	100.0	31.0	45.3	44.4	100.0	100.0	100.0
500	38.6	39.9	27.8	100.0	100.0	100.0	90.4	93.0	88.2	100.0	100.0	100.0
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors												
50	3.3	2.5	100.0	100.0	100.0	100.0	7.4	6.0	100.0	100.0	100.0	100.0
150	1.9	4.4	4.3	100.0	100.0	100.0	20.4	30.1	30.7	100.0	100.0	100.0
500	35.1	37.0	25.6	100.0	100.0	100.0	86.4	87.7	80.7	100.0	100.0	100.0
Continuous-updating system GMM estimator based on "SYS3"												
50	16.3	13.9	0.0	81.8	90.1	0.0	20.6	24.0	0.0	78.1	87.0	0.0
150	10.7	10.2	10.6	93.7	99.3	99.7	37.0	51.8	50.5	91.8	98.1	98.8
500	39.2	39.6	27.4	100.0	100.0	100.0	91.8	93.9	88.7	99.9	100.0	100.0
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors												
50	12.7	10.2	0.0	81.8	90.1	0.0	11.5	14.4	0.0	78.1	87.0	0.0
150	7.0	6.6	6.0	93.7	99.3	99.7	19.6	32.1	34.2	91.8	98.1	98.8
500	25.7	32.6	23.0	100.0	100.0	100.0	81.4	87.7	82.5	99.9	100.0	100.0

Table A.30: Size(%) and power(%) of weak instruments robust tests ($\theta = (0.9, 0.56)'$) for ARX(1) model

| | size ($H_0: \theta = (0.9, 0.56)'$) | | | power ($H_1: \theta = (0.8, 0.46)'$) | | | size ($H_0: \theta = (0.9, 0.56)'$) | | | power ($H_1: \theta = (0.8, 0.46)'$) | | |
| | $\tau^2 = 1$ | | | | | | $\tau^2 = 5$ | | | | | |
N/T	5	10	15	5	10	15	5	10	15	5	10	15
	Anderson and Rubin test based on moment conditions "DIF1"											
50	78.0	–	–	81.1	–	–	77.6	–	–	81.5	–	–
150	17.7	100.0	–	32.7	100.0	–	17.9	100.0	–	31.4	100.0	–
500	10.3	56.7	100.0	59.0	98.6	100.0	10.0	55.8	100.0	58.5	98.6	100.0
	Anderson and Rubin test based on moment conditions "DIF2"											
50	48.0	100.0	–	53.4	99.9	–	48.2	100.0	–	53.3	100.0	–
150	11.8	54.7	95.2	25.3	79.1	99.2	10.9	54.8	94.5	24.1	77.3	99.2
500	9.2	13.6	23.5	59.9	93.5	99.8	8.5	13.4	23.3	56.4	90.7	99.4
	Anderson and Rubin test based on moment conditions "DIF3"											
50	8.4	8.0	8.1	8.0	8.5	9.5	8.9	8.4	8.4	7.7	8.5	9.8
150	6.3	6.3	6.0	6.2	6.6	9.5	6.0	6.4	6.1	6.5	7.0	6.7
500	5.2	4.0	3.7	5.4	6.6	13.2	6.1	4.2	3.7	7.6	8.2	7.0
	Anderson and Rubin test based on moment conditions "SYS1"											
50	97.6	–	–	98.7	–	–	98.1	–	–	98.5	–	–
150	44.3	100.0	–	60.9	100.0	–	53.2	100.0	–	62.6	100.0	–
500	34.5	81.9	100.0	90.7	100.0	100.0	67.9	89.6	100.0	92.7	100.0	100.0
	Anderson and Rubin test based on moment conditions "SYS2"											
50	87.1	–	–	88.9	–	–	87.5	–	–	89.4	–	–
150	31.1	89.8	100.0	50.1	98.8	100.0	42.7	92.4	100.0	51.6	99.0	100.0
500	31.8	34.5	53.4	89.5	99.9	100.0	68.1	56.2	66.3	91.7	100.0	100.0
	Anderson and Rubin test based on moment conditions "SYS3"											
50	16.8	16.0	15.1	25.8	42.2	56.7	19.4	20.1	17.8	25.0	44.5	58.4
150	15.3	12.4	11.2	33.2	70.9	90.7	29.4	21.1	20.9	35.7	74.2	93.0
500	37.4	23.2	13.1	84.4	99.8	100.0	84.3	65.5	49.7	88.0	99.9	100.0
	Lagrange Multiplier test based on moment conditions "DIF1"											
50	56.0	–	–	67.0	–	–	56.6	–	–	64.3	–	–
150	9.8	71.3	–	8.9	92.9	–	9.7	72.9	–	9.4	94.1	–
500	4.9	11.4	76.4	16.5	44.9	99.6	3.7	12.0	76.0	13.9	39.0	99.9
	Lagrange Multiplier test based on moment conditions "DIF2"											
50	36.6	81.1	–	42.6	85.2	–	37.5	77.9	–	42.4	84.4	–
150	7.7	23.7	67.9	7.7	22.0	90.0	7.7	23.3	66.4	7.9	22.2	89.2
500	4.6	6.2	7.7	16.1	69.3	92.4	4.0	6.6	7.6	9.6	50.0	79.6
	Lagrange Multiplier test based on moment conditions "DIF3"											
50	6.7	6.2	7.2	7.2	6.0	7.7	6.1	5.5	8.1	6.3	6.3	7.8
150	6.5	5.9	5.6	6.2	6.0	6.4	6.1	6.0	5.9	6.0	7.2	5.4
500	5.0	4.5	5.0	4.6	4.6	7.6	4.9	4.8	5.3	4.6	5.1	5.2
	Lagrange Multiplier test based on moment conditions "SYS1"											
50	58.3	–	–	63.0	–	–	52.6	–	–	59.9	–	–
150	18.9	72.6	–	25.4	88.7	–	21.5	68.4	–	23.8	83.8	–
500	14.5	15.8	53.7	59.3	70.3	99.5	10.3	14.9	36.7	69.1	81.7	99.1
	Lagrange Multiplier test based on moment conditions "SYS2"											
50	47.4	–	–	53.3	–	–	42.0	–	–	46.8	–	–
150	15.6	41.7	64.4	19.6	70.8	88.9	20.7	28.5	52.5	22.6	61.7	78.7
500	16.9	8.9	12.0	62.7	41.5	44.6	9.7	11.9	15.4	68.3	39.9	73.6
	Lagrange Multiplier test based on moment conditions "SYS3"											
50	14.8	10.7	10.7	19.5	31.5	34.6	27.9	19.7	17.6	21.5	37.4	48.0
150	10.6	10.5	8.3	26.5	34.1	36.6	12.3	8.4	7.2	40.2	55.6	65.4
500	24.4	15.3	12.5	67.4	45.9	40.3	7.4	5.7	7.1	91.4	76.5	78.2
	Conditional likelihood ratio test based on moment conditions "DIF1"											
50	62.1	–	–	73.1	–	–	62.9	–	–	72.6	–	–
150	10.3	71.5	–	10.5	93.3	–	10.8	73.1	–	11.2	94.4	–
500	5.0	11.6	79.3	17.3	46.1	99.6	3.9	12.2	78.6	14.4	40.3	99.9
	Conditional likelihood ratio test based on moment conditions "DIF2"											
50	46.4	81.0	–	52.7	85.1	–	47.1	78.0	–	52.9	84.4	–
150	8.0	24.9	71.9	9.0	28.5	91.7	8.3	25.7	71.4	8.8	28.4	91.2
500	4.7	6.3	7.5	16.9	69.7	92.5	4.0	6.5	7.9	10.1	51.0	80.0
	Conditional likelihood ratio test based on moment conditions "DIF3"											
50	7.3	6.2	7.3	7.7	6.3	7.5	7.0	5.7	8.1	6.7	6.5	7.9
150	6.4	5.9	5.8	6.3	6.0	6.2	6.2	5.9	5.9	6.0	7.4	5.6
500	5.2	4.5	5.2	4.6	4.5	7.9	4.8	5.0	5.3	4.8	5.0	5.3
	Conditional likelihood ratio test based on moment conditions "SYS1"											
50	58.4	–	–	62.9	–	–	52.1	–	–	59.9	–	–
150	19.3	72.8	–	25.5	88.8	–	22.3	68.5	–	23.8	83.8	–
500	14.8	16.0	53.8	59.6	70.5	99.5	10.9	15.0	36.5	68.8	81.7	99.1
	Conditional likelihood ratio test based on moment conditions "SYS2"											
50	47.5	–	–	53.4	–	–	41.8	–	–	46.6	–	–
150	16.0	42.0	64.6	19.8	71.2	89.0	20.7	28.4	52.5	22.2	61.4	78.9
500	17.6	8.7	12.2	62.8	42.0	44.7	9.9	11.7	15.3	68.3	39.8	73.8
	Conditional likelihood ratio test based on moment conditions "SYS3"											
50	15.1	10.6	11.1	20.3	32.3	35.5	27.8	20.0	17.4	21.8	37.6	47.9
150	10.7	10.5	8.4	26.7	34.9	37.2	13.1	8.3	7.4	40.2	55.6	65.1
500	24.3	15.6	12.6	67.9	46.2	40.6	7.9	5.9	7.4	91.6	76.8	78.3

Table A.31: Mean bias(×100) and RMSE(×100) of γ ($\gamma = 0.4$) for AR(1) model

	bias(×100)								RMSE(×100)							
	$\tau^2 = 1$				$\tau^2 = 5$				$\tau^2 = 1$				$\tau^2 = 5$			
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Transformed likelihood estimator																
50	0.241	0.036	-0.171	-0.058	0.241	0.036	-0.171	-0.058	8.503	5.114	4.066	3.414	8.503	5.114	4.066	3.414
150	-0.153	0.099	0.074	0.026	-0.153	0.099	0.074	0.026	4.772	2.890	2.358	2.009	4.772	2.890	2.358	2.009
500	0.107	-0.080	-0.039	-0.027	0.107	-0.080	-0.039	-0.027	2.655	1.646	1.300	1.074	2.655	1.646	1.300	1.074
Iterative transformed likelihood estimator																
50	0.242	0.036	-0.172	-0.058	0.241	0.036	-0.172	-0.058	8.503	5.114	4.066	3.413	8.503	5.114	4.066	3.413
150	-0.151	0.099	0.074	0.026	-0.152	0.099	0.074	0.026	4.773	2.890	2.358	2.009	4.773	2.890	2.358	2.009
500	0.110	-0.080	-0.039	-0.027	0.109	-0.080	-0.039	-0.027	2.655	1.646	1.300	1.074	2.655	1.646	1.300	1.074
One-step first-difference GMM estimator based on "DIF1"																
50	-0.247	-2.071	—	—	-2.207	-2.812	—	—	10.498	6.048	—	—	12.991	6.663	—	—
150	1.480	-0.312	-0.504	—	0.155	-0.788	-0.738	—	6.389	3.448	2.695	—	7.653	3.816	2.907	—
500	2.436	0.074	-0.090	-0.196	1.470	-0.281	-0.253	-0.273	4.326	1.954	1.485	1.227	4.559	2.156	1.587	1.281
Two-step first-difference GMM estimator based on "DIF1"																
50	-0.394	-1.556	—	—	-2.402	-2.290	—	—	12.114	15.886	—	—	15.151	16.819	—	—
150	1.521	-0.137	-0.574	—	0.193	-0.613	-0.779	—	6.938	4.182	4.406	—	8.338	4.666	4.606	—
500	2.381	0.031	-0.066	-0.159	1.383	-0.348	-0.219	-0.244	4.372	2.078	1.707	1.521	4.635	2.289	1.804	1.579
Continuous-updating first-difference GMM estimator based on "DIF1"																
50	2.646	-1.781	—	—	1.982	1.512	—	—	15.524	36.371	—	—	19.958	39.609	—	—
150	2.572	0.770	0.103	—	1.689	0.462	0.060	—	7.481	4.836	6.021	—	9.026	5.272	6.232	—
500	2.764	0.285	0.191	0.077	1.913	-0.043	0.070	0.015	4.622	2.143	1.802	1.669	4.873	2.312	1.873	1.721
One-step first-difference GMM estimator based on "DIF2"																
50	0.847	-0.696	-1.008	-0.861	0.113	-1.652	-1.727	-1.437	10.792	6.128	4.998	4.196	16.291	8.688	6.415	5.148
150	2.179	0.371	0.056	-0.211	3.012	0.472	0.202	-0.294	6.605	3.657	2.833	2.425	10.564	5.115	3.681	3.026
500	2.933	0.336	0.168	0.022	4.604	0.944	0.492	0.133	4.636	2.064	1.631	1.349	7.562	3.005	2.103	1.630
Two-step first-difference GMM estimator based on "DIF2"																
50	0.984	-0.071	-0.082	0.447	-0.082	-0.978	-0.660	-0.014	11.934	7.630	6.598	7.341	17.996	10.856	7.984	8.309
150	2.305	0.748	0.411	0.231	3.163	0.713	0.719	0.223	6.965	4.010	3.159	2.819	11.383	5.582	4.074	3.407
500	2.953	0.422	0.357	0.195	4.852	1.041	0.682	0.333	4.678	2.114	1.720	1.431	7.930	3.118	2.247	1.717
Continuous-updating first-difference GMM estimator based on "DIF2"																
50	3.796	1.971	2.241	2.478	6.826	2.583	2.328	2.393	14.517	9.787	9.164	11.590	25.652	13.814	10.792	12.189
150	3.303	1.542	1.144	0.943	5.628	2.089	1.733	1.078	7.479	4.389	3.489	3.112	13.197	6.273	4.574	3.735
500	3.332	0.661	0.587	0.412	5.997	1.474	1.000	0.591	4.937	2.195	1.800	1.487	8.834	3.335	2.392	1.806
One-step first-difference GMM estimator based on "DIF3"																
50	2.708	1.007	0.330	0.395	4.512	1.871	0.819	0.700	11.315	6.327	4.981	4.100	20.265	10.338	7.235	5.877
150	3.091	1.248	0.694	0.302	5.409	2.102	1.419	0.654	7.015	3.952	2.926	2.423	13.165	6.364	4.544	3.639
500	3.474	0.951	0.530	0.282	6.280	1.813	1.123	0.689	5.019	2.289	1.698	1.356	9.132	3.791	2.627	2.021
Two-step first-difference GMM estimator based on "DIF3"																
50	2.546	1.243	0.496	0.605	4.091	2.073	0.900	0.881	11.646	6.665	5.137	4.248	21.100	10.778	7.344	6.063
150	3.085	1.329	0.778	0.379	5.358	2.159	1.522	0.726	7.165	4.007	2.978	2.449	13.618	6.507	4.618	3.675
500	3.427	0.993	0.559	0.312	6.094	1.912	1.187	0.738	5.019	2.324	1.720	1.368	9.086	3.881	2.685	2.050
Continuous-updating first-difference GMM estimator based on "DIF3"																
50	3.342	1.521	0.684	0.727	6.269	2.694	1.250	1.082	12.475	6.867	5.228	4.304	24.717	11.337	7.543	6.210
150	3.359	1.430	0.841	0.421	6.012	2.316	1.632	0.798	7.409	4.059	3.004	2.458	14.673	6.646	4.684	3.701
500	3.522	1.022	0.577	0.324	6.069	1.947	1.212	0.756	5.102	2.340	1.729	1.372	9.257	3.914	2.703	2.059

Table A.31(cont.)

	bias(×100)				RMSE(×100)				bias(×100)				RMSE(×100)			
	$\tau^2=1$								$\tau^2=5$							
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	1.514	—	—	—	10.032	—	—	—	21.653	—	—	—	27.931	—	—	—
150	1.128	0.243	0.093	—	5.732	3.446	2.734	—	9.470	7.477	6.730	—	13.649	9.394	7.954	—
500	1.404	0.081	0.040	-0.049	3.495	1.947	1.509	1.241	3.778	2.320	2.131	1.937	6.311	3.627	2.869	2.493
Two-step system GMM estimator based on "SYS1"																
50	1.442	—	—	—	10.408	—	—	—	15.727	—	—	—	23.498	—	—	—
150	0.768	0.460	0.169	—	5.342	3.765	4.573	—	4.024	3.910	4.184	—	8.502	6.288	6.413	—
500	0.776	-0.008	0.026	0.008	2.858	1.786	1.535	1.419	0.942	0.423	0.553	0.636	3.130	1.982	1.714	1.619
Continuous-updating system GMM estimator based on "SYS1"																
50	1.322	—	—	—	12.868	—	—	—	1.633	—	—	—	14.467	—	—	—
150	0.669	0.483	0.057	—	5.512	4.343	6.693	—	0.383	0.464	0.038	—	5.523	4.365	6.825	—
500	0.731	-0.035	0.013	0.004	2.852	1.827	1.607	1.581	0.363	-0.104	-0.013	-0.007	2.792	1.839	1.605	1.583
One-step system GMM estimator based on "SYS2"																
50	2.074	0.906	0.511	—	10.193	6.136	4.937	—	24.879	23.611	21.200	—	31.084	26.611	23.283	—
150	1.460	0.638	0.456	0.226	5.813	3.634	2.939	2.493	11.539	10.215	9.231	8.346	15.801	12.197	10.521	9.264
500	1.635	0.221	0.193	0.090	3.599	2.031	1.622	1.354	4.989	3.537	3.155	2.745	7.502	4.833	3.889	3.316
Two-step system GMM estimator based on "SYS2"																
50	1.479	0.769	0.803	—	10.127	7.922	9.303	—	17.529	17.291	16.357	—	25.427	21.631	20.022	—
150	0.663	0.688	0.450	0.418	5.422	3.885	3.271	2.964	4.737	4.643	4.245	3.809	9.320	7.188	6.093	5.297
500	0.617	0.035	0.193	0.137	2.903	1.934	1.643	1.403	1.106	0.626	0.688	0.615	3.324	2.248	1.878	1.605
Continuous-updating system GMM estimator based on "SYS2"																
50	1.021	0.702	0.876	—	11.561	11.143	17.162	—	2.134	1.186	5.876	—	14.507	12.143	22.206	—
150	0.444	0.485	0.229	0.226	5.519	4.035	3.445	3.172	0.388	0.480	0.285	0.254	5.514	4.089	3.481	3.213
500	0.531	-0.046	0.127	0.056	2.876	1.954	1.653	1.410	0.358	-0.057	0.121	0.072	2.851	1.970	1.672	1.407
One-step system GMM estimator based on "SYS3"																
50	1.400	0.451	0.040	0.219	10.121	5.888	4.765	3.916	10.004	1.519	0.115	0.431	22.474	10.867	7.649	5.933
150	1.243	0.632	0.349	0.141	5.668	3.506	2.771	2.290	3.594	0.946	0.476	0.230	12.837	6.760	4.505	3.501
500	1.526	0.354	0.225	0.112	3.471	1.979	1.556	1.265	1.717	0.397	0.281	0.176	7.702	3.749	2.534	1.900
Two-step system GMM estimator based on "SYS3"																
50	2.783	1.371	0.584	0.737	10.722	6.624	5.092	4.220	8.101	3.091	1.476	1.364	18.701	9.733	6.820	5.526
150	2.109	1.077	0.639	0.353	6.034	3.672	2.891	2.368	4.503	2.110	1.330	0.765	9.570	5.566	4.023	3.279
500	2.164	0.564	0.346	0.193	3.776	2.009	1.590	1.282	4.370	1.355	0.877	0.539	6.342	3.097	2.242	1.773
Continuous-updating system GMM estimator based on "SYS3"																
50	2.675	1.392	0.599	0.762	11.413	6.914	5.191	4.321	3.821	2.172	1.057	1.061	16.633	9.817	6.838	5.524
150	1.955	1.065	0.643	0.355	6.079	3.693	2.910	2.376	3.489	1.661	1.131	0.649	9.051	5.381	3.968	3.264
500	2.049	0.542	0.341	0.191	3.708	2.005	1.591	1.282	3.792	1.171	0.793	0.498	5.874	3.006	2.209	1.763

Table A.32: Median bias(×100) and MAE(×100) of γ ($\gamma = 0.4$) for AR(1) model

	$\tau^2 = 1$ median bias(×100)				MAE(×100)				$\tau^2 = 5$ median bias(×100)				MAE(×100)			
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Transformed likelihood estimator																
50	0.046	0.078	-0.226	-0.041	5.544	3.547	2.684	2.356	0.046	0.078	-0.226	-0.041	5.544	3.547	2.684	2.356
150	-0.132	-0.070	0.102	-0.018	2.952	1.977	1.636	1.373	-0.132	-0.070	0.102	-0.018	2.953	1.978	1.636	1.373
500	0.120	-0.100	-0.046	-0.033	1.770	1.107	0.914	0.696	0.120	-0.100	-0.046	-0.033	1.769	1.107	0.914	0.696
Iterative transformed likelihood estimator																
50	0.046	0.078	-0.227	-0.041	5.542	3.545	2.684	2.356	0.050	0.078	-0.226	-0.041	5.541	3.546	2.683	2.356
150	-0.132	-0.070	0.102	-0.018	2.951	1.976	1.635	1.373	-0.135	-0.071	0.102	-0.019	2.954	1.978	1.636	1.373
500	0.122	-0.099	-0.045	-0.033	1.770	1.106	0.914	0.696	0.121	-0.100	-0.045	-0.034	1.771	1.106	0.915	0.696
One-step first-difference GMM estimator based on "DIF1"																
50	-0.513	-2.086	—	—	7.062	4.362	—	—	-2.647	-2.709	—	—	8.614	4.653	—	—
150	1.498	-0.419	-0.629	—	4.285	2.370	1.853	—	-0.682	-0.945	-0.850	—	4.864	2.570	1.939	—
500	2.572	0.017	-0.099	-0.188	3.111	1.294	1.035	0.802	1.672	-0.342	-0.282	-0.282	3.183	1.427	1.080	0.860
Two-step first-difference GMM estimator based on "DIF1"																
50	-0.996	-1.764	—	—	8.265	9.021	—	—	-2.834	-2.021	—	—	9.521	9.751	—	—
150	1.335	-0.030	-0.634	—	4.633	2.771	2.793	—	-0.602	-0.578	-0.836	—	5.478	3.050	3.119	—
500	2.350	-0.069	-0.054	-0.180	3.106	1.399	1.129	1.004	1.487	-0.407	-0.239	-0.240	3.095	1.616	1.211	1.066
Continuous-updating first-difference GMM estimator based on "DIF1"																
50	1.586	-0.931	—	—	9.538	16.190	—	—	0.890	0.422	—	—	11.532	17.341	—	—
150	2.161	0.872	0.026	—	4.848	3.235	3.948	—	1.071	0.431	-0.169	—	5.691	3.385	3.973	—
500	2.747	0.202	0.197	0.066	3.270	1.424	1.181	1.096	1.981	-0.147	0.066	-0.003	3.318	1.663	1.272	1.162
One-step first-difference GMM estimator based on "DIF2"																
50	0.366	-0.750	-0.945	-0.882	7.045	4.355	3.437	2.907	-1.167	-1.341	-1.447	-1.477	10.559	5.616	4.390	3.497
150	2.075	0.171	0.058	-0.312	4.447	2.291	1.923	1.684	2.683	0.410	0.304	-0.359	7.137	3.508	2.541	2.115
500	2.994	0.309	0.118	0.045	3.370	1.379	1.149	0.898	4.445	0.934	0.536	0.170	5.282	2.010	1.527	1.051
Two-step first-difference GMM estimator based on "DIF2"																
50	0.818	-0.174	-0.330	0.171	8.201	5.396	4.503	4.920	-1.437	-0.743	-0.451	-0.149	11.686	7.264	5.183	5.685
150	2.194	0.640	0.429	0.154	4.682	2.645	2.059	2.026	2.751	0.588	0.706	0.140	7.652	3.773	2.648	2.377
500	3.002	0.284	0.304	0.221	3.312	1.412	1.160	0.903	4.766	1.059	0.658	0.389	5.540	2.092	1.575	1.141
Continuous-updating first-difference GMM estimator based on "DIF2"																
50	3.659	2.073	2.037	1.953	9.202	6.581	6.064	6.782	4.349	2.740	2.285	2.506	15.313	9.070	7.054	8.237
150	3.116	1.373	1.185	0.839	5.086	2.874	2.288	2.221	5.104	1.937	1.767	0.991	8.642	4.026	2.911	2.638
500	3.374	0.510	0.545	0.455	3.618	1.458	1.216	0.947	5.904	1.584	0.987	0.636	6.279	2.256	1.679	1.216
One-step first-difference GMM estimator based on "DIF3"																
50	2.310	0.906	0.153	0.467	7.162	4.500	3.199	2.805	3.289	1.685	0.862	0.665	12.937	7.073	4.891	3.859
150	2.908	1.100	0.608	0.282	4.632	2.529	1.971	1.650	5.181	1.919	1.460	0.602	8.819	4.310	3.126	2.612
500	3.492	0.927	0.491	0.260	3.690	1.532	1.154	0.942	6.277	1.847	1.159	0.759	6.794	2.628	1.902	1.439
Two-step first-difference GMM estimator based on "DIF3"																
50	2.044	1.257	0.367	0.724	7.742	4.806	3.279	2.874	3.186	1.722	1.002	0.971	13.305	7.571	4.898	4.103
150	3.061	1.219	0.732	0.337	4.851	2.558	2.012	1.649	4.808	1.903	1.524	0.704	8.913	4.344	3.230	2.645
500	3.371	0.950	0.518	0.316	3.628	1.507	1.171	0.930	6.036	2.111	1.189	0.808	6.419	2.745	1.922	1.450
Continuous-updating first-difference GMM estimator based on "DIF3"																
50	2.617	1.481	0.518	0.834	8.134	4.890	3.307	2.960	4.630	2.545	1.408	1.217	15.287	7.855	5.005	4.215
150	3.352	1.295	0.766	0.388	4.970	2.568	2.036	1.650	5.529	2.130	1.735	0.749	9.633	4.474	3.280	2.659
500	3.463	0.966	0.528	0.330	3.684	1.535	1.167	0.928	5.948	2.101	1.213	0.827	6.553	2.726	1.910	1.454

Table A.32(cont.)

N/T	median bias(×100) τ²=1				MAE(×100) τ²=1				median bias(×100) τ²=5				MAE(×100) τ²=5			
	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	1.573	—	—	—	6.363	—	—	—	22.179	—	—	—	22.366	—	—	—
150	0.731	0.166	0.000	—	3.740	2.261	1.860	—	9.191	7.277	6.730	—	9.443	7.283	6.730	—
500	1.438	-0.009	0.062	-0.049	2.450	1.373	1.014	0.836	3.808	2.154	2.109	1.895	4.495	2.388	2.159	1.916
Two-step system GMM estimator based on "SYS1"																
50	1.337	—	—	—	6.872	—	—	—	13.352	—	—	—	14.249	—	—	—
150	0.613	0.345	0.042	—	3.371	2.392	3.079	—	3.025	3.657	4.063	—	4.689	4.278	4.582	—
500	0.881	-0.110	0.052	0.031	1.945	1.230	1.004	0.932	0.887	0.349	0.546	0.632	2.035	1.312	1.155	1.053
Continuous-updating system GMM estimator based on "SYS1"																
50	0.911	—	—	—	8.487	—	—	—	0.834	—	—	—	8.026	—	—	—
150	0.597	0.412	0.178	—	3.599	2.903	4.568	—	0.258	0.375	-0.008	—	3.636	2.907	4.482	—
500	0.808	-0.061	0.029	-0.030	1.915	1.279	1.077	1.058	0.393	-0.138	-0.023	-0.023	1.875	1.281	1.075	1.038
One-step system GMM estimator based on "SYS2"																
50	2.140	0.822	0.546	—	6.491	4.265	3.333	—	25.320	23.194	20.715	—	25.539	23.194	20.715	—
150	1.234	0.576	0.416	0.190	3.684	2.362	1.964	1.796	11.249	9.839	9.119	8.320	11.510	9.839	9.119	8.320
500	1.587	0.183	0.181	0.132	2.518	1.427	1.123	0.901	5.189	3.273	3.140	2.744	5.480	3.303	3.147	2.760
Two-step system GMM estimator based on "SYS2"																
50	1.444	0.649	0.825	—	6.766	5.112	6.028	—	14.797	16.432	15.998	—	15.248	16.432	16.055	—
150	0.377	0.653	0.422	0.378	3.442	2.568	2.195	2.091	3.733	4.207	4.052	3.728	5.223	4.723	4.130	3.868
500	0.622	-0.023	0.243	0.159	1.941	1.357	1.088	0.922	0.994	0.492	0.641	0.634	2.184	1.479	1.234	1.087
Continuous-updating system GMM estimator based on "SYS2"																
50	0.635	0.562	-0.022	—	7.680	6.894	9.187	—	1.382	0.511	3.948	—	7.620	6.940	10.549	—
150	0.303	0.372	0.207	0.263	3.606	2.684	2.309	2.227	0.124	0.393	0.128	0.264	3.639	2.786	2.381	2.205
500	0.526	-0.083	0.128	0.077	1.921	1.357	1.094	0.911	0.324	-0.150	0.042	0.056	1.975	1.346	1.071	0.937
One-step system GMM estimator based on "SYS3"																
50	1.344	0.447	0.019	—	6.375	3.957	3.140	—	9.909	1.337	0.173	—	14.672	7.155	5.114	3.927
150	0.829	0.432	0.328	0.164	3.610	2.282	1.840	1.606	2.977	0.799	0.574	0.504	8.110	4.497	3.131	2.308
500	1.584	0.324	0.189	0.111	2.389	1.424	1.070	0.840	1.407	0.408	0.279	0.181	5.203	2.533	1.786	1.285
Two-step system GMM estimator based on "SYS3"																
50	2.806	1.243	0.624	—	7.058	4.597	3.470	—	7.925	2.873	1.505	—	12.068	6.668	4.451	3.669
150	1.876	0.998	0.601	0.324	3.860	2.312	1.963	1.640	4.429	1.972	1.306	1.373	6.474	3.591	2.685	2.327
500	2.122	0.524	0.309	0.215	2.611	1.332	1.087	0.843	4.479	1.268	0.849	0.595	4.766	2.125	1.545	1.188
Continuous-updating system GMM estimator based on "SYS3"																
50	2.358	1.096	0.601	0.874	7.467	4.755	3.629	2.906	4.280	2.157	1.157	1.105	11.542	6.552	4.556	3.579
150	1.756	0.981	0.608	0.299	3.904	2.312	1.989	1.629	3.509	1.455	1.102	0.596	5.823	3.541	2.631	2.332
500	2.043	0.482	0.303	0.212	2.592	1.347	1.092	0.845	3.877	1.055	0.747	0.556	4.289	2.076	1.532	1.180

Table A.33: Size(%) and power(%) of γ ($\gamma = 0.4$) for AR(1) model

| | size ($H_0 : \gamma = 0.0$) | | | | power ($H_1 : \gamma = -0.1$) | | | | size ($H_0 : \gamma = 0.0$) | | | | power ($H_1 : \gamma = -0.1$) | | | |
| | $\tau^2 = 1$ | | | | | | | | $\tau^2 = 5$ | | | | | | | |
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
							Transformed likelihood estimator									
50	7.0	6.4	7.2	5.1	26.3	51.7	72.9	83.1	7.0	6.4	7.2	5.1	26.3	51.7	72.9	83.1
150	5.4	4.7	5.2	6.2	57.0	91.4	98.9	99.9	5.4	4.7	5.2	6.2	57.0	91.4	98.9	99.9
500	5.1	5.1	5.2	4.9	95.7	100.0	100.0	100.0	5.1	5.1	5.2	4.9	95.7	100.0	100.0	100.0
						Iterative transformed likelihood estimator										
50	7.0	6.4	7.2	5.1	26.3	51.7	72.9	83.0	7.0	6.4	7.2	5.1	26.3	51.7	72.8	83.1
150	5.4	4.7	5.2	6.1	57.0	91.4	98.9	99.9	5.4	4.7	5.2	6.1	57.0	91.4	98.9	99.9
500	5.1	5.1	5.2	4.9	95.7	100.0	100.0	100.0	5.1	5.1	5.2	4.9	95.7	100.0	100.0	100.0
					One-step first-difference GMM estimator based on "DIF1"											
50	7.1	7.8	—	—	21.1	55.4	—	—	8.6	8.0	—	—	22.2	53.1	—	—
150	5.8	5.2	6.1	—	30.6	83.4	97.6	—	6.8	5.5	6.5	—	30.0	82.4	96.3	—
500	11.9	4.1	5.0	5.6	60.2	99.9	100.0	100.0	7.2	4.8	5.6	6.0	53.1	99.8	100.0	100.0
					Two-step first-difference GMM estimator based on "DIF1"											
50	19.8	85.7	—	—	36.5	90.9	—	—	21.6	88.0	—	—	35.5	91.3	—	—
150	10.4	23.7	59.4	—	37.6	89.8	97.1	—	10.7	23.7	60.2	—	37.0	87.1	96.8	—
500	13.5	9.6	18.4	26.8	62.2	99.8	100.0	100.0	8.5	9.3	16.5	26.4	56.3	99.9	100.0	100.0
				Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors												
50	7.0	2.1	—	—	18.3	2.2	—	—	8.2	2.7	—	—	18.2	3.0	—	—
150	6.1	5.0	0.1	—	28.1	65.0	17.8	—	6.1	5.2	0.0	—	26.0	61.6	15.7	—
500	11.4	4.9	4.4	3.8	58.3	99.6	100.0	100.0	6.6	4.7	5.9	3.3	50.6	99.5	100.0	100.0
				Continuous-updating first-difference GMM estimator based on "DIF1"												
50	27.4	89.6	—	—	36.9	93.2	—	—	30.6	91.2	—	—	36.9	92.8	—	—
150	13.9	29.1	68.1	—	32.9	81.2	92.0	—	13.3	28.4	68.7	—	32.1	78.5	91.6	—
500	15.5	10.4	19.9	31.8	58.5	99.7	100.0	100.0	10.8	9.7	18.4	32.3	50.8	99.9	100.0	100.0
			Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors													
50	10.2	31.4	—	—	16.0	34.6	—	—	11.6	29.9	—	—	17.9	32.8	—	—
150	7.4	7.1	8.7	—	22.3	50.9	43.0	—	7.2	7.9	7.0	—	21.0	47.3	40.1	—
500	11.9	5.8	5.4	5.8	50.9	99.4	99.9	100.0	6.9	4.3	6.8	5.1	43.7	99.4	99.8	99.9
					One-step first-difference GMM estimator based on "DIF2"											
50	7.2	5.4	6.6	5.9	17.4	42.1	61.9	72.7	6.8	7.6	7.1	6.2	15.3	28.4	47.6	65.3
150	6.2	5.6	5.0	5.2	25.6	75.2	93.5	98.8	7.1	5.3	5.0	5.6	16.7	46.5	76.4	93.7
500	14.9	5.0	5.4	5.5	53.4	99.7	100.0	100.0	16.7	6.1	4.9	5.7	23.3	87.6	99.9	100.0
					Two-step first-difference GMM estimator based on "DIF2"											
50	14.1	27.6	41.0	63.6	28.7	59.7	77.2	84.0	15.2	28.9	39.5	65.2	24.2	49.2	70.6	80.9
150	10.6	11.8	13.2	18.1	29.2	76.7	93.6	98.7	11.7	10.2	13.9	16.5	19.3	53.0	79.6	93.5
500	15.3	6.3	8.8	9.0	55.1	99.8	100.0	100.0	19.6	7.5	8.9	8.6	24.0	88.2	99.5	100.0
				Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors												
50	7.0	4.5	2.6	0.7	16.7	26.9	20.5	6.1	7.4	7.2	2.5	1.7	13.5	18.2	13.7	4.9
150	7.5	6.2	4.9	5.4	23.2	65.2	85.2	93.7	6.8	5.8	7.0	5.5	13.7	38.7	64.1	81.5
500	14.5	4.6	6.3	6.3	52.7	99.5	100.0	100.0	14.9	5.8	6.3	5.9	19.3	85.0	99.3	100.0
				Continuous-updating first-difference GMM estimator based on "DIF2"												
50	20.3	37.2	55.1	72.1	27.4	51.9	66.6	81.2	26.0	39.1	51.3	75.3	28.5	44.1	62.0	76.3
150	12.8	14.1	16.3	23.8	24.6	69.1	88.6	96.5	17.9	15.7	19.7	22.0	18.4	42.7	70.8	89.2
500	17.4	7.7	10.5	8.9	51.1	99.5	100.0	100.0	25.1	10.0	11.1	9.9	20.2	85.2	99.1	100.0
			Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors													
50	9.2	9.6	9.6	16.1	13.0	23.0	23.8	25.5	11.4	13.7	10.1	15.0	13.8	16.9	19.5	21.2
150	8.5	7.5	5.9	6.2	18.0	53.7	75.6	85.4	7.9	7.6	7.8	6.7	8.9	27.9	50.5	69.8
500	15.4	5.4	7.5	6.4	44.8	98.8	99.8	99.8	14.3	6.9	7.7	6.4	12.2	78.6	98.3	100.0
					One-step first-difference GMM estimator based on "DIF3"											
50	6.6	4.6	6.9	5.4	13.5	35.3	53.7	64.2	5.5	6.3	5.5	6.4	9.0	17.2	26.9	36.5
150	8.0	6.8	5.8	4.7	21.2	66.5	89.9	98.4	8.9	6.7	5.6	6.1	9.8	30.0	52.8	74.9
500	16.7	7.3	6.7	5.8	47.2	99.2	100.0	100.0	18.6	8.5	7.1	7.1	13.3	69.7	96.3	99.7
					Two-step first-difference GMM estimator based on "DIF3"											
50	8.7	7.6	8.5	7.3	16.7	33.9	56.0	64.0	8.5	8.1	7.1	7.8	12.7	19.1	28.9	38.5
150	9.4	8.3	6.1	5.6	23.1	67.1	89.6	98.3	11.8	6.9	6.1	6.8	11.3	31.2	52.1	74.6
500	17.0	7.9	6.8	6.1	49.3	99.0	100.0	100.0	18.5	9.6	8.0	7.1	14.5	68.4	95.7	99.7
				Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors												
50	6.3	5.0	7.1	5.7	13.3	30.4	50.0	59.5	6.6	6.5	5.4	6.2	9.8	16.7	25.7	34.1
150	7.7	7.6	6.1	5.5	20.6	64.7	88.0	98.3	9.8	6.1	5.7	5.9	10.0	28.8	50.4	73.0
500	15.6	7.4	6.7	5.9	46.8	99.0	100.0	100.0	15.6	9.1	7.6	6.9	12.3	66.9	95.3	99.7
				Continuous-updating first-difference GMM estimator based on "DIF3"												
50	10.7	8.0	8.6	7.5	16.4	33.1	53.1	62.4	12.0	9.2	7.8	7.7	15.0	19.1	28.1	37.7
150	10.6	8.3	6.8	5.8	23.0	65.8	88.9	98.1	13.7	7.4	6.7	7.1	13.2	30.7	51.5	74.0
500	17.6	8.2	6.9	6.1	48.4	98.9	100.0	100.0	18.9	10.0	8.2	7.4	15.7	67.9	95.7	99.7
			Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors													
50	7.3	5.3	7.2	6.2	13.0	28.9	47.8	58.4	7.6	7.3	5.5	6.6	11.3	15.5	24.6	33.0
150	7.7	7.2	6.2	5.6	18.2	62.4	86.7	97.2	9.7	6.2	5.9	6.0	9.3	26.9	48.9	70.7
500	15.5	7.1	6.7	5.9	42.8	97.6	99.3	98.9	13.1	8.5	7.4	6.8	11.8	64.8	94.5	98.8

Table A.33(cont.)

	size ($H_0 : \gamma = 0.0$)				power ($H_1 : \gamma = -0.1$)				size ($H_0 : \gamma = 0.0$)				power ($H_1 : \gamma = -0.1$)			
	$\tau^2 = 1$								$\tau^2 = 5$							
One-step system GMM estimator based on "SYS1"																
50	7.9	–	–	–	17.7	–	–	–	37.3	–	–	–	22.0	–	–	–
150	7.0	5.7	5.8	–	35.5	80.5	95.4	–	20.0	34.2	47.3	–	7.3	14.3	21.6	–
500	7.0	4.6	4.6	5.2	77.0	100.0	100.0	100.0	11.6	16.7	22.3	27.6	24.0	82.2	98.0	99.9
Two-step system GMM estimator based on "SYS1"																
50	29.5	–	–	–	43.9	–	–	–	63.5	–	–	–	54.5	–	–	–
150	13.3	30.6	72.7	–	59.2	93.0	97.5	–	31.6	57.1	84.1	–	48.7	78.6	89.7	–
500	8.5	10.3	20.3	32.6	93.4	100.0	100.0	100.0	11.1	16.1	28.6	41.6	92.5	100.0	100.0	100.0
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors																
50	7.1	–	–	–	16.6	–	–	–	19.0	–	–	–	13.3	–	–	–
150	6.8	2.9	0.0	–	45.1	61.4	2.1	–	10.2	5.9	1.4	–	24.4	20.8	2.2	–
500	6.7	4.8	4.6	2.4	92.0	100.0	100.0	100.0	6.4	5.5	4.3	1.8	86.5	99.4	100.0	99.6
Continuous-updating system GMM estimator based on "SYS1"																
50	38.1	–	–	–	50.2	–	–	–	45.8	–	–	–	58.7	–	–	–
150	14.2	34.5	80.8	–	59.2	91.4	95.1	–	17.3	44.0	84.1	–	66.4	92.7	95.8	–
500	8.7	10.2	21.0	35.4	93.5	100.0	100.0	100.0	8.7	13.4	24.6	39.4	95.4	100.0	100.0	100.0
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors																
50	12.2	–	–	–	21.4	–	–	–	12.1	–	–	–	21.6	–	–	–
150	6.6	6.9	8.9	–	44.2	61.4	40.9	–	6.4	6.5	9.0	–	45.7	62.2	41.4	–
500	6.0	5.6	6.3	5.8	90.7	99.9	99.9	99.9	5.8	5.4	6.5	6.2	93.1	100.0	100.0	100.0
One-step system GMM estimator based on "SYS2"																
50	8.5	5.9	7.0	–	17.2	35.1	51.8	–	41.1	61.5	72.6	–	25.2	34.2	32.3	–
150	6.8	6.6	6.0	4.5	32.9	75.6	90.5	97.5	23.2	43.3	56.5	64.4	9.2	9.4	11.8	12.9
500	8.3	4.7	5.1	5.2	74.9	99.9	100.0	100.0	14.2	23.2	30.8	37.6	16.6	60.2	86.8	97.5
Two-step system GMM estimator based on "SYS2"																
50	21.8	43.1	74.3	–	38.4	70.3	85.5	–	61.6	83.4	94.2	–	53.9	73.8	86.2	–
150	11.8	15.7	21.1	28.1	56.0	83.3	94.5	98.8	29.6	48.5	55.4	61.3	43.6	61.0	72.9	83.7
500	6.7	6.8	9.8	10.3	93.1	100.0	100.0	100.0	11.4	13.0	16.8	16.6	89.9	99.4	100.0	100.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors																
50	6.9	3.8	1.6	–	18.3	13.1	2.9	–	23.6	23.0	6.4	–	15.3	13.0	3.9	–
150	6.6	6.0	5.1	3.3	44.6	67.1	82.1	86.7	12.5	16.4	15.1	12.1	22.3	28.1	33.4	35.1
500	5.9	4.4	6.1	5.4	91.1	100.0	100.0	100.0	6.8	6.4	8.2	6.4	82.0	98.7	99.9	100.0
Continuous-updating system GMM estimator based on "SYS2"																
50	27.5	54.5	84.2	–	44.1	72.0	87.7	–	37.3	64.9	90.4	–	53.1	80.0	92.5	–
150	12.2	17.5	23.3	31.2	57.6	83.3	94.6	98.4	15.9	23.8	30.5	38.6	62.8	86.3	96.0	98.7
500	6.3	7.0	10.3	10.5	93.2	100.0	100.0	100.0	7.7	8.0	12.5	11.4	94.5	100.0	100.0	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors																
50	9.4	12.5	21.9	–	22.7	26.0	32.3	–	11.1	13.1	24.1	–	23.2	27.3	31.1	–
150	6.8	6.6	6.1	5.9	44.8	66.7	80.0	86.0	6.8	6.8	6.3	5.3	45.9	66.4	80.3	85.2
500	5.7	4.2	6.2	5.4	91.2	99.7	99.9	99.9	5.9	4.2	6.4	5.3	92.4	99.7	100.0	100.0
One-step system GMM estimator based on "SYS3"																
50	7.3	5.7	6.7	4.8	18.0	37.4	59.0	68.9	14.1	7.1	5.4	5.2	8.1	11.9	25.6	36.9
150	6.2	6.4	5.5	4.8	35.6	77.3	94.1	99.0	7.0	6.6	5.8	5.8	5.6	27.6	55.6	80.9
500	8.2	5.0	6.2	5.7	77.3	99.9	100.0	100.0	4.9	5.1	5.4	5.1	16.0	73.5	97.2	100.0
Two-step system GMM estimator based on "SYS3"																
50	13.7	11.6	10.9	10.1	21.7	41.2	60.4	69.1	20.9	13.5	11.7	10.4	15.6	22.4	37.3	47.0
150	9.4	8.2	7.8	6.9	34.1	76.1	92.8	98.9	12.4	10.1	8.2	7.2	10.3	40.8	67.0	85.6
500	11.2	5.9	7.1	5.7	72.6	99.9	100.0	100.0	14.7	8.0	8.3	6.5	21.4	87.3	99.9	100.0
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors																
50	9.9	7.5	6.7	5.9	14.6	32.3	51.3	60.7	9.1	7.8	6.8	6.0	7.1	15.0	28.6	37.7
150	7.8	6.8	6.6	5.4	29.9	73.1	91.2	98.3	9.5	8.3	6.4	5.8	7.6	37.4	63.9	83.7
500	10.4	5.8	6.6	5.1	71.7	99.9	100.0	100.0	15.5	7.7	8.1	6.5	20.5	86.9	99.9	100.0
Continuous-updating system GMM estimator based on "SYS3"																
50	16.3	13.4	11.1	11.2	24.3	41.4	59.7	68.2	15.7	14.3	11.6	10.3	17.5	25.3	39.5	49.4
150	9.8	8.4	8.2	6.8	35.3	76.2	92.6	98.6	8.9	8.4	8.0	7.4	12.1	43.7	69.2	86.2
500	10.3	5.9	7.0	5.5	74.0	99.9	100.0	100.0	11.7	7.4	7.8	6.3	24.7	89.1	99.9	100.0
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors																
50	11.2	8.5	7.1	6.7	16.5	31.8	49.0	59.1	13.0	9.5	7.3	6.6	13.1	19.8	31.9	39.0
150	7.8	7.0	6.6	5.5	31.1	70.9	91.0	97.9	10.2	8.1	6.6	5.8	11.2	40.6	65.7	84.0
500	10.1	5.7	6.7	5.1	71.9	99.7	99.6	99.4	14.7	7.3	7.6	6.3	27.4	89.0	99.9	100.0

Table A.34: Size(%) and power(%) of weak instruments robust tests ($\gamma = 0.0$) for AR(1) model

| N/T | size ($H_0 : \theta = 0.0$) | | | | power ($H_1 : \theta = -0.1$) | | | | size ($H_0 : \theta = 0.0$) | | | | power ($H_1 : \theta = -0.1$) | | | |
| | $\tau^2 = 1$ | | | | | | | | $\tau^2 = 5$ | | | | | | | |
	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
	Anderson and Rubin test based on moment conditions "DIF1"															
50	25.6	100.0	–	–	27.6	100.0	–	–	26.8	100.0	–	–	27.4	100.0	–	–
150	14.4	66.0	100.0	–	19.4	82.6	100.0	–	19.2	67.8	100.0	–	21.0	80.6	100.0	–
500	23.0	19.2	70.4	100.0	40.6	88.0	99.4	100.0	44.2	21.8	69.4	100.0	60.8	86.6	99.4	100.0
	Anderson and Rubin test based on moment conditions "DIF2"															
50	16.4	44.6	87.0	99.8	19.8	53.0	90.2	99.8	20.2	48.8	87.6	99.6	19.8	50.0	89.2	100.0
150	11.6	15.2	24.0	44.6	17.2	35.0	61.8	83.8	18.0	16.0	25.6	44.2	17.2	25.6	45.6	74.4
500	20.8	10.0	11.6	12.4	35.6	87.8	97.2	99.4	50.0	14.4	13.2	14.8	45.4	48.4	79.2	96.0
	Anderson and Rubin test based on moment conditions "DIF3"															
50	10.4	6.4	8.8	5.8	11.0	20.0	37.4	50.2	10.6	8.8	7.6	6.8	10.8	12.6	17.0	25.0
150	12.4	9.0	8.2	8.2	16.0	46.8	77.0	92.0	23.0	11.2	8.6	8.0	20.6	20.4	37.8	61.0
500	26.0	9.2	6.6	6.0	44.4	97.0	100.0	100.0	61.6	20.8	12.4	9.4	57.0	64.8	91.0	99.0
	Anderson and Rubin test based on moment conditions "SYS1"															
50	42.2	–	–	–	45.8	–	–	–	43.6	–	–	–	47.6	–	–	–
150	18.2	85.0	100.0	–	36.6	95.0	100.0	–	22.0	84.6	100.0	–	42.0	95.8	100.0	–
500	23.8	25.6	80.0	100.0	77.0	96.2	100.0	100.0	42.6	28.4	80.2	100.0	86.0	96.8	100.0	100.0
	Anderson and Rubin test based on moment conditions "SYS2"															
50	26.6	83.6	100.0	–	33.0	92.0	99.8	–	28.8	84.4	100.0	–	36.0	91.2	99.8	–
150	15.4	25.6	48.6	80.0	34.4	55.6	83.2	98.2	20.2	26.0	53.0	81.2	40.0	59.2	83.6	98.4
500	23.6	11.0	16.0	20.6	79.8	94.6	97.8	99.8	45.2	14.4	18.6	21.6	87.2	95.6	97.6	99.8
	Anderson and Rubin test based on moment conditions "SYS3"															
50	13.4	11.4	12.8	8.2	18.0	25.0	39.2	44.4	14.8	10.2	12.0	9.2	16.0	14.4	25.2	28.8
150	14.4	8.2	9.0	7.4	24.8	48.6	76.4	89.6	18.6	9.8	8.6	6.8	20.8	25.2	44.8	66.8
500	23.6	11.8	8.2	5.8	61.8	98.0	100.0	100.0	55.0	17.0	11.4	7.6	61.0	72.6	94.6	99.8
	Lagrange Multiplier test based on moment conditions "DIF1"															
50	16.0	85.0	–	–	13.6	86.4	–	–	16.6	83.4	–	–	16.8	84.4	–	–
150	10.6	21.8	56.4	–	23.0	50.0	94.4	–	8.8	21.0	59.4	–	21.6	45.6	92.4	–
500	14.6	6.0	14.4	29.8	50.4	99.8	100.0	74.2	8.4	6.4	12.8	31.8	42.8	99.8	100.0	72.0
	Lagrange Multiplier test based on moment conditions "DIF2"															
50	13.6	24.6	42.6	59.8	11.6	33.2	69.6	78.4	13.2	27.2	41.0	60.8	10.8	29.0	61.0	75.8
150	10.6	10.4	11.8	21.4	18.4	61.4	82.0	84.4	12.2	10.6	14.8	23.6	6.4	33.0	58.4	73.8
500	15.8	5.8	9.4	9.2	44.0	99.4	100.0	100.0	19.0	7.0	9.6	11.0	8.8	80.8	98.8	100.0
	Lagrange Multiplier test based on moment conditions "DIF3"															
50	8.2	6.0	8.8	7.2	10.4	26.4	47.2	60.8	7.8	7.2	5.4	6.8	9.0	13.8	23.4	32.8
150	8.2	9.8	7.0	8.0	15.2	62.8	86.8	98.2	10.2	8.2	6.4	7.8	7.6	25.4	49.0	71.6
500	16.6	7.2	6.4	6.4	40.4	99.4	100.0	100.0	15.2	8.4	7.0	6.8	8.8	64.0	95.0	99.8
	Lagrange Multiplier test based on moment conditions "SYS1"															
50	22.8	–	–	–	28.0	–	–	–	22.2	–	–	–	24.4	–	–	–
150	9.8	24.4	71.4	–	48.4	56.0	91.4	–	9.0	25.0	70.4	–	49.6	42.6	83.4	–
500	7.0	5.4	16.8	30.6	93.6	100.0	100.0	92.8	5.8	6.2	15.4	29.8	95.6	100.0	99.8	76.2
	Lagrange Multiplier test based on moment conditions "SYS2"															
50	14.4	35.2	72.8	–	24.4	47.4	75.8	–	14.8	38.0	74.8	–	23.8	41.2	76.2	–
150	9.4	10.4	15.4	23.0	47.4	76.4	84.2	66.4	8.8	9.8	15.8	24.4	48.8	75.6	70.6	44.6
500	5.4	3.4	9.2	8.2	93.0	100.0	100.0	100.0	5.6	2.8	8.4	8.0	94.6	100.0	100.0	100.0
	Lagrange Multiplier test based on moment conditions "SYS3"															
50	11.6	8.6	12.6	9.2	16.6	32.8	53.8	64.0	11.4	11.0	10.6	8.4	10.8	22.4	34.8	43.8
150	9.8	9.2	7.4	8.0	32.2	73.6	90.6	98.8	12.0	9.0	7.8	8.2	15.6	42.4	68.6	85.2
500	10.2	5.4	5.8	4.8	72.6	100.0	100.0	100.0	16.6	6.6	8.0	7.0	26.4	88.8	100.0	100.0
	Conditional likelihood ratio test based on moment conditions "DIF1"															
50	22.6	85.4	–	–	24.4	86.4	–	–	25.4	83.4	–	–	27.4	84.2	–	–
150	10.8	29.8	56.4	–	23.2	64.6	94.4	–	9.4	29.6	59.0	–	21.6	59.8	92.4	–
500	14.8	6.4	15.0	41.0	50.4	99.6	100.0	95.0	8.6	6.6	12.6	42.0	42.8	99.8	100.0	96.4
	Conditional likelihood ratio test based on moment conditions "DIF2"															
50	16.4	37.0	46.8	60.4	16.2	43.0	71.6	78.2	17.8	41.8	44.8	61.4	18.2	41.6	65.0	76.0
150	10.8	11.2	12.2	22.0	18.4	61.8	82.4	86.8	12.4	10.6	15.2	24.0	7.2	34.2	58.6	75.2
500	16.2	5.6	9.2	9.2	43.8	99.4	100.0	100.0	19.4	7.4	9.0	11.2	9.6	80.8	99.0	100.0
	Conditional likelihood ratio test based on moment conditions "DIF3"															
50	8.2	5.8	8.8	7.0	11.0	26.6	47.6	60.2	9.0	7.4	5.6	6.8	9.0	13.6	23.8	33.2
150	8.4	9.6	6.6	8.2	15.0	63.0	86.8	98.0	10.8	8.0	6.8	7.8	8.4	25.2	49.4	71.2
500	16.4	7.0	6.4	5.4	40.6	99.4	100.0	100.0	15.8	8.4	7.2	6.6	9.2	64.0	95.0	99.8
	Conditional likelihood ratio test based on moment conditions "SYS1"															
50	32.8	–	–	–	38.4	–	–	–	25.4	–	–	–	28.4	–	–	–
150	10.0	39.2	71.2	–	48.4	68.2	91.4	–	9.2	27.0	70.4	–	50.2	44.6	83.6	–
500	7.2	5.6	16.8	45.6	93.8	100.0	100.0	94.6	6.0	6.4	16.0	31.6	95.6	100.0	99.8	77.2
	Conditional likelihood ratio test based on moment conditions "SYS2"															
50	19.2	37.8	73.0	–	30.2	50.6	75.6	–	17.6	39.0	74.8	–	26.0	41.0	76.0	–
150	10.0	11.0	16.4	31.0	47.6	77.0	85.6	74.4	9.4	10.2	16.2	25.2	49.6	75.6	73.2	46.2
500	5.2	3.6	8.8	8.0	93.2	100.0	100.0	100.0	5.4	2.8	8.6	8.4	94.6	100.0	100.0	100.0
	Conditional likelihood ratio test based on moment conditions "SYS3"															
50	13.2	8.6	13.0	9.6	19.0	33.6	54.6	64.6	13.2	11.0	11.0	8.6	14.6	23.2	35.6	44.6
150	9.8	9.6	7.4	8.0	31.8	73.8	90.6	98.6	12.4	9.0	8.0	8.0	16.2	42.2	68.2	85.2
500	10.4	5.4	5.8	5.0	72.6	100.0	100.0	100.0	17.0	6.4	8.0	6.2	27.0	88.8	100.0	100.0

Table A.35: Mean bias(×100) and RMSE(×100) of γ ($\gamma = 0.4$) for AR(1) model

	bias(×100) $\tau^2 = 1$				RMSE(×100) $\tau^2 = 1$				bias(×100) $\tau^2 = 5$				RMSE(×100) $\tau^2 = 5$			
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Transformed likelihood estimator																
50	1.465	0.151	-0.147	-0.086	13.972	5.559	4.180	3.349	4.013	0.604	-0.086	-0.086	18.529	7.702	4.589	3.349
150	-0.176	-0.210	-0.076	-0.039	6.060	3.041	2.220	1.966	1.823	-0.155	-0.076	-0.039	12.424	3.578	2.220	1.966
500	0.175	-0.020	0.039	-0.033	3.403	1.791	1.274	1.048	0.410	-0.020	0.039	-0.033	5.075	1.791	1.274	1.048
Iterative transformed likelihood estimator																
50	0.899	0.151	-0.147	-0.086	12.337	5.559	4.180	3.349	3.774	0.523	-0.084	-0.086	18.089	7.261	4.607	3.349
150	-0.177	-0.210	-0.076	-0.040	6.059	3.040	2.220	1.966	1.557	-0.208	-0.076	-0.039	11.724	3.045	2.220	1.966
500	0.174	-0.020	0.039	-0.033	3.402	1.791	1.274	1.048	0.304	-0.020	0.039	-0.033	4.033	1.791	1.274	1.048
One-step first-difference GMM estimator based on "DIF1"																
50	-7.426	-5.088	—	—	16.527	8.947	—	—	-10.638	-6.044	—	—	21.304	9.966	—	—
150	-2.762	-2.163	-1.569	—	9.115	4.791	3.337	—	-4.026	-2.467	-1.760	—	11.971	5.346	3.594	—
500	-0.652	-0.647	-0.442	-0.484	5.193	2.556	1.703	1.414	-1.098	-0.773	-0.482	-0.520	6.790	2.828	1.800	1.486
Two-step first-difference GMM estimator based on "DIF1"																
50	-6.797	-4.919	—	—	18.221	19.257	—	—	-11.338	-7.469	—	—	25.014	22.781	—	—
150	-2.362	-1.892	-1.107	—	9.629	5.464	4.991	—	-3.830	-2.360	-1.300	—	12.713	6.247	5.410	—
500	-0.563	-0.570	-0.414	-0.461	5.269	2.734	1.944	1.755	-1.037	-0.724	-0.484	-0.494	6.950	3.048	2.082	1.849
Continuous-updating first-difference GMM estimator based on "DIF1"																
50	0.742	-8.581	—	—	22.269	45.034	—	—	0.469	-12.488	—	—	31.576	48.679	—	—
150	0.285	-0.067	0.604	—	9.945	5.830	7.052	—	0.696	-0.099	0.404	—	13.599	6.737	7.476	—
500	0.291	0.044	0.080	-0.012	5.327	2.726	2.006	1.853	0.363	0.029	0.069	-0.006	7.056	3.030	2.131	1.950
One-step first-difference GMM estimator based on "DIF2"																
50	-6.943	-3.145	-2.545	-1.881	17.587	9.169	6.721	5.338	-14.900	-11.203	-8.367	-6.381	29.374	18.223	13.479	10.662
150	-2.425	-1.480	-0.742	-0.643	9.586	5.101	3.577	3.014	-6.159	-5.314	-3.145	-2.510	17.643	10.854	7.241	5.867
500	-0.490	-0.336	-0.157	-0.193	5.398	2.709	1.871	1.573	-1.381	-1.460	-1.038	-0.766	10.432	5.552	3.768	2.841
Two-step first-difference GMM estimator based on "DIF2"																
50	-6.545	-2.573	-1.308	-0.328	18.715	10.042	8.373	8.639	-15.058	-10.866	-6.310	-4.414	33.048	20.524	15.026	13.311
150	-2.071	-1.062	-0.286	-0.237	9.682	5.147	3.675	3.215	-5.841	-4.550	-2.123	-1.316	17.897	10.926	7.053	5.344
500	-0.500	-0.257	-0.027	-0.086	5.441	2.744	1.895	1.605	-1.590	-1.422	-0.819	-0.541	10.560	5.667	3.664	2.760
Continuous-updating first-difference GMM estimator based on "DIF2"																
50	-0.460	1.153	1.406	2.045	20.551	11.535	10.892	13.155	0.227	-0.633	-0.225	-0.332	37.810	23.594	18.130	19.459
150	0.224	0.338	0.821	0.819	9.789	5.133	3.835	3.428	1.696	0.119	0.863	0.848	20.571	10.353	6.755	5.171
500	0.261	0.172	0.337	0.239	5.460	2.750	1.940	1.624	0.785	0.106	0.226	0.194	10.980	5.577	3.551	2.683
One-step first-difference GMM estimator based on "DIF3"																
50	-2.430	-0.198	-0.379	-0.070	17.022	9.526	6.720	5.296	-13.269	-1.157	-1.534	-1.126	55.928	27.164	17.254	12.999
150	-0.789	-0.495	-0.091	-0.016	9.677	5.355	3.819	3.156	-5.666	-1.733	-0.014	-0.275	33.137	15.649	10.106	7.806
500	-0.119	0.000	0.042	-0.006	5.573	2.915	2.053	1.648	-1.776	-0.239	-0.103	-0.104	17.426	7.989	5.350	4.004
Two-step first-difference GMM estimator based on "DIF3"																
50	-2.465	0.202	-0.062	0.219	17.710	9.513	6.935	5.343	-12.282	0.415	-1.613	-0.586	71.611	29.066	16.694	12.249
150	-0.605	-0.373	0.038	0.065	9.738	5.333	3.858	3.110	-4.810	-1.428	0.103	-0.181	32.364	15.312	9.826	7.339
500	-0.077	0.057	0.069	0.021	5.593	2.920	2.043	1.655	-1.652	-0.187	-0.125	-0.055	17.235	7.851	5.188	3.974
Continuous-updating first-difference GMM estimator based on "DIF3"																
50	-0.341	0.745	0.320	0.431	18.514	9.737	7.044	5.435	-11.841	2.401	-0.203	0.243	55.502	26.898	17.855	12.715
150	0.098	-0.163	0.138	0.135	9.918	5.338	3.871	3.116	-0.702	-0.314	0.567	0.113	34.021	16.149	10.053	7.415
500	0.146	0.122	0.102	0.044	5.609	2.928	2.045	1.656	0.400	0.150	0.040	0.046	18.219	7.929	5.203	3.990

Table A.35(cont.)

N/T	bias(×100) τ²=1				RMSE(×100) τ²=1				bias(×100) τ²=5				RMSE(×100) τ²=5			
	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	1.768	—	—	—	12.468	—	—	—	35.955	—	—	—	39.442	—	—	—
150	0.707	0.288	0.224	—	7.294	4.070	3.044	—	23.825	21.486	18.735	—	27.525	23.207	19.942	—
500	0.402	0.145	0.168	0.018	4.217	2.368	1.645	1.372	11.111	9.431	8.227	7.265	14.752	10.715	8.986	7.822
Two-step system GMM estimator based on "SYS1"																
50	2.053	—	—	—	12.552	—	—	—	34.071	—	—	—	38.495	—	—	—
150	0.317	0.196	0.344	—	6.136	3.948	4.405	—	19.357	17.216	15.728	—	24.401	19.657	17.409	—
500	0.299	0.077	0.081	-0.053	3.370	1.940	1.534	1.421	5.935	4.467	4.263	4.107	9.688	6.039	5.245	4.836
Continuous-updating system GMM estimator based on "SYS1"																
50	1.624	—	—	—	15.115	—	—	—	9.002	—	—	—	24.353	—	—	—
150	-0.075	-0.002	0.138	—	6.376	4.572	6.843	—	0.583	0.084	0.113	—	8.035	5.133	7.189	—
500	0.233	0.067	0.066	-0.069	3.362	1.955	1.636	1.557	0.303	0.080	0.056	-0.063	3.518	1.975	1.640	1.553
One-step system GMM estimator based on "SYS2"																
50	2.533	2.981	2.743	—	12.703	8.353	6.627	—	38.372	39.789	39.698	—	41.566	41.084	40.771	—
150	1.006	0.923	0.999	1.017	7.334	4.409	3.528	3.060	26.061	27.854	26.776	26.352	29.786	29.421	27.915	27.337
500	0.505	0.384	0.423	0.292	4.201	2.481	1.829	1.577	12.501	13.679	13.236	12.345	16.468	15.101	14.176	13.058
Two-step system GMM estimator based on "SYS2"																
50	1.788	1.995	1.789	—	12.385	9.057	9.895	—	35.231	35.769	36.479	—	39.507	37.909	38.231	—
150	0.241	0.276	0.394	0.325	6.274	4.253	3.586	3.262	20.743	21.047	20.127	19.949	25.780	23.463	21.934	21.473
500	0.208	0.121	0.202	0.063	3.422	2.293	1.759	1.522	6.718	6.341	6.172	5.609	10.796	8.207	7.471	6.595
Continuous-updating system GMM estimator based on "SYS2"																
50	0.509	0.312	0.354	—	14.407	13.117	20.616	—	9.505	3.615	6.606	—	23.966	17.974	34.380	—
150	-0.311	-0.238	-0.199	-0.260	6.452	4.409	3.752	3.548	1.248	-0.113	-0.154	-0.233	9.963	4.698	3.772	3.541
500	0.088	-0.035	0.064	-0.080	3.429	2.304	1.760	1.529	0.170	-0.027	0.067	-0.063	3.566	2.336	1.777	1.537
One-step system GMM estimator based on "SYS3"																
50	-0.236	-0.033	-0.170	0.050	12.300	7.509	5.529	4.460	24.383	1.764	0.099	0.038	37.787	20.089	14.285	10.580
150	-0.225	-0.049	-0.032	0.037	7.533	4.163	3.082	2.614	10.579	0.133	-0.182	-0.009	24.217	12.586	8.638	6.492
500	0.019	0.023	0.077	-0.005	4.235	2.359	1.690	1.408	0.740	-0.162	-0.007	-0.119	14.898	7.770	4.878	3.647
Two-step system GMM estimator based on "SYS3"																
50	1.295	0.950	0.638	0.697	12.866	7.574	5.788	4.704	20.760	4.593	2.121	1.638	37.668	16.754	10.717	8.046
150	0.675	0.408	0.225	0.266	7.115	4.159	3.117	2.601	8.154	2.145	0.959	0.703	19.905	8.528	6.106	4.751
500	0.338	0.190	0.187	0.061	4.136	2.328	1.695	1.417	1.235	0.827	0.516	0.189	8.900	4.882	3.297	2.604
Continuous-updating system GMM estimator based on "SYS3"																
50	0.653	0.805	0.704	0.736	14.181	7.848	6.019	4.829	1.116	0.717	0.511	0.577	31.893	15.168	10.737	7.962
150	0.305	0.377	0.214	0.271	7.329	4.220	3.140	2.613	0.616	0.327	0.116	0.246	16.826	8.042	6.077	4.732
500	0.181	0.171	0.183	0.059	4.168	2.338	1.699	1.421	-0.696	0.077	0.203	0.009	8.484	4.811	3.262	2.616

Table A.36: Median bias(×100) and MAE(×100) of γ ($\gamma = 0.4$) for AR(1) model

	$\tau^2 = 1$ median bias(×100)				$\tau^2 = 1$ MAE(×100)				$\tau^2 = 5$ median bias(×100)				$\tau^2 = 5$ MAE(×100)			
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Transformed likelihood estimator																
50	-0.360	0.286	-0.107	-0.135	7.148	3.666	2.791	2.286	0.121	0.301	-0.091	-0.135	7.522	3.713	2.804	2.286
150	-0.268	-0.133	-0.017	-0.071	4.340	1.992	1.454	1.304	-0.088	-0.133	-0.017	-0.071	4.472	1.992	1.454	1.304
500	0.020	0.002	0.059	-0.045	2.283	1.240	0.876	0.697	0.033	0.002	0.059	-0.045	2.298	1.240	0.876	0.697
Iterative transformed likelihood estimator																
50	-0.360	0.286	-0.108	-0.134	7.084	3.664	2.791	2.286	0.153	0.312	-0.091	-0.135	7.584	3.731	2.806	2.286
150	-0.268	-0.131	-0.019	-0.071	4.349	1.992	1.453	1.303	-0.099	-0.132	-0.019	-0.071	4.450	1.991	1.456	1.303
500	0.011	0.006	0.061	-0.044	2.290	1.240	0.876	0.698	0.039	0.005	0.060	-0.043	2.292	1.239	0.875	0.699
One-step first-difference GMM estimator based on "DIF1"																
50	-7.344	-4.580	—	—	10.924	5.950	—	—	-11.500	-5.868	—	—	15.141	6.735	—	—
150	-3.011	-2.161	-1.471	—	6.397	3.146	2.191	—	-4.175	-2.407	-1.706	—	8.280	3.406	2.422	—
500	-0.663	-0.745	-0.438	-0.518	3.563	1.690	1.124	0.966	-0.973	-0.812	-0.470	-0.519	4.419	1.898	1.191	1.003
Two-step first-difference GMM estimator based on "DIF1"																
50	-6.332	-5.636	—	—	12.778	12.400	—	—	-11.319	-7.262	—	—	17.185	13.581	—	—
150	-2.247	-1.601	-1.083	—	6.197	3.684	3.539	—	-4.086	-2.183	-1.208	—	8.468	4.105	3.730	—
500	-0.546	-0.591	-0.373	-0.408	3.613	1.889	1.342	1.117	-1.118	-0.768	-0.444	-0.465	4.699	2.066	1.374	1.173
Continuous-updating first-difference GMM estimator based on "DIF1"																
50	1.083	-1.054	—	—	14.484	20.958	—	—	0.445	-5.377	—	—	19.998	24.265	—	—
150	0.576	-0.155	0.711	—	6.560	3.952	4.699	—	0.650	-0.165	0.712	—	9.188	4.705	4.946	—
500	0.371	0.045	0.032	0.028	3.588	1.763	1.331	1.206	0.324	-0.027	0.057	0.013	4.682	1.980	1.439	1.264
One-step first-difference GMM estimator based on "DIF2"																
50	-7.230	-2.561	-2.709	-1.777	11.683	6.174	4.711	3.574	-16.953	-11.360	-8.042	-5.812	21.862	12.651	9.452	6.945
150	-2.548	-1.288	-0.716	-0.540	6.455	3.323	2.433	1.918	-7.222	-5.031	-3.083	-2.090	12.886	7.155	4.838	3.691
500	-0.729	-0.318	-0.122	-0.213	3.730	1.741	1.283	1.082	-2.076	-1.726	-1.052	-0.853	7.010	3.852	2.609	1.975
Two-step first-difference GMM estimator based on "DIF2"																
50	-6.103	-2.285	-1.420	-0.266	12.796	6.449	5.812	5.823	-17.827	-10.196	-6.205	-3.936	24.092	13.807	9.906	8.750
150	-1.910	-0.903	-0.171	-0.117	6.607	3.503	2.561	2.125	-6.639	-4.260	-1.822	-1.088	13.236	7.352	4.299	3.463
500	-0.635	-0.218	-0.060	-0.152	3.726	1.790	1.274	1.132	-2.225	-1.623	-0.767	-0.586	7.136	3.894	2.594	1.921
Continuous-updating first-difference GMM estimator based on "DIF2"																
50	-0.067	1.351	1.535	2.964	13.193	7.403	6.989	7.974	-2.289	-0.073	2.029	1.684	28.853	15.678	12.250	11.371
150	0.402	0.431	0.870	0.925	6.701	3.484	2.622	2.485	0.356	0.455	1.282	1.117	14.059	7.029	4.623	3.483
500	0.040	0.245	0.294	0.187	3.819	1.837	1.268	1.086	0.269	0.060	0.203	0.182	7.375	3.750	2.363	1.786
One-step first-difference GMM estimator based on "DIF3"																
50	-2.754	0.013	-0.518	0.050	11.081	6.324	4.638	3.427	-15.984	-1.334	-0.666	-0.657	30.598	15.376	10.573	7.991
150	-0.968	-0.453	0.078	0.034	6.706	3.361	2.551	2.018	-6.143	-1.431	0.107	-0.270	19.631	10.303	6.844	5.043
500	-0.133	0.005	0.107	-0.022	3.938	1.925	1.337	1.130	-2.529	-0.446	-0.069	-0.287	11.773	5.345	3.458	2.691
Two-step first-difference GMM estimator based on "DIF3"																
50	-2.856	0.499	-0.171	0.482	11.899	6.398	4.684	3.324	-14.948	-0.847	-1.356	-0.109	31.675	14.638	10.509	7.634
150	-0.580	-0.280	0.229	0.156	6.798	3.335	2.561	2.005	-5.195	-1.153	0.223	0.106	19.244	9.812	6.412	4.681
500	-0.167	0.121	0.153	0.051	3.881	1.907	1.350	1.119	-2.366	-0.209	-0.061	-0.089	12.035	5.146	3.388	2.642
Continuous-updating first-difference GMM estimator based on "DIF3"																
50	-1.074	0.984	0.233	0.734	12.107	6.573	4.726	3.395	-7.372	1.999	-0.204	0.698	37.460	15.947	10.764	7.779
150	0.033	-0.036	0.271	0.208	6.945	3.378	2.536	2.025	0.083	0.334	0.513	0.447	21.581	10.056	6.540	4.666
500	0.008	0.192	0.168	0.071	3.885	1.931	1.367	1.120	-0.424	0.066	0.053	0.004	12.123	5.240	3.408	2.696

Table A.36(cont.)

N/T	median bias(×100) τ²=1 5	10	15	20	MAE(×100) τ²=1 5	10	15	20	median bias(×100) τ²=5 5	10	15	20	MAE(×100) τ²=5 5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	1.694	–	–	–	8.378	–	–	–	38.153	–	–	–	38.153	–	–	–
150	0.645	0.229	0.208	–	4.883	2.642	2.179	–	25.280	21.310	18.390	–	25.301	21.310	18.390	–
500	0.298	0.215	0.149	-0.015	2.880	1.527	1.069	0.897	11.694	9.022	8.011	7.046	12.045	9.022	8.011	7.046
Two-step system GMM estimator based on "SYS1"																
50	1.877	–	–	–	8.336	–	–	–	36.822	–	–	–	36.867	–	–	–
150	0.472	0.150	0.246	–	4.260	2.692	2.993	–	19.057	16.583	15.160	–	19.057	16.583	15.160	–
500	0.104	0.028	0.059	-0.058	2.296	1.341	1.045	0.941	4.511	3.937	3.968	3.830	5.019	3.951	3.973	3.830
Continuous-updating system GMM estimator based on "SYS1"																
50	1.531	–	–	–	9.748	–	–	–	6.051	–	–	–	12.470	–	–	–
150	-0.220	0.049	0.311	–	4.419	3.303	4.414	–	-0.267	0.055	0.355	–	4.826	3.296	4.267	–
500	0.069	0.008	0.067	-0.061	2.303	1.364	1.075	1.051	0.131	0.023	0.021	-0.065	2.287	1.331	1.067	1.054
One-step system GMM estimator based on "SYS2"																
50	2.241	3.216	2.477	–	8.479	5.620	4.282	–	40.852	41.051	40.739	–	40.852	41.051	40.739	–
150	1.047	0.862	1.047	1.170	4.948	2.817	2.439	2.063	27.590	28.270	26.976	26.619	27.621	28.270	26.976	26.619
500	0.458	0.414	0.390	0.281	2.819	1.654	1.188	1.037	13.344	13.208	13.080	12.126	13.785	13.208	13.080	12.126
Two-step system GMM estimator based on "SYS2"																
50	1.768	2.085	1.950	–	8.312	6.223	6.423	–	38.154	37.688	37.706	–	38.154	37.688	37.706	–
150	0.328	0.185	0.476	0.343	4.332	2.813	2.464	2.211	21.143	20.728	19.912	19.659	21.143	20.728	19.912	19.659
500	0.038	0.074	0.216	0.094	2.335	1.558	1.173	1.012	5.238	5.691	5.693	5.148	5.650	5.691	5.693	5.148
Continuous-updating system GMM estimator based on "SYS2"																
50	-0.086	-0.203	0.297	–	9.728	7.915	10.453	–	4.362	1.076	4.229	–	11.820	8.617	16.382	–
150	-0.365	-0.223	-0.185	-0.136	4.473	3.008	2.541	2.443	0.024	-0.210	-0.263	-0.165	4.736	3.005	2.465	2.499
500	-0.055	-0.091	0.087	-0.057	2.424	1.500	1.143	1.023	-0.008	-0.133	0.072	-0.024	2.372	1.496	1.155	0.994
One-step system GMM estimator based on "SYS3"																
50	0.571	0.536	0.023	0.127	8.721	5.104	3.900	3.179	25.199	3.427	1.264	0.512	27.965	12.711	9.309	6.773
150	-0.152	0.113	0.098	0.130	4.877	2.660	2.131	1.758	11.474	1.198	0.646	0.328	15.940	8.962	5.697	4.298
500	-0.018	0.080	0.090	0.003	2.678	1.505	1.089	0.958	2.395	0.431	0.008	-0.001	10.306	5.153	3.181	2.541
Two-step system GMM estimator based on "SYS3"																
50	1.728	1.194	0.918	0.740	9.225	5.095	4.053	3.354	21.150	5.561	2.493	1.696	24.931	10.336	7.001	5.235
150	0.834	0.614	0.348	0.333	4.562	2.671	2.175	1.736	7.616	2.405	1.108	0.788	11.722	5.990	4.126	3.233
500	0.357	0.295	0.207	0.102	2.690	1.532	1.101	0.927	1.492	1.219	0.523	0.225	5.828	3.568	2.167	1.743
Continuous-updating system GMM estimator based on "SYS3"																
50	1.273	0.787	0.994	0.663	9.880	5.361	4.159	3.426	3.769	2.194	1.188	0.622	20.425	9.806	7.045	4.983
150	0.446	0.542	0.363	0.351	4.675	2.757	2.183	1.747	-0.046	0.643	0.390	0.257	9.706	5.558	4.170	3.304
500	0.188	0.261	0.194	0.109	2.843	1.552	1.129	0.933	-0.714	0.511	0.199	0.014	5.579	3.414	2.179	1.726

Table A.37: Size(%) and power(%) of γ ($\gamma = 0.4$) for AR(1) model

| | size ($H_0 : \gamma = 0.4$) | | | | power ($H_1 : \gamma = 0.3$) | | | | size ($H_0 : \gamma = 0.4$) | | | | power ($H_1 : \gamma = 0.3$) | | | |
| | $\tau^2 = 1$ | | | | | | | | $\tau^2 = 5$ | | | | | | | |
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
						Transformed likelihood estimator										
50	7.8	6.9	7.2	6.7	24.1	47.7	70.1	85.7	10.5	7.4	7.3	6.7	26.1	48.1	70.1	85.7
150	5.0	4.7	4.2	5.8	42.4	90.3	99.6	99.8	7.9	4.8	4.2	5.8	43.7	90.4	99.6	99.8
500	5.1	5.3	5.0	4.7	81.4	100.0	100.0	100.0	5.5	5.3	5.0	4.7	81.5	100.0	100.0	100.0
						Iterative transformed likelihood estimator										
50	6.3	6.9	7.2	6.7	22.7	47.6	70.1	85.7	10.3	7.5	7.3	6.7	25.9	47.9	70.1	85.7
150	5.0	4.7	4.2	5.8	42.4	90.3	99.6	99.8	7.7	4.8	4.3	5.8	43.7	90.3	99.6	99.8
500	5.1	5.2	5.0	4.7	81.4	100.0	100.0	100.0	5.4	5.2	5.0	4.7	81.4	100.0	100.0	100.0
						One-step first-difference GMM estimator based on "DIF1"										
50	9.5	14.1	—	—	26.2	57.2	—	—	12.3	15.8	—	—	27.6	54.4	—	—
150	6.0	7.3	7.8	—	31.6	82.9	97.6	—	7.4	8.5	8.5	—	27.2	76.6	97.1	—
500	5.8	6.1	5.3	6.1	56.3	99.3	100.0	100.0	6.9	6.1	5.0	6.3	40.1	97.8	100.0	100.0
						Two-step first-difference GMM estimator based on "DIF1"										
50	24.8	87.6	—	—	40.3	92.0	—	—	29.1	88.5	—	—	42.6	91.3	—	—
150	10.5	27.2	62.0	—	36.5	86.9	96.4	—	10.7	29.5	61.7	—	31.5	82.9	95.3	—
500	7.0	10.2	15.6	28.9	56.4	98.8	100.0	100.0	8.5	10.7	15.8	28.4	42.3	97.8	100.0	100.0
						Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors										
50	7.7	3.1	—	—	18.9	3.3	—	—	10.1	1.8	—	—	18.9	2.9	—	—
150	5.8	4.1	0.2	—	28.5	58.5	12.4	—	7.0	5.5	0.2	—	23.9	52.4	10.4	—
500	5.9	6.5	4.4	4.6	53.9	98.1	100.0	100.0	7.0	5.8	5.2	4.7	38.1	95.7	100.0	100.0
						Continuous-updating first-difference GMM estimator based on "DIF1"										
50	30.8	92.3	—	—	35.0	92.2	—	—	35.3	92.2	—	—	37.2	92.9	—	—
150	10.4	30.2	71.0	—	28.0	75.6	90.1	—	11.7	31.1	71.2	—	22.7	69.1	87.5	—
500	7.1	11.8	16.6	31.7	51.2	98.0	100.0	100.0	7.6	11.3	16.6	32.7	35.9	95.3	100.0	100.0
						Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors										
50	10.1	31.3	—	—	16.5	33.6	—	—	13.7	34.6	—	—	18.8	37.1	—	—
150	6.0	6.3	8.4	—	20.4	43.6	31.7	—	6.4	6.5	9.0	—	16.6	36.7	27.5	—
500	6.4	6.4	5.3	6.3	47.2	96.1	99.6	100.0	6.4	6.1	5.6	6.2	30.9	91.8	99.8	99.9
						One-step first-difference GMM estimator based on "DIF2"										
50	7.9	8.9	7.9	7.0	21.8	36.9	54.4	67.0	15.5	13.6	13.3	13.2	26.0	35.7	44.1	55.2
150	5.5	6.1	5.9	6.9	27.9	67.3	86.9	96.0	8.2	9.8	7.4	9.2	22.9	37.1	54.2	73.1
500	6.1	5.8	4.8	4.1	53.0	97.2	100.0	100.0	6.3	5.6	5.2	4.5	23.5	55.7	86.6	98.3
						Two-step first-difference GMM estimator based on "DIF2"										
50	19.4	27.1	45.2	66.4	33.7	56.5	72.2	81.4	28.3	40.1	52.7	66.9	36.9	58.1	70.8	82.2
150	7.7	11.4	12.8	16.6	31.6	72.0	89.7	96.1	10.5	17.4	17.0	19.7	25.4	45.9	63.9	82.0
500	6.7	7.1	5.7	7.0	53.5	97.3	100.0	100.0	6.8	8.4	6.7	7.8	27.3	59.3	90.2	98.0
						Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors										
50	7.8	5.8	3.4	1.6	19.4	22.2	18.2	4.6	13.1	8.3	2.3	1.2	21.9	17.4	9.0	3.0
150	4.9	5.9	4.5	4.3	26.7	58.3	78.2	88.5	8.2	7.1	6.0	5.7	17.4	30.0	41.4	58.3
500	6.2	5.6	4.3	4.6	51.1	97.1	99.9	100.0	6.5	6.2	4.5	4.9	24.4	55.8	86.6	97.5
						Continuous-updating first-difference GMM estimator based on "DIF2"										
50	21.5	34.8	54.0	75.0	27.9	45.8	64.5	78.9	26.5	46.3	60.3	75.2	30.4	47.6	60.4	77.0
150	7.8	12.0	14.4	19.3	25.4	60.9	82.3	92.8	11.4	15.9	16.4	20.9	18.0	29.2	45.3	69.6
500	6.7	6.9	6.1	7.6	48.6	96.9	99.9	100.0	6.9	8.6	6.5	8.3	21.3	49.2	83.4	97.3
						Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors										
50	9.3	8.9	9.8	14.3	15.9	16.5	20.3	21.3	13.9	16.9	15.8	19.1	19.0	18.1	19.6	22.4
150	5.1	5.3	4.9	6.0	19.1	46.2	66.2	76.3	7.2	7.3	7.4	6.6	13.5	16.5	24.5	41.9
500	5.9	5.6	4.4	4.6	45.5	96.1	99.8	99.9	5.9	6.3	4.5	5.5	18.6	43.8	77.2	96.1
						One-step first-difference GMM estimator based on "DIF3"										
50	5.9	6.8	6.0	5.9	14.8	24.0	38.7	48.5	7.7	6.6	5.6	5.6	12.5	12.2	13.7	18.4
150	4.5	5.8	6.0	5.8	22.3	51.7	76.0	90.4	4.9	6.0	5.8	5.4	10.9	16.2	21.6	32.9
500	5.5	5.0	4.2	4.0	48.0	92.1	99.9	100.0	5.4	4.0	4.1	3.3	11.8	26.5	47.1	68.6
						Two-step first-difference GMM estimator based on "DIF3"										
50	8.6	8.8	7.3	7.6	19.3	26.6	39.5	48.5	16.6	8.9	8.6	7.8	21.2	14.2	18.2	20.2
150	5.2	6.5	6.4	5.6	24.0	52.4	76.3	90.9	7.1	6.8	6.1	5.9	12.0	17.1	23.2	33.9
500	5.9	4.9	4.9	4.2	47.9	92.4	99.9	100.0	5.5	4.9	4.3	4.2	12.0	27.6	49.6	70.9
						Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors										
50	6.5	6.8	6.0	6.2	15.3	24.0	35.8	43.8	12.7	7.5	7.1	6.7	15.9	12.2	14.3	17.3
150	4.7	6.1	5.9	5.4	22.0	50.7	75.3	89.9	7.0	5.6	5.5	5.1	12.4	15.4	21.4	32.8
500	6.0	5.0	4.6	4.1	47.5	92.3	99.9	100.0	5.7	4.7	4.2	3.8	12.3	26.9	48.4	70.2
						Continuous-updating first-difference GMM estimator based on "DIF3"										
50	9.1	8.6	8.1	7.8	17.9	25.8	38.0	46.2	16.2	10.5	8.9	7.9	19.6	13.5	17.0	18.7
150	5.3	6.8	6.6	5.6	22.2	51.2	75.5	90.2	8.2	7.2	6.3	6.0	12.3	16.2	21.6	33.2
500	5.9	4.8	4.4	4.1	47.1	92.4	99.9	100.0	6.0	5.0	4.5	3.9	11.3	26.1	47.8	69.4
						Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors										
50	7.2	7.3	6.1	6.6	14.5	22.5	34.8	41.5	15.0	8.8	8.3	7.1	19.0	12.9	15.3	17.4
150	5.3	6.6	5.5	5.2	20.1	47.3	73.7	89.0	10.1	6.4	5.6	5.6	13.4	15.0	20.4	29.9
500	6.2	5.1	4.2	4.1	45.9	91.4	98.6	99.4	6.1	4.5	4.7	3.9	13.1	25.7	46.5	69.1

N/T	size ($H_0 : \gamma = 0.4$)				power ($H_1 : \gamma = 0.3$)				size ($H_0 : \gamma = 0.4$)				power ($H_1 : \gamma = 0.3$)			
	$\tau^2 = 1$								$\tau^2 = 5$							
	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	9.4	–	–	–	12.7	–	–	–	73.9	–	–	–	60.4	–	–	–
150	5.6	5.1	4.8	–	25.8	67.8	90.2	–	56.1	79.9	87.8	–	36.8	40.0	36.2	–
500	5.9	5.6	4.8	5.0	65.1	99.0	100.0	100.0	31.5	56.4	73.6	83.3	10.3	10.7	16.6	28.8
Two-step system GMM estimator based on "SYS1"																
50	32.7	–	–	–	44.0	–	–	–	89.7	–	–	–	84.8	–	–	–
150	12.2	31.4	72.9	–	47.7	92.0	97.1	–	74.8	94.8	98.9	–	65.1	80.5	92.0	–
500	8.2	12.0	19.1	33.7	85.2	100.0	100.0	100.0	45.0	67.3	82.8	90.3	59.9	88.3	94.3	97.8
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors																
50	6.5	–	–	–	11.4	–	–	–	49.6	–	–	–	39.0	–	–	–
150	4.0	1.7	0.0	–	34.6	53.5	1.0	–	38.3	41.4	13.2	–	25.1	20.6	6.0	–
500	5.5	5.3	4.9	1.2	81.9	100.0	100.0	100.0	18.1	26.6	28.1	16.1	30.8	53.8	59.0	50.8
Continuous-updating system GMM estimator based on "SYS1"																
50	41.2	–	–	–	50.2	–	–	–	69.3	–	–	–	71.1	–	–	–
150	12.8	39.0	81.1	–	52.6	90.8	94.2	–	30.0	59.9	89.6	–	64.3	94.6	97.0	–
500	7.7	11.6	21.3	38.2	86.1	100.0	100.0	100.0	12.5	21.2	33.7	49.8	84.0	100.0	100.0	100.0
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors																
50	16.2	–	–	–	21.2	–	–	–	23.6	–	–	–	30.0	–	–	–
150	6.1	7.5	7.9	–	37.6	62.3	35.4	–	5.2	7.1	10.2	–	36.7	63.6	37.3	–
500	6.0	5.9	7.5	5.3	82.1	100.0	100.0	100.0	5.3	5.8	7.9	5.5	76.9	100.0	100.0	100.0
One-step system GMM estimator based on "SYS2"																
50	9.5	11.5	8.8	–	11.0	21.0	29.0	–	76.6	93.6	97.8	–	64.0	83.1	89.7	–
150	6.3	5.4	5.6	7.9	24.4	57.1	76.8	88.4	59.9	86.5	94.5	98.4	42.1	60.5	68.7	74.0
500	5.9	6.2	4.8	5.5	64.4	97.6	99.9	100.0	34.8	65.6	84.6	92.5	12.6	15.8	17.1	15.6
Two-step system GMM estimator based on "SYS2"																
50	27.3	50.5	76.1	–	38.9	62.5	84.2	–	89.8	98.3	99.7	–	84.4	95.2	99.1	–
150	10.3	15.9	22.1	28.8	45.8	80.7	93.1	96.9	75.6	94.7	97.9	99.4	65.2	79.8	82.3	86.0
500	6.3	8.7	7.7	9.7	83.7	99.6	100.0	100.0	46.6	70.1	80.4	85.2	58.0	70.6	76.3	84.0
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors																
50	8.1	2.7	1.7	–	13.2	8.5	2.6	–	63.8	54.3	14.2	–	53.3	42.6	9.9	–
150	4.6	4.4	5.0	2.4	33.8	59.7	73.0	77.6	46.4	74.6	82.7	84.5	34.6	48.7	53.0	51.4
500	4.9	5.5	4.6	4.6	80.2	99.2	100.0	100.0	20.5	41.9	54.9	59.8	30.1	37.2	46.1	55.5
Continuous-updating system GMM estimator based on "SYS2"																
50	34.0	59.6	86.3	–	44.6	73.6	88.8	–	61.5	79.1	94.6	–	71.7	87.7	96.6	–
150	11.4	17.0	22.8	33.4	50.7	82.2	93.4	96.7	30.0	37.1	44.9	56.5	65.5	90.6	97.7	98.6
500	6.2	9.5	8.5	10.0	84.5	99.5	100.0	100.0	11.3	16.8	14.9	18.0	83.2	99.9	100.0	100.0
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors																
50	14.2	16.1	26.4	–	23.2	26.1	35.0	–	24.1	18.8	37.4	–	31.2	28.9	41.0	–
150	5.5	5.0	5.9	5.2	39.2	62.7	77.4	82.6	7.6	6.3	5.9	5.4	39.4	62.3	76.5	81.2
500	4.7	5.9	5.0	5.0	81.7	99.1	100.0	99.7	4.2	6.7	4.4	5.4	76.4	98.9	100.0	100.0
One-step system GMM estimator based on "SYS3"																
50	6.8	7.5	5.5	5.3	12.8	31.0	46.4	60.6	39.9	12.8	8.9	8.1	29.2	6.4	6.8	11.1
150	6.5	4.9	4.6	5.1	24.3	67.5	90.9	96.8	21.9	9.1	6.6	6.4	13.9	3.8	13.9	33.2
500	5.9	5.5	4.9	4.5	68.1	98.8	100.0	100.0	9.6	5.8	6.1	5.1	2.9	17.0	55.1	83.8
Two-step system GMM estimator based on "SYS3"																
50	16.2	13.1	10.4	9.9	21.5	34.0	48.3	61.1	49.8	22.3	18.0	14.1	41.1	20.0	23.4	29.5
150	8.5	6.9	6.2	6.0	26.8	68.7	90.5	97.1	25.7	11.4	8.6	8.8	20.4	20.6	36.9	57.3
500	7.5	6.7	6.0	4.8	69.5	98.9	100.0	100.0	12.5	6.5	6.1	4.9	24.4	47.8	83.2	97.4
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors																
50	8.5	8.9	7.2	6.2	13.4	25.3	40.8	52.0	23.8	12.4	9.5	8.5	18.7	9.4	13.0	19.2
150	6.5	5.4	5.2	5.0	23.4	64.4	88.7	96.2	10.1	7.4	7.0	6.7	5.7	14.3	32.8	52.4
500	7.1	6.3	5.5	4.3	68.8	98.9	100.0	100.0	6.9	5.8	5.8	4.2	13.1	44.6	82.2	96.8
Continuous-updating system GMM estimator based on "SYS3"																
50	20.0	14.1	12.8	11.5	26.4	35.8	48.1	61.0	37.8	20.3	16.2	13.5	37.9	23.7	26.6	32.8
150	9.4	7.5	6.8	6.3	30.2	68.5	90.5	97.0	18.1	8.3	8.1	7.9	19.4	25.4	42.4	60.3
500	8.3	6.6	5.7	4.9	70.6	98.9	100.0	100.0	9.0	6.0	5.6	4.8	29.1	53.4	85.4	97.8
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors																
50	14.2	9.3	7.2	6.0	18.5	27.7	40.2	52.1	27.1	15.0	11.0	9.2	24.4	17.6	19.1	23.8
150	8.1	6.3	4.9	5.0	26.1	62.4	88.3	96.1	10.7	6.0	6.6	6.5	12.5	21.5	39.1	55.9
500	7.5	6.3	5.3	4.4	68.7	98.6	99.5	99.8	6.7	5.9	5.5	4.6	25.7	51.0	84.4	96.9

Table A.38: Size(%) and power(%) of weak instruments robust tests ($\gamma = 0.4$) for AR(1) model

| | size ($H_0: \theta = 0.4$) | | | | power ($H_1: \theta = 0.3$) | | | | size ($H_0: \theta = 0.4$) | | | | power ($H_1: \theta = 0.3$) | | | |
| | $\tau^2 = 1$ | | | | | | | | $\tau^2 = 5$ | | | | | | | |
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Anderson and Rubin test based on moment conditions "DIF1"																
50	20.2	100.0	–	–	22.3	100.0	–	–	20.0	100.0	–	–	20.2	100.0	–	–
150	8.1	63.7	100.0	–	14.0	79.8	100.0	–	8.1	63.9	100.0	–	11.6	77.4	100.0	–
500	5.8	16.1	66.4	99.9	23.3	70.4	99.0	100.0	5.8	16.7	66.2	99.8	14.5	61.6	97.9	100.0
Anderson and Rubin test based on moment conditions "DIF2"																
50	12.8	45.1	87.1	99.1	15.1	50.9	90.5	99.5	13.1	45.3	87.8	99.8	12.9	48.4	89.0	99.7
150	6.3	13.5	22.1	40.5	12.5	32.2	53.2	76.9	7.2	13.1	21.5	42.6	8.2	18.6	32.3	60.8
500	4.7	7.0	7.8	9.2	24.9	66.9	90.6	97.2	5.0	6.0	8.3	9.6	9.0	16.6	39.9	65.9
Anderson and Rubin test based on moment conditions "DIF3"																
50	7.8	7.8	8.1	7.2	11.5	17.8	28.9	35.1	5.3	6.2	7.4	5.4	6.0	7.3	10.4	12.4
150	6.2	6.2	4.0	5.5	12.4	34.4	59.4	79.3	4.8	7.0	5.1	4.9	5.8	9.8	12.9	20.1
500	4.4	5.2	4.3	3.9	31.2	82.3	98.5	100.0	4.5	5.0	4.2	5.5	6.6	14.6	31.5	52.2
Anderson and Rubin test based on moment conditions "SYS1"																
50	40.4	–	–	–	44.4	–	–	–	40.0	–	–	–	44.2	–	–	–
150	10.8	83.6	100.0	–	26.0	95.7	100.0	–	10.9	83.6	100.0	–	23.1	94.6	100.0	–
500	5.5	20.3	78.7	100.0	46.8	93.2	100.0	100.0	5.8	19.6	78.7	100.0	39.5	91.7	100.0	100.0
Anderson and Rubin test based on moment conditions "SYS2"																
50	23.7	86.2	100.0	–	29.5	89.1	100.0	–	26.0	84.9	100.0	–	29.6	87.8	100.0	–
150	9.1	23.8	49.1	81.3	24.9	54.7	80.9	96.5	9.2	23.3	46.6	81.6	22.7	52.3	79.1	95.8
500	5.8	7.5	13.5	17.5	48.0	81.4	95.7	98.8	5.8	7.3	13.8	18.1	42.4	78.8	94.5	98.7
Anderson and Rubin test based on moment conditions "SYS3"																
50	11.3	10.1	11.2	10.8	15.5	24.1	35.5	42.4	9.8	10.7	10.1	7.8	11.6	12.9	18.0	18.7
150	6.8	7.2	5.1	7.4	18.8	43.9	71.1	86.6	6.7	5.6	6.0	5.8	9.5	14.4	24.3	35.7
500	4.9	6.3	5.0	5.0	44.3	94.4	99.8	100.0	3.8	5.0	5.1	5.6	13.7	32.4	62.5	86.9
Lagrange Multiplier test based on moment conditions "DIF1"																
50	16.6	85.1	–	–	15.9	87.8	–	–	17.0	87.2	–	–	17.2	87.6	–	–
150	6.8	23.8	60.2	–	20.7	42.8	89.8	–	7.0	24.5	58.3	–	14.9	36.0	89.0	–
500	6.2	9.2	13.6	36.2	47.4	97.8	99.8	73.8	6.8	9.3	12.6	35.6	30.1	93.9	99.9	72.8
Lagrange Multiplier test based on moment conditions "DIF2"																
50	11.8	28.3	45.2	61.7	11.7	32.3	68.8	76.0	12.4	29.7	45.3	62.4	11.5	30.0	56.2	74.0
150	5.3	8.7	12.7	17.0	19.5	53.8	74.8	80.4	5.8	8.5	12.5	18.5	8.9	17.1	33.2	51.2
500	6.2	6.3	5.9	6.3	46.3	96.6	99.9	100.0	5.7	6.8	5.3	6.5	15.3	45.9	82.1	97.3
Lagrange Multiplier test based on moment conditions "DIF3"																
50	7.3	9.0	7.6	6.8	11.8	22.4	36.1	44.9	6.5	7.1	6.2	6.9	8.0	9.2	12.7	16.5
150	5.3	6.5	5.8	5.7	18.3	49.3	75.2	90.1	5.9	5.7	6.1	5.8	7.3	13.2	19.4	29.8
500	6.2	4.9	4.5	4.2	45.2	92.4	99.8	100.0	4.9	4.6	4.7	4.0	10.0	24.7	46.0	68.9
Lagrange Multiplier test based on moment conditions "SYS1"																
50	18.9	–	–	–	23.9	–	–	–	20.9	–	–	–	24.1	–	–	–
150	7.9	25.1	70.6	–	41.2	52.5	91.9	–	9.1	26.7	70.9	–	35.9	37.3	78.9	–
500	6.5	8.6	15.7	30.9	83.6	100.0	100.0	87.7	5.9	9.1	16.8	31.8	76.8	100.0	98.4	60.1
Lagrange Multiplier test based on moment conditions "SYS2"																
50	16.1	37.2	72.5	–	20.5	41.9	76.7	–	17.0	39.1	70.7	–	21.4	40.8	74.1	–
150	7.1	11.1	14.4	23.7	41.2	73.0	82.0	59.9	7.3	12.3	16.5	23.5	35.9	58.7	54.9	34.5
500	4.8	7.6	6.5	8.0	82.4	99.5	100.0	100.0	5.2	7.9	6.9	7.9	75.5	99.2	100.0	100.0
Lagrange Multiplier test based on moment conditions "SYS3"																
50	10.9	10.7	9.8	8.2	17.7	33.2	46.2	59.2	11.0	9.6	9.4	7.5	14.2	16.6	21.9	30.4
150	6.5	6.3	5.4	5.3	28.4	67.1	90.8	96.9	6.3	5.0	5.9	6.5	13.0	23.6	43.1	59.8
500	7.0	6.1	5.3	4.5	71.6	98.9	100.0	100.0	5.5	5.1	5.2	4.3	26.2	55.4	86.6	97.9
Conditional likelihood ratio test based on moment conditions "DIF1"																
50	23.8	85.1	–	–	23.0	88.0	–	–	23.1	87.4	–	–	23.6	87.6	–	–
150	7.1	33.4	60.7	–	21.1	55.0	89.9	–	7.8	34.4	58.9	–	15.3	51.5	89.2	–
500	6.2	9.6	14.1	45.9	47.9	97.8	99.8	86.0	6.8	9.5	13.1	47.2	30.3	94.0	100.0	85.9
Conditional likelihood ratio test based on moment conditions "DIF2"																
50	14.9	40.0	48.9	61.8	16.1	44.1	72.7	76.3	14.9	43.4	48.5	62.7	14.6	42.6	60.7	74.2
150	5.4	8.6	12.9	18.0	19.6	54.1	75.3	82.1	6.9	9.2	13.3	19.8	8.8	18.3	35.2	54.0
500	6.0	6.5	6.1	6.2	46.4	96.6	99.9	100.0	5.8	6.6	5.7	6.4	15.5	46.1	81.7	97.5
Conditional likelihood ratio test based on moment conditions "DIF3"																
50	8.0	8.9	7.7	6.7	13.2	22.7	36.1	44.6	6.2	7.6	6.8	6.8	7.3	9.7	12.8	16.4
150	4.9	6.6	5.9	5.5	18.6	48.8	75.2	89.4	5.3	5.5	5.8	5.8	6.4	13.1	19.6	29.5
500	6.1	5.1	4.7	4.2	44.8	92.3	99.8	100.0	4.7	4.6	4.8	3.7	10.0	24.5	46.7	69.4
Conditional likelihood ratio test based on moment conditions "SYS1"																
50	25.5	–	–	–	29.9	–	–	–	21.9	–	–	–	25.2	–	–	–
150	8.2	31.5	70.7	–	42.0	59.6	92.1	–	9.4	27.3	71.0	–	37.1	37.6	78.9	–
500	6.4	8.7	16.3	37.7	83.5	100.0	100.0	88.6	5.8	9.0	16.9	32.3	76.8	100.0	98.4	60.4
Conditional likelihood ratio test based on moment conditions "SYS2"																
50	19.5	39.6	72.3	–	25.5	43.4	76.5	–	18.1	39.3	70.5	–	22.2	41.2	74.0	–
150	7.1	11.5	15.9	26.3	41.3	73.6	84.0	63.3	7.5	12.9	17.3	23.5	35.8	58.8	55.2	34.8
500	4.9	7.6	6.6	8.4	82.1	99.5	100.0	100.0	5.2	8.0	6.8	7.7	75.8	99.2	100.0	100.0
Conditional likelihood ratio test based on moment conditions "SYS3"																
50	12.1	11.1	9.6	8.1	18.7	34.2	47.2	59.7	12.1	10.4	9.8	7.8	15.7	18.0	22.7	30.8
150	6.5	6.6	5.4	5.2	27.9	67.0	90.9	97.0	6.8	5.0	5.9	5.9	12.5	24.1	42.9	60.1
500	7.1	6.1	5.4	4.6	71.7	98.9	100.0	100.0	5.5	4.9	5.1	4.2	26.3	55.4	86.5	98.0

Table A.39: Mean bias($\times100$) and RMSE($\times100$) of γ ($\gamma = 0.9$) for AR(1) model

| | bias($\times100$) | | | | RMSE($\times100$) | | | | bias($\times100$) | | | | RMSE($\times100$) | | | |
| | $\tau^2=1$ | | | | $\tau^2=1$ | | | | $\tau^2=5$ | | | | $\tau^2=5$ | | | |
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Transformed likelihood estimator																
50	-3.210	0.826	1.273	1.144	13.134	7.415	5.817	5.071	-3.399	0.746	0.921	0.884	13.147	7.412	5.614	4.832
150	-0.254	1.683	1.498	0.779	9.503	6.059	4.863	3.588	-0.834	1.227	1.037	0.634	9.589	5.758	4.391	3.363
500	2.211	2.102	0.970	0.564	7.485	5.207	3.459	2.633	1.086	1.482	1.143	0.949	7.203	4.709	3.650	3.195
Iterative transformed likelihood estimator																
50	-4.310	0.369	1.073	1.145	13.882	7.414	5.707	5.107	-4.630	0.158	0.433	0.660	13.738	7.364	5.173	4.553
150	-1.639	1.510	1.879	1.295	10.413	6.308	5.306	4.251	-3.117	0.433	1.047	0.893	10.068	5.605	4.427	3.762
500	1.141	2.394	1.552	0.917	8.995	5.874	4.116	3.110	-1.857	1.078	1.575	1.568	7.964	5.006	4.433	4.060
One-step first-difference GMM estimator based on "DIF1"																
50	-53.735	-27.704	—	—	62.911	30.990	—	—	-58.098	-29.863	—	—	66.697	32.947	—	—
150	-38.438	-19.260	-11.269	—	49.389	22.153	12.639	—	-46.411	-22.288	-12.645	—	56.660	25.242	14.077	—
500	-18.574	-8.369	-4.848	-3.375	28.469	10.852	5.978	4.099	-29.776	-10.638	-5.690	-3.808	40.263	13.242	6.861	4.545
Two-step first-difference GMM estimator based on "DIF1"																
50	-61.636	-32.615	—	—	75.040	47.107	—	—	-67.736	-36.278	—	—	80.072	51.216	—	—
150	-44.543	-22.312	-12.511	—	58.945	27.125	16.153	—	-55.189	-27.307	-14.819	—	68.198	32.339	18.586	—
500	-20.432	-8.946	-5.162	-3.604	32.222	12.047	6.691	4.721	-34.127	-12.101	-6.342	-4.190	47.046	15.556	7.953	5.350
Continuous-updating first-difference GMM estimator based on "DIF1"																
50	-57.926	-59.590	—	—	89.192	92.638	—	—	-63.506	-61.471	—	—	94.433	94.885	—	—
150	-29.397	-13.641	-13.487	—	60.482	37.076	40.630	—	-43.282	-19.964	-17.837	—	75.683	46.973	47.374	—
500	-8.526	-0.525	-0.199	-0.197	28.753	7.893	4.941	3.706	-16.623	-1.391	-0.295	-0.208	42.417	10.863	5.696	4.176
One-step first-difference GMM estimator based on "DIF2"																
50	-60.371	-37.532	-25.128	-19.153	73.269	47.043	32.742	25.962	-68.346	-48.118	-38.535	-33.284	80.052	55.358	44.710	39.271
150	-44.014	-24.977	-13.209	-8.427	58.928	34.280	19.750	13.337	-59.047	-46.275	-35.955	-29.270	71.847	52.955	41.908	34.751
500	-19.548	-8.581	-4.422	-2.572	35.345	14.197	7.888	4.942	-45.437	-33.461	-26.115	-20.908	57.203	39.474	31.545	25.912
Two-step first-difference GMM estimator based on "DIF2"																
50	-66.902	-43.557	-28.458	-21.285	84.742	56.432	39.788	32.592	-76.455	-57.493	-47.292	-40.733	92.574	67.502	57.073	50.886
150	-48.647	-28.444	-14.101	-8.245	67.246	40.787	23.170	15.080	-65.933	-56.205	-45.749	-37.732	81.812	65.494	54.208	45.522
500	-22.004	-9.126	-4.366	-2.494	39.558	15.959	8.117	5.007	-50.244	-39.648	-32.471	-27.042	64.434	47.324	39.590	33.476
Continuous-updating first-difference GMM estimator based on "DIF2"																
50	-61.278	-43.298	-33.829	-31.202	93.625	75.529	66.508	64.892	-67.443	-62.561	-54.908	-59.287	99.096	95.107	87.622	92.716
150	-35.863	-14.734	-3.990	-1.808	68.940	40.805	20.965	12.598	-53.310	-36.665	-29.971	-25.010	86.436	68.189	61.133	53.264
500	-12.042	-1.978	-0.545	-0.302	34.719	12.127	6.032	3.865	-29.033	-12.877	-8.921	-6.168	57.813	32.230	26.015	20.267
One-step first-difference GMM estimator based on "DIF3"																
50	-43.729	-17.764	-10.911	-4.858	80.017	56.999	41.843	38.673	-55.471	-33.101	-23.486	-23.253	98.126	77.078	73.163	62.413
150	-29.818	-9.484	-2.672	-1.738	64.834	36.062	18.150	13.649	-51.275	-35.437	-28.630	-24.241	90.694	71.164	67.011	65.797
500	-9.077	-1.592	-0.986	-0.269	42.245	14.338	8.927	6.282	-48.854	-25.040	-17.288	-11.376	97.507	62.475	53.556	45.819
Two-step first-difference GMM estimator based on "DIF3"																
50	-48.645	-20.015	-13.306	-6.223	92.289	65.358	48.544	34.613	-59.345	-36.190	-30.455	-26.703	105.070	85.242	81.880	70.512
150	-33.218	-10.519	-2.764	-1.458	71.823	39.414	19.417	13.454	-56.180	-42.108	-34.495	-29.830	96.857	83.385	79.708	80.971
500	-10.860	-1.602	-0.886	-0.231	42.620	14.189	8.768	6.266	-53.893	-30.009	-22.576	-15.394	97.630	72.828	63.224	50.531
Continuous-updating first-difference GMM estimator based on "DIF3"																
50	-53.242	-26.040	-16.391	-8.425	87.220	58.936	45.492	30.600	-67.094	-50.178	-45.475	-43.902	99.212	85.313	82.007	81.059
150	-36.535	-12.254	-3.724	-1.929	71.083	36.552	18.197	12.655	-63.108	-51.600	-43.412	-36.024	96.813	86.931	78.629	70.741
500	-13.054	-1.794	-0.693	-0.061	37.015	12.025	7.888	5.900	-58.743	-35.864	-29.110	-19.680	93.316	69.621	63.487	49.796

Table A.39(cont.)

N/T	bias(×100), τ²=1				RMSE(×100), τ²=1				bias(×100), τ²=5				RMSE(×100), τ²=5			
	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	5.776	–	–	–	9.292	–	–	–	9.787	–	–	–	9.953	–	–	–
150	4.874	4.228	3.425	–	8.460	5.509	4.428	–	9.755	9.600	9.505	–	9.906	9.640	9.532	–
500	2.688	2.705	2.146	1.632	5.428	3.884	2.958	2.341	9.264	9.280	9.081	8.906	9.492	9.340	9.116	8.930
Two-step system GMM estimator based on "SYS1"																
50	5.197	–	–	–	10.810	–	–	–	9.817	–	–	–	10.081	–	–	–
150	4.036	3.630	3.128	–	8.516	5.273	4.579	–	9.679	9.537	9.466	–	9.987	9.598	9.505	–
500	1.351	1.815	1.598	1.218	4.937	3.195	2.563	2.096	9.034	9.111	8.988	8.870	9.463	9.207	9.034	8.902
Continuous-updating system GMM estimator based on "SYS1"																
50	-0.564	–	–	–	13.808	–	–	–	2.311	–	–	–	14.025	–	–	–
150	-0.830	-0.147	-0.246	–	8.902	5.804	7.245	–	3.150	2.845	1.844	–	9.772	7.601	9.401	–
500	-0.726	0.039	0.097	-0.015	5.299	2.722	1.954	1.714	2.669	2.293	1.069	0.439	7.460	5.283	3.578	2.637
One-step system GMM estimator based on "SYS2"																
50	6.507	–	–	–	9.573	–	–	–	9.835	–	–	–	9.996	–	–	–
150	5.297	6.976	6.897	–	8.651	8.028	7.577	–	9.790	9.875	9.863	–	9.940	9.917	9.887	–
500	2.899	3.486	3.395	5.485	5.470	4.407	3.966	5.937	9.311	9.437	9.389	9.401	9.538	9.496	9.421	9.422
Two-step system GMM estimator based on "SYS2"																
50	5.444	–	–	–	11.091	–	–	–	9.806	–	–	–	10.125	–	–	–
150	4.222	4.050	4.116	–	8.748	5.818	5.388	–	9.696	9.561	9.578	–	10.047	9.656	9.637	–
500	1.411	1.875	1.743	1.639	5.152	3.414	2.795	2.471	9.063	9.127	8.988	8.992	9.543	9.262	9.064	9.043
Continuous-updating system GMM estimator based on "SYS2"																
50	-0.787	–	–	–	13.485	–	–	–	2.041	–	–	–	13.352	–	–	–
150	-1.138	-0.874	-2.986	–	9.421	12.057	20.518	–	3.004	2.235	-1.286	–	10.057	11.610	22.803	–
500	-0.776	-0.242	-0.030	-0.125	5.561	3.117	2.217	1.846	2.603	2.145	1.974	0.607	7.644	5.570	3.911	3.181
One-step system GMM estimator based on "SYS3"																
50	3.839	0.627	-0.448	-0.754	10.577	8.426	6.618	6.131	9.596	9.047	8.558	7.317	10.660	10.725	11.379	11.124
150	2.131	-1.056	-0.855	-0.586	6.839	5.000	3.888	3.516	9.317	8.347	6.984	5.384	10.873	11.468	12.001	12.039
500	-0.844	-0.793	-0.354	-0.234	4.221	2.616	2.140	1.948	8.423	6.046	3.423	2.023	10.214	12.481	12.360	12.231
Two-step system GMM estimator based on "SYS3"																
50	3.166	0.801	0.257	0.304	12.880	10.898	8.595	6.131	9.458	8.867	7.403	7.052	12.880	11.418	11.847	11.959
150	1.977	0.032	-0.124	-0.158	11.048	6.453	4.633	3.516	9.438	7.733	5.821	4.333	11.860	12.010	10.992	9.927
500	-0.282	-0.147	-0.078	-0.051	6.272	3.462	2.323	1.948	8.127	5.585	2.828	1.962	11.085	10.186	8.672	7.153
Continuous-updating system GMM estimator based on "SYS3"																
50	-5.356	-3.369	-2.027	-0.521	23.833	14.715	10.215	6.368	-3.669	-8.858	-7.605	-4.428	29.083	38.204	32.097	22.852
150	-3.188	-1.661	-0.832	-0.535	13.462	8.018	5.264	3.964	0.252	-5.953	-3.243	-2.519	17.124	30.251	20.736	16.151
500	-2.459	-0.721	-0.205	-0.134	8.791	4.278	2.473	2.071	-0.256	-3.405	-2.206	-1.355	12.957	18.702	12.763	9.499

Table A.40: Median bias(×100) and MAE(×100) of γ ($\gamma = 0.9$) for AR(1) model

N/T	median bias(×100) $\tau^2 = 1$				MAE(×100) $\tau^2 = 1$				median bias(×100) $\tau^2 = 5$				MAE(×100) $\tau^2 = 5$			
	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Transformed likelihood estimator																
50	0.472	1.472	0.423	0.325	9.900	6.412	4.317	3.070	-0.341	1.430	0.202	0.162	9.900	6.418	4.064	2.893
150	2.332	1.118	0.481	0.109	8.745	4.377	2.578	1.580	1.299	0.460	0.078	0.073	8.522	4.037	2.325	1.519
500	4.258	1.031	0.218	0.087	6.831	2.663	1.321	0.849	2.172	0.579	0.279	0.179	6.327	2.480	1.342	0.871
Iterative transformed likelihood estimator																
50	-3.421	0.641	0.634	0.392	8.573	5.288	3.891	3.106	-3.594	0.406	0.054	0.209	8.409	5.274	3.509	2.830
150	-2.227	0.497	0.729	0.252	7.089	3.716	2.714	1.745	-3.605	-0.416	0.224	0.118	6.704	3.189	2.254	1.581
500	-1.154	0.805	0.389	0.215	6.450	2.634	1.422	0.920	-3.549	-0.201	0.238	0.275	5.730	2.163	1.372	0.971
One-step first-difference GMM estimator based on "DIF1"																
50	-52.685	-26.756	—	—	52.685	26.756	—	—	-56.255	-28.621	—	—	56.282	28.621	—	—
150	-37.313	-18.287	-10.781	—	37.827	18.287	10.781	—	-45.589	-21.076	-12.313	—	45.736	21.076	12.313	—
500	-18.079	-7.899	-4.738	-3.369	18.982	7.989	4.749	3.374	-29.157	-10.123	-5.554	-3.808	29.897	10.153	5.558	3.808
Two-step first-difference GMM estimator based on "DIF1"																
50	-60.266	-30.895	—	—	61.270	32.329	—	—	-66.029	-34.884	—	—	66.327	36.735	—	—
150	-39.532	-20.189	-11.587	—	40.140	20.236	11.749	—	-51.052	-25.145	-14.390	—	51.246	25.145	14.407	—
500	-17.924	-8.240	-4.983	-3.467	19.704	8.437	5.047	3.480	-31.243	-11.045	-6.247	-4.280	32.041	11.130	6.296	4.282
Continuous-updating first-difference GMM estimator based on "DIF1"																
50	-37.525	-31.541	-1.031	—	37.525	31.541	10.000	—	-45.872	-32.235	-2.568	—	45.872	32.235	10.000	—
150	-7.839	-2.496	-0.047	—	10.000	10.000	10.000	—	-21.425	-5.155	0.049	—	21.425	10.000	10.000	—
500	1.103	-0.006	—	0.002	10.000	5.424	3.240	2.373	-0.617	-0.302	—	-0.121	10.000	6.661	3.765	2.655
One-step first-difference GMM estimator based on "DIF2"																
50	-59.725	-33.679	-21.641	-15.368	59.822	33.679	21.641	15.368	-66.448	-46.397	-37.081	-31.207	66.448	46.397	37.081	31.207
150	-41.482	-20.518	-10.119	-6.810	42.419	20.681	10.561	7.150	-59.917	-45.943	-34.220	-27.238	60.026	45.943	34.220	27.238
500	-18.534	-7.117	-3.859	-2.205	22.327	8.246	4.769	3.115	-46.246	-32.406	-23.978	-19.485	46.509	32.406	24.014	19.485
Two-step first-difference GMM estimator based on "DIF2"																
50	-64.314	-37.940	-24.114	-16.197	64.584	37.940	24.258	16.906	-75.238	-56.104	-45.757	-38.212	75.295	56.104	45.757	38.212
150	-43.858	-21.840	-9.447	-5.791	44.936	22.116	9.845	6.232	-65.335	-56.947	-43.880	-36.593	65.447	56.947	43.880	36.593
500	-19.334	-7.127	-3.532	-2.108	23.407	8.343	4.671	3.007	-49.669	-39.355	-30.056	-25.299	50.526	39.482	30.056	25.299
Continuous-updating first-difference GMM estimator based on "DIF2"																
50	-40.455	-16.742	-8.507	-5.783	40.455	16.742	10.000	10.000	-52.721	-43.693	-29.192	-34.720	52.721	43.693	29.192	34.720
150	-10.521	-2.102	0.348	0.041	10.521	10.000	6.559	4.605	-31.136	-12.749	-4.635	-4.073	31.136	12.749	10.000	10.000
500	-0.889	0.040	-0.284	-0.197	10.000	6.370	3.610	2.466	-9.342	-0.180	-0.864	-0.081	10.000	10.000	10.000	10.000
One-step first-difference GMM estimator based on "DIF3"																
50	-40.007	-12.896	-6.042	-2.882	49.234	25.231	15.784	12.269	-53.721	-27.010	-17.104	-17.461	60.554	38.364	32.074	31.539
150	-23.966	-7.410	-2.282	-1.343	35.487	15.977	10.243	7.254	-47.284	-29.338	-20.034	-15.276	54.981	38.029	32.931	28.443
500	-8.508	-1.421	-1.056	-0.246	21.917	8.731	5.503	4.027	-46.752	-19.004	-12.399	-5.925	54.343	30.032	24.012	18.417
Two-step first-difference GMM estimator based on "DIF3"																
50	-41.510	-10.255	-6.462	-2.714	51.716	25.362	15.652	11.717	-55.254	-24.633	-20.535	-17.485	64.685	42.653	34.499	34.498
150	-23.265	-6.678	-2.268	-1.164	34.603	16.272	9.806	7.049	-48.882	-33.115	-19.108	-14.940	57.635	41.691	33.483	28.640
500	-8.483	-1.374	-0.861	-0.227	22.021	8.634	5.165	3.999	-47.411	-20.277	-12.079	-7.278	56.342	31.716	25.107	18.944
Continuous-updating first-difference GMM estimator based on "DIF3"																
50	-28.075	-3.754	-1.737	0.373	28.075	10.000	10.000	10.000	-47.792	-21.524	-11.997	-10.710	47.792	21.524	11.997	10.710
150	-11.116	-1.450	-0.084	0.057	11.116	10.000	10.000	7.118	-39.101	-21.912	-14.045	-8.821	39.101	21.912	14.045	10.000
500	-0.884	0.332	-0.172	0.171	10.000	8.756	5.241	3.974	-36.076	-11.266	-5.000	-1.534	36.076	11.266	10.000	10.000

Table A.40(cont.)

	τ² = 1 median bias(×100)				MAE(×100)				τ² = 5 median bias(×100)				MAE(×100)			
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	6.535	—	—	—	7.142	—	—	—	9.811	—	—	—	9.811	—	—	—
150	5.616	4.567	3.592	—	6.209	4.649	3.699	—	9.758	9.649	9.544	—	9.758	9.649	9.544	—
500	3.078	2.919	2.164	1.605	3.919	3.135	2.235	1.715	9.313	9.359	9.141	8.930	9.313	9.359	9.141	8.930
Two-step system GMM estimator based on "SYS1"																
50	6.259	—	—	—	7.531	—	—	—	9.767	—	—	—	9.767	—	—	—
150	4.670	4.090	3.573	—	5.871	4.374	3.863	—	9.586	9.559	9.505	—	9.589	9.559	9.505	—
500	1.982	2.065	1.683	1.143	3.329	2.533	1.885	1.392	8.871	9.009	8.994	8.907	8.871	9.009	8.994	8.907
Continuous-updating system GMM estimator based on "SYS1"																
50	5.489	—	—	—	10.000	—	—	—	9.296	—	—	—	10.000	—	—	—
150	1.438	0.645	0.923	—	6.484	4.247	5.024	—	7.917	5.399	4.722	—	9.584	7.397	7.988	—
500	0.246	0.143	0.107	-0.061	3.437	1.945	1.375	1.173	4.945	1.463	0.296	0.048	7.001	3.278	1.691	1.295
One-step system GMM estimator based on "SYS2"																
50	7.194	7.362	7.190	—	7.534	7.362	7.190	—	9.824	9.878	9.872	—	9.824	9.878	9.872	—
150	5.901	5.860	5.758	5.705	6.568	5.906	5.758	5.705	9.778	9.739	9.734	9.759	9.778	9.739	9.734	9.759
500	3.184	3.743	3.449	3.189	4.041	3.796	3.453	3.193	9.343	9.474	9.404	9.404	9.343	9.474	9.404	9.404
Two-step system GMM estimator based on "SYS2"																
50	6.272	6.676	6.309	—	7.610	6.918	6.481	—	9.769	9.822	9.848	—	9.769	9.822	9.848	—
150	4.650	4.271	4.448	4.145	5.971	4.609	4.571	4.156	9.644	9.608	9.567	9.581	9.644	9.608	9.567	9.581
500	1.884	2.143	1.845	1.671	3.385	2.682	1.991	1.771	8.893	9.039	8.962	8.959	8.897	9.039	8.962	8.959
Continuous-updating system GMM estimator based on "SYS2"																
50	5.213	3.059	4.220	—	10.000	9.598	10.000	—	9.334	8.926	8.827	—	10.000	10.000	10.000	—
150	1.445	0.066	0.106	-0.213	6.906	4.456	3.367	3.063	8.016	4.192	2.460	1.596	9.848	6.985	5.359	4.523
500	0.116	-0.064	0.009	-0.135	3.580	2.255	1.516	1.214	4.966	1.834	0.396	0.028	7.028	4.072	2.218	1.602
One-step system GMM estimator based on "SYS3"																
50	5.416	2.337	0.563	0.354	7.596	5.923	4.695	3.662	9.624	9.048	8.304	7.059	9.658	9.123	8.490	7.479
150	2.739	0.250	0.207	0.012	5.237	3.765	2.716	2.279	9.129	7.638	6.165	4.813	9.194	7.780	6.541	5.638
500	0.517	0.041	0.038	0.034	3.335	2.080	1.700	1.299	7.654	5.049	3.138	2.166	7.739	5.731	4.807	4.245
Two-step system GMM estimator based on "SYS3"																
50	5.524	2.945	1.555	1.029	8.730	6.068	4.938	3.688	9.699	9.159	8.350	7.545	9.774	9.278	8.772	8.034
150	3.194	1.248	0.706	0.190	5.929	3.603	2.761	2.146	9.201	7.945	6.408	5.319	9.274	8.150	6.925	6.157
500	1.059	0.438	0.206	0.131	3.601	2.013	1.557	1.236	7.846	6.334	4.470	3.453	8.001	6.673	5.251	4.198
Continuous-updating system GMM estimator based on "SYS3"																
50	3.896	1.267	0.610	0.757	10.000	6.746	5.147	3.834	8.706	7.485	6.201	5.168	10.000	10.000	10.000	8.222
150	1.447	0.398	0.314	-0.041	6.479	3.827	2.933	2.264	7.704	6.048	4.396	3.358	9.898	8.520	7.081	6.206
500	0.250	0.238	0.113	0.062	3.682	2.148	1.616	1.270	5.526	3.865	2.218	1.689	7.979	6.486	5.201	4.112

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Table A.41: Size(%) and power(%) of γ ($\gamma = 0.9$) for AR(1) model

| | size ($H_0 : \gamma = 0.9$) | | | | power ($H_1 : \gamma = 0.8$) | | | | size ($H_0 : \gamma = 0.9$) | | | | power ($H_1 : \gamma = 0.8$) | | | |
| | $\tau^2 = 1$ | | | | | | | | $\tau^2 = 5$ | | | | | | | |
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Transformed likelihood estimator																
50	15.0	22.0	19.9	21.3	23.9	32.9	49.6	68.2	14.6	22.3	19.1	19.9	24.2	33.3	51.4	70.2
150	20.9	20.8	17.6	12.2	25.3	45.1	71.1	87.6	20.0	19.1	14.7	11.5	27.4	47.8	75.0	89.2
500	25.7	18.3	9.9	8.0	32.4	65.7	88.4	94.1	23.3	16.4	10.8	9.4	37.0	70.1	87.1	90.7
Iterative transformed likelihood estimator																
50	16.4	22.8	19.7	19.8	27.1	35.5	52.9	68.8	16.1	21.2	17.0	16.4	27.1	36.4	56.3	71.9
150	20.7	21.3	19.7	16.3	36.0	57.2	71.2	83.7	18.3	18.0	14.0	14.0	40.9	67.5	80.2	88.7
500	30.6	24.2	15.8	12.0	60.0	67.9	81.8	91.6	23.0	20.8	17.7	18.6	80.7	80.5	83.5	87.5
One-step first-difference GMM estimator based on "DIF1"																
50	41.3	58.3	−	−	53.0	88.7	−	−	43.4	62.3	−	−	55.8	90.3	−	−
150	28.3	45.5	53.1	−	43.8	86.7	98.8	−	33.0	50.7	57.7	−	48.4	88.4	98.8	−
500	17.0	22.2	26.2	29.7	33.5	81.1	99.5	100.0	23.1	28.2	29.7	32.4	37.7	80.4	98.8	100.0
Two-step first-difference GMM estimator based on "DIF1"																
50	64.5	92.0	−	−	73.9	96.2	−	−	67.4	93.9	−	−	76.1	95.3	−	−
150	45.3	70.3	84.1	−	56.6	93.2	97.2	−	52.6	76.8	84.7	−	62.2	93.9	98.0	−
500	24.4	33.4	45.8	56.4	38.3	84.4	99.0	100.0	32.8	41.0	51.4	60.9	46.0	84.8	98.5	100.0
Two-step first-difference GMM estimator based on "DIF1" with Windmeijer standard errors																
50	30.5	2.5	−	−	38.7	3.3	−	−	34.5	2.8	−	−	40.7	3.2	−	−
150	23.4	25.7	1.8	−	32.9	57.2	9.7	−	28.0	29.2	2.5	−	36.1	59.7	11.5	−
500	15.0	19.5	22.1	16.0	26.9	72.6	96.9	99.8	19.8	24.1	24.8	18.2	28.9	72.9	96.0	99.5
Continuous-updating first-difference GMM estimator based on "DIF1"																
50	47.5	91.7	−	−	53.2	79.2	−	−	50.7	91.2	−	−	54.9	78.2	−	−
150	27.4	34.9	82.2	−	33.2	50.2	66.3	−	35.1	38.3	83.0	−	40.0	50.9	65.8	−
500	11.9	9.4	26.6	41.4	18.9	44.3	82.6	98.1	18.6	10.7	29.1	41.7	23.6	38.4	77.1	95.7
Continuous-updating first-difference GMM estimator based on "DIF1" with NW standard errors																
50	30.4	40.6	−	−	34.8	49.0	−	−	35.1	47.6	−	−	39.0	54.4	−	−
150	15.7	12.6	13.8	−	20.9	22.6	26.0	−	23.0	22.6	31.6	−	26.8	30.8	38.6	−
500	7.9	2.3	5.3	7.8	13.3	25.4	58.6	82.3	12.4	5.0	18.6	27.7	15.6	24.0	57.4	75.5
One-step first-difference GMM estimator based on "DIF2"																
50	34.5	31.5	26.2	23.7	45.1	53.5	58.1	67.4	38.1	41.1	40.3	41.1	47.8	60.9	63.5	70.0
150	25.4	17.7	10.0	9.9	36.2	43.2	52.5	73.4	31.6	37.3	33.3	32.8	42.2	55.8	61.0	69.7
500	13.3	7.9	6.0	5.6	25.1	40.1	72.7	91.8	26.3	28.3	25.7	22.6	37.0	51.1	60.6	66.2
Two-step first-difference GMM estimator based on "DIF2"																
50	57.2	69.7	74.3	79.4	64.3	83.7	88.6	91.1	63.5	81.7	87.1	90.2	69.9	88.8	94.0	95.7
150	40.1	44.4	34.5	34.1	49.7	65.3	72.4	85.9	47.9	70.7	76.9	78.3	58.0	81.6	88.2	93.2
500	20.2	16.4	13.4	13.2	32.3	49.9	77.4	94.7	38.1	52.1	57.7	60.2	47.8	68.8	78.1	87.5
Two-step first-difference GMM estimator based on "DIF2" with Windmeijer standard errors																
50	32.4	20.1	7.6	3.6	39.1	29.6	15.1	5.2	35.6	29.1	14.7	7.9	41.6	37.7	21.0	10.1
150	24.8	16.3	9.6	6.7	30.3	33.9	40.8	55.7	31.2	34.7	31.1	26.1	36.3	45.2	46.2	49.4
500	14.0	9.1	7.1	7.7	23.0	39.0	70.9	92.2	25.5	26.6	31.8	33.7	32.9	42.6	55.4	64.6
Continuous-updating first-difference GMM estimator based on "DIF2"																
50	45.4	46.9	55.8	75.2	49.4	55.7	61.1	68.9	49.1	56.5	63.1	82.1	52.9	61.0	65.1	70.6
150	28.8	17.9	12.7	19.7	32.8	30.1	36.5	60.7	38.8	37.8	38.1	41.2	41.6	43.0	44.0	48.6
500	10.6	4.7	5.6	8.4	17.3	23.1	56.3	86.5	23.9	20.8	19.1	17.3	28.3	28.1	28.8	33.4
Continuous-updating first-difference GMM estimator based on "DIF2" with NW standard errors																
50	28.8	24.1	22.9	20.4	33.9	29.8	31.3	30.0	33.2	32.0	33.6	37.5	37.5	36.5	39.0	42.8
150	17.2	9.5	4.3	2.5	22.2	16.0	18.2	30.9	24.0	21.1	17.4	17.7	28.3	25.1	23.3	25.8
500	6.9	2.4	3.3	4.9	12.3	17.6	47.2	78.4	16.3	10.7	6.6	6.5	20.1	16.9	14.7	16.0
One-step first-difference GMM estimator based on "DIF3"																
50	12.9	4.6	3.2	3.0	17.8	8.2	9.7	11.1	12.9	4.7	4.5	3.8	18.9	7.7	6.9	6.9
150	7.8	3.3	2.3	2.5	12.6	10.0	12.1	17.8	9.3	3.4	1.8	1.6	13.2	5.3	3.7	4.0
500	5.1	2.4	3.6	4.2	11.5	13.7	26.7	39.7	6.2	1.7	0.7	1.4	9.8	3.5	3.2	4.0
Two-step first-difference GMM estimator based on "DIF3"																
50	25.4	11.5	11.2	8.6	30.5	17.5	18.0	17.4	29.3	18.9	17.6	16.3	35.5	23.6	22.1	20.6
150	16.4	8.6	4.5	4.9	21.3	15.7	15.2	19.9	22.5	16.5	13.7	12.6	27.6	21.6	17.9	17.8
500	8.4	3.5	3.5	4.4	14.4	15.0	26.6	40.8	18.0	9.9	8.8	5.9	22.2	13.6	11.9	9.6
Two-step first-difference GMM estimator based on "DIF3" with Windmeijer standard errors																
50	18.5	10.0	8.8	8.3	21.6	12.1	14.2	13.7	20.5	13.1	12.9	12.2	23.5	16.6	14.0	12.7
150	13.8	10.2	5.2	5.1	18.2	15.2	13.2	18.9	18.4	12.3	12.3	11.8	21.2	13.5	13.3	13.0
500	11.3	5.1	3.8	4.5	16.7	14.5	25.6	40.0	15.1	10.9	8.7	8.9	17.8	12.3	10.1	10.4
Continuous-updating first-difference GMM estimator based on "DIF3"																
50	23.5	11.8	9.8	7.9	27.4	16.5	17.9	16.5	29.1	21.3	19.5	18.9	33.7	25.4	23.5	21.8
150	16.7	7.1	3.3	3.6	20.2	13.3	12.9	18.9	23.7	18.6	16.0	13.1	26.4	21.4	18.9	17.7
500	7.6	2.8	1.6	2.2	12.0	13.3	25.2	39.4	19.7	11.3	10.3	6.6	23.3	13.7	13.1	10.0
Continuous-updating first-difference GMM estimator based on "DIF3" with NW standard errors																
50	24.5	12.9	8.3	6.9	27.9	16.5	14.5	14.5	28.3	22.7	19.5	19.1	31.2	25.8	22.6	22.6
150	16.7	7.4	2.8	2.3	20.6	12.8	12.1	17.2	28.0	22.9	18.7	17.5	30.7	26.0	21.7	20.5
500	7.7	1.8	1.3	2.3	12.8	11.7	22.9	37.7	24.3	16.1	12.7	8.6	28.1	19.7	15.1	12.8

Table A.41(cont.)

N/T	size ($H_0 : \gamma = 0.9$)				power ($H_1 : \gamma = 0.8$)				size ($H_0 : \gamma = 0.9$)				power ($H_1 : \gamma = 0.8$)			
	$\tau^2 = 1$								$\tau^2 = 5$							
	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
One-step system GMM estimator based on "SYS1"																
50	28.4	–	–	–	1.8	–	–	–	95.4	–	–	–	0.0	–	–	–
150	26.8	34.1	33.1	–	4.4	32.9	73.6	–	95.0	99.9	100.0	–	0.2	1.9	3.8	–
500	18.4	22.7	23.7	21.8	23.3	82.6	98.7	100.0	93.9	99.8	100.0	100.0	1.7	9.4	22.2	48.1
Two-step system GMM estimator based on "SYS1"																
50	64.5	–	–	–	53.0	–	–	–	98.8	–	–	–	50.7	–	–	–
150	49.6	74.5	88.9	–	54.2	91.4	99.3	–	98.6	100.0	100.0	–	49.5	70.1	90.7	–
500	28.9	49.8	59.6	65.2	81.3	99.7	100.0	100.0	97.7	99.9	100.0	100.0	61.1	78.2	88.7	96.2
Two-step system GMM estimator based on "SYS1" with Windmeijer standard errors																
50	15.0	–	–	–	4.3	–	–	–	78.3	–	–	–	2.6	–	–	–
150	19.2	9.1	1.3	–	10.7	9.8	2.7	–	86.1	94.6	51.1	–	8.1	5.1	2.3	–
500	13.6	10.6	5.6	0.7	45.8	84.2	93.2	96.7	83.2	98.9	99.5	99.2	10.6	12.3	7.0	9.3
Continuous-updating system GMM estimator based on "SYS1"																
50	75.0	–	–	–	45.8	–	–	–	97.4	–	–	–	43.6	–	–	–
150	52.5	72.9	92.7	–	62.7	95.2	96.2	–	95.4	97.3	98.7	–	55.0	76.2	80.2	–
500	29.1	37.5	45.6	58.6	88.6	99.9	100.0	100.0	87.9	87.2	85.3	89.2	74.9	84.9	94.2	97.3
Continuous-updating system GMM estimator based on "SYS1" with NW standard errors																
50	14.6	–	–	–	19.6	–	–	–	36.5	–	–	–	13.0	–	–	–
150	16.6	22.8	31.8	–	33.9	59.9	54.9	–	32.6	35.7	45.8	–	18.5	41.3	51.1	–
500	15.2	13.7	10.7	9.3	70.8	95.6	98.8	99.5	27.2	24.1	21.6	31.7	31.0	66.0	83.7	89.2
One-step system GMM estimator based on "SYS2"																
50	30.6	54.1	63.9	–	1.6	5.2	11.9	–	95.5	99.8	100.0	–	0.0	0.6	1.8	–
150	28.6	46.1	58.3	66.9	3.7	17.4	34.2	50.8	95.3	99.9	100.0	100.0	0.2	1.6	2.6	3.0
500	20.4	33.0	40.0	45.2	22.3	72.2	93.5	98.5	94.0	100.0	100.0	100.0	1.7	6.8	12.3	18.7
Two-step system GMM estimator based on "SYS2"																
50	56.7	80.7	91.3	–	45.4	67.4	86.5	–	98.5	100.0	100.0	–	45.5	62.7	81.4	–
150	44.4	58.8	69.7	77.1	46.1	73.9	84.6	93.7	98.1	100.0	100.0	100.0	42.8	49.9	57.1	60.8
500	26.1	35.7	39.5	42.4	74.3	97.4	99.7	100.0	96.9	100.0	100.0	100.0	52.3	62.2	68.8	73.9
Two-step system GMM estimator based on "SYS2" with Windmeijer standard errors																
50	17.9	12.3	2.9	–	6.0	7.4	3.2	–	83.0	84.8	46.4	–	3.1	1.9	0.9	–
150	19.2	20.3	26.8	23.6	11.7	24.0	34.8	40.3	88.0	99.7	99.9	100.0	7.5	10.9	13.2	17.2
500	12.2	13.3	14.9	15.3	41.0	84.1	97.1	99.5	85.4	99.4	99.9	100.0	9.9	18.8	27.9	34.0
Continuous-updating system GMM estimator based on "SYS2"																
50	69.2	86.1	94.4	–	43.8	64.3	64.5	–	97.4	97.9	99.4	–	42.7	54.3	56.3	–
150	49.1	56.4	58.0	66.0	57.6	88.6	95.8	97.9	94.5	94.8	93.4	94.0	51.5	73.6	81.8	82.9
500	26.7	28.3	26.1	24.9	82.0	99.7	100.0	100.0	87.1	87.3	78.6	78.4	72.5	83.8	93.3	95.4
Continuous-updating system GMM estimator based on "SYS2" with NW standard errors																
50	12.7	15.4	24.3	–	21.3	28.8	32.4	–	33.4	30.2	37.2	–	15.1	21.8	28.0	–
150	16.5	14.6	13.9	9.9	33.1	51.3	66.4	69.4	32.5	23.7	23.3	19.9	19.2	34.7	48.7	55.9
500	14.2	10.1	6.8	6.8	61.5	93.6	98.7	99.9	27.3	21.3	15.8	10.1	29.1	64.5	84.8	91.1
One-step system GMM estimator based on "SYS3"																
50	17.3	13.6	10.5	8.2	0.7	5.5	17.0	35.2	77.2	62.1	48.1	42.3	0.2	0.6	0.8	1.8
150	13.7	8.8	6.3	7.3	2.8	30.4	76.0	92.8	69.3	46.9	36.0	27.1	0.6	1.7	4.5	9.0
500	9.2	7.1	5.2	5.6	36.1	95.8	100.0	100.0	58.9	31.2	19.7	17.9	2.5	10.0	16.3	27.1
Two-step system GMM estimator based on "SYS3"																
50	29.7	22.0	17.6	14.1	22.5	25.1	38.8	53.7	84.6	71.7	57.9	51.2	23.3	17.7	21.9	26.6
150	19.6	11.6	9.9	9.2	20.7	46.5	78.8	93.7	78.5	57.1	42.6	33.2	22.7	18.3	21.9	27.5
500	12.9	8.3	6.4	7.3	52.4	95.3	100.0	100.0	68.2	40.5	24.8	20.1	33.2	18.9	28.4	39.7
Two-step system GMM estimator based on "SYS3" with Windmeijer standard errors																
50	17.6	14.8	12.5	10.1	5.6	11.0	22.6	38.2	57.6	49.5	40.5	35.9	8.3	7.8	5.8	6.5
150	14.0	11.2	8.2	8.5	9.3	36.4	76.3	92.5	56.3	40.9	32.0	25.6	11.3	5.4	7.6	14.4
500	11.4	7.6	5.9	6.8	44.3	93.5	100.0	100.0	45.5	29.2	19.8	16.0	10.4	10.3	17.2	27.8
Continuous-updating system GMM estimator based on "SYS3"																
50	29.5	24.1	20.5	16.0	25.0	30.5	42.4	57.3	79.2	65.6	56.1	49.8	27.5	22.9	24.7	26.7
150	20.4	14.5	11.7	10.1	24.5	50.8	86.4	96.7	74.2	54.3	43.9	37.1	27.2	19.9	22.9	32.1
500	16.9	9.4	7.0	7.7	60.2	97.1	100.0	100.0	64.0	40.2	28.8	24.1	37.5	28.0	37.0	54.9
Continuous-updating system GMM estimator based on "SYS3" with NW standard errors																
50	13.2	14.4	13.5	10.6	14.4	25.1	36.6	49.0	30.6	32.8	30.4	30.2	9.5	11.0	13.7	15.9
150	14.2	13.2	9.0	9.3	25.9	52.6	81.6	91.5	30.4	31.3	27.6	23.1	9.5	13.5	19.0	32.5
500	15.2	9.6	6.2	7.1	62.6	93.2	98.9	99.7	31.1	25.4	18.7	16.5	20.2	29.3	41.3	57.7

Table A.42: Size(%) and power(%) of weak instruments robust tests ($\gamma = 0.9$) for AR(1) model

	size ($H_0 : \theta = 0.9$)				power ($H_1 : \theta = 0.8$)				size ($H_0 : \theta = 0.9$)				power ($H_1 : \theta = 0.8$)			
	$\tau^2 = 1$								$\tau^2 = 5$							
N/T	5	10	15	20	5	10	15	20	5	10	15	20	5	10	15	20
Anderson and Rubin test based on moment conditions "DIF1"																
50	20.4	100.0	–	–	20.6	100.0	–	–	21.0	100.0	–	–	20.3	100.0	–	–
150	8.0	65.5	100.0	–	8.8	68.2	100.0	–	8.8	66.1	100.0	–	8.8	67.4	100.0	–
500	5.5	16.7	64.7	99.7	5.7	21.5	80.5	100.0	5.1	16.4	64.6	99.8	5.4	19.5	77.2	100.0
Anderson and Rubin test based on moment conditions "DIF2"																
50	11.5	45.1	86.6	99.6	11.5	46.4	87.4	99.9	12.3	45.4	86.2	100.0	11.8	45.7	86.9	99.8
150	6.8	12.6	21.3	41.8	7.3	15.5	27.6	56.4	6.9	13.1	22.2	41.0	7.1	12.8	22.0	42.1
500	5.7	5.5	7.6	9.1	6.1	8.8	22.3	41.4	5.6	5.4	9.0	9.3	5.6	5.6	9.3	11.0
Anderson and Rubin test based on moment conditions "DIF3"																
50	5.7	6.4	7.7	5.7	6.2	6.9	9.5	8.9	4.8	6.3	5.7	5.6	4.9	6.5	5.7	5.8
150	5.4	6.8	5.0	5.0	5.1	7.8	7.9	12.0	4.6	6.2	4.5	4.8	4.5	6.0	5.0	4.6
500	3.7	4.2	5.5	5.3	4.7	8.3	13.7	25.1	3.1	4.0	5.3	4.6	3.5	4.0	5.6	5.2
Anderson and Rubin test based on moment conditions "SYS1"																
50	39.1	–	–	–	42.8	–	–	–	39.7	–	–	–	43.0	–	–	–
150	11.2	84.4	100.0	–	27.3	97.2	100.0	–	11.0	83.9	100.0	–	27.2	97.0	100.0	–
500	6.1	19.1	78.7	100.0	59.8	99.7	100.0	100.0	6.0	19.2	79.3	100.0	59.5	99.7	100.0	100.0
Anderson and Rubin test based on moment conditions "SYS2"																
50	23.8	85.8	100.0	–	26.6	88.6	100.0	–	23.8	85.7	99.9	–	26.4	88.5	100.0	–
150	9.3	22.2	49.0	81.4	20.5	48.2	79.7	96.4	9.1	23.1	48.3	80.1	19.4	47.8	79.6	96.7
500	5.6	6.8	15.2	19.0	45.2	78.7	94.2	98.9	5.2	6.8	14.2	17.7	45.1	79.3	94.0	98.8
Anderson and Rubin test based on moment conditions "SYS3"																
50	10.8	10.1	11.2	8.0	19.4	33.1	49.0	58.8	10.0	10.2	8.8	8.5	18.6	32.3	48.3	58.1
150	6.5	7.6	5.7	6.0	26.4	64.6	87.3	95.4	6.6	5.5	5.3	6.5	26.3	65.2	87.2	95.4
500	4.8	5.7	5.8	5.3	68.3	99.6	100.0	100.0	4.5	5.2	6.0	4.8	68.0	99.6	100.0	100.0
Lagrange Multiplier test based on moment conditions "DIF1"																
50	22.2	87.9	–	–	25.4	89.7	–	–	22.8	88.9	–	–	24.7	88.4	–	–
150	7.7	46.6	74.1	–	7.6	47.2	91.1	–	7.9	50.0	74.8	–	9.1	52.7	90.6	–
500	6.3	8.7	20.9	71.8	7.7	24.4	45.3	57.7	6.0	9.5	22.2	73.8	7.0	16.1	31.9	61.6
Lagrange Multiplier test based on moment conditions "DIF2"																
50	15.4	38.4	57.0	68.0	15.6	44.2	68.5	77.4	14.8	40.9	54.9	68.1	15.2	46.7	62.8	73.4
150	6.8	10.2	13.3	19.8	6.2	10.3	18.9	29.7	7.3	12.7	19.8	30.6	7.8	12.0	23.7	33.8
500	5.3	6.1	6.0	6.6	7.6	17.8	50.4	82.4	7.0	7.0	7.2	7.2	7.2	7.0	5.9	10.4
Lagrange Multiplier test based on moment conditions "DIF3"																
50	7.9	6.7	7.2	7.0	7.2	8.1	9.6	11.1	6.3	7.9	7.1	6.7	6.8	7.8	7.6	6.5
150	5.4	5.5	4.9	4.9	5.5	8.4	10.4	17.5	5.3	5.9	4.9	4.8	5.6	4.6	5.3	6.5
500	5.2	4.7	4.2	5.4	7.4	11.7	22.7	37.0	5.2	4.8	4.8	5.3	5.2	4.5	4.9	6.4
Lagrange Multiplier test based on moment conditions "SYS1"																
50	19.7	–	–	–	21.1	–	–	–	22.1	–	–	–	22.1	–	–	–
150	7.8	27.0	72.6	–	37.5	49.9	84.8	–	8.2	25.4	72.7	–	36.6	46.4	82.1	–
500	5.4	10.2	16.9	31.7	87.8	99.3	88.0	91.8	6.6	9.2	16.3	31.2	84.7	86.9	77.4	77.6
Lagrange Multiplier test based on moment conditions "SYS2"																
50	16.8	35.6	74.0	–	17.1	42.9	75.8	–	17.1	37.1	72.8	–	17.6	41.6	74.9	–
150	7.8	10.7	14.9	23.7	28.8	48.4	41.6	31.6	7.6	11.9	14.7	23.1	28.9	32.9	29.9	31.0
500	5.5	6.4	6.1	8.1	76.7	99.2	100.0	100.0	5.9	7.1	6.6	7.8	74.8	88.1	84.7	82.7
Lagrange Multiplier test based on moment conditions "SYS3"																
50	9.9	9.3	7.8	7.5	20.9	39.7	57.8	69.3	12.9	10.0	10.3	7.9	22.1	39.8	57.0	69.4
150	7.0	6.1	6.0	7.0	39.3	80.3	95.7	98.7	7.0	5.9	5.7	7.2	39.2	75.0	89.3	94.4
500	5.7	6.1	4.4	5.9	87.6	99.6	100.0	100.0	6.1	4.7	5.7	6.7	78.9	94.2	96.1	97.9
Conditional likelihood ratio test based on moment conditions "DIF1"																
50	22.6	87.7	–	–	23.3	89.7	–	–	22.2	88.9	–	–	23.4	88.5	–	–
150	9.0	62.2	74.2	–	9.1	64.5	91.4	–	8.8	64.3	75.1	–	8.3	66.1	90.7	–
500	6.6	9.7	22.1	77.5	7.7	25.9	50.1	63.0	5.4	11.1	24.5	79.7	7.5	19.4	38.0	70.0
Conditional likelihood ratio test based on moment conditions "DIF2"																
50	12.6	44.2	60.1	68.1	12.1	45.3	71.4	77.7	12.9	44.3	57.8	68.1	13.4	46.3	65.0	74.2
150	7.3	12.2	16.8	25.0	7.7	14.8	23.5	37.7	7.7	13.5	21.1	36.8	7.6	13.2	22.6	38.6
500	5.6	6.0	6.0	6.8	7.7	17.5	50.6	82.6	6.1	5.5	8.6	9.4	5.4	6.4	8.9	12.1
Conditional likelihood ratio test based on moment conditions "DIF3"																
50	5.9	6.1	7.6	6.6	6.7	8.1	10.0	11.9	5.2	6.8	6.1	6.3	5.3	6.4	6.1	6.2
150	5.3	5.5	5.1	5.0	5.3	8.7	10.5	17.0	4.9	5.9	4.9	5.0	4.9	6.3	5.3	6.1
500	4.9	4.7	4.5	5.5	7.1	11.4	22.9	36.8	3.4	3.8	4.7	5.4	4.0	4.4	4.6	6.5
Conditional likelihood ratio test based on moment conditions "SYS1"																
50	20.5	–	–	–	21.8	–	–	–	22.1	–	–	–	22.2	–	–	–
150	8.2	27.6	72.8	–	37.5	50.6	84.8	–	7.9	25.5	73.1	–	35.8	46.7	82.0	–
500	5.7	10.3	17.5	32.1	88.2	99.3	88.1	91.8	5.9	9.3	16.3	31.5	85.1	86.9	77.3	77.7
Conditional likelihood ratio test based on moment conditions "SYS2"																
50	17.1	36.0	74.3	–	17.8	43.2	75.8	–	16.8	37.1	72.7	–	17.6	41.6	74.9	–
150	8.2	11.2	15.1	24.0	29.2	48.6	42.5	32.2	7.5	11.7	15.0	23.3	29.2	33.2	29.9	30.8
500	5.6	6.4	5.9	8.2	76.6	99.2	100.0	100.0	5.9	7.0	6.5	7.8	74.8	88.4	84.9	82.7
Conditional likelihood ratio test based on moment conditions "SYS3"																
50	11.3	9.7	8.3	7.9	20.9	40.8	58.5	70.5	13.4	10.2	10.7	8.6	22.3	40.0	57.4	69.5
150	7.0	6.0	5.9	7.1	40.0	80.2	95.8	98.7	7.1	6.1	6.1	6.9	39.4	75.7	89.9	95.0
500	5.6	6.1	4.3	5.7	87.7	99.7	100.0	100.0	6.3	4.7	5.8	6.7	79.2	94.5	96.8	98.6