rely on lags of y_{it} for the identification of α and β, the over-identifying restrictions arising from the strict exogeneity of x_{it} and the lack of correlation with η_i were not used in the simulated GMM estimator. Thus, we chose[6]

$$Z_i = [\text{diag}\,(y_{i1} \cdots y_{is}) \vdots (\bar{x}_{i3} \cdots \bar{x}_{iT})'] \qquad (s = 1, \ldots, T-2)$$

which is a valid instrument set provided $\phi = 0$.

In the base design, the sample size is $N = 100$ and $T = 7$, the v_{it} are independent over time and homoskedastic: $\theta_1 = \phi = 0$, $\theta_0 = \sigma^2 = 1$, $\sigma^2_\eta = 1$, $\beta = 1$, $\rho = 0{\cdot}8$ and $\sigma^2_\varepsilon = 0{\cdot}9$. Tables 1 and 2 summarize the results for $\alpha = 0{\cdot}2$, $0{\cdot}5$, $0{\cdot}8$ obtained from 100 replications. Results for other variants of this design were calculated ($N = 200$, $T = 6$, $\sigma^2 = 2$, 5, $\sigma^2_\eta = 0$, $\rho = 0$], and are available from the authors on request. However the conclusions are the same as for the results reported here.

Table 1 reports sample means and standard deviations for one-step and two-step GMM estimators (GMM1 and GMM2 respectively), OLS in levels, within-groups, and

TABLE 1

Biases in the estimates

	GMM1	GMM2	OLS	Within-groups	AHd	AHl	One-step ASE	Robust One-step ASE	Two-step ASE
				$\alpha = 0{\cdot}5, \beta = 1$					
Coefficient: α									
Mean	0·4884	0·4920	0·7216	0·3954	−2·4753	0·5075	0·0683	0·0677	0·0604
St. Dev.	0·0671	0·0739	0·0216	0·0272	45·9859	0·0821	0·0096	0·0120	0·0106
Coefficient: β									
Mean	1·0053	0·9976	0·7002	1·0409	0·1625	0·9996	0·0612	0·0607	0·0548
St. Dev.	0·0631	0·0668	0·0484	0·0480	9·8406	0·0650	0·0031	0·0055	0·0052
				$\alpha = 0{\cdot}2, \beta = 1$					
Coefficient: α									
Mean	0·1937	0·1979	0·5108	0·0957	0·2025	0·2044	0·0610	0·0602	0·0533
St. Dev.	0·0597	0·0670	0·0340	0·0309	0·1973	0·0661	0·0045	0·0066	0·0060
Coefficient: β									
Mean	1·0048	0·9960	0·7030	1·0430	0·9973	0·9991	0·0620	0·0615	0·0553
St. Dev.	0·0630	0·0687	0·0526	0·0476	0·0818	0·0654	0·0028	0·0058	0·0052
				$\alpha = 0{\cdot}8, \beta = 1$					
Coefficient: α									
Mean	0·7827	0·7810	0·8997	0·7160	0·8103	0·8038	0·0529	0·0527	0·0470
St. Dev.	0·0582	0·0609	0·0090	0·0206	0·1313	0·2677	0·0069	0·0082	0·0075
Coefficient: β									
Mean	1·0001	0·9926	0·7754	1·0137	1·0000	0·9980	0·0609	0·0601	0·0544
St. Dev.	0·0622	0·0671	0·0423	0·0461	0·0789	0·0893	0·0035	0·0056	0·0056

Notes.

(i) $N = 100$, $T = 7$, 100 replications, $\sigma^2 = \sigma^2_\eta = 1$.
(ii) Exogenous variable is first order autoregressive with $\rho = 0{\cdot}8$ and $\sigma^2_\varepsilon = 0{\cdot}9$.
(iii) GMM1 and GMM2 are respectively one step and two step difference—IV estimators of the type described in Section 2. Both GMM use $Z_i = [\text{diag}\,(y_{i1} \cdots y_{is}) : (\bar{x}_{i3} \cdots \bar{x}_{iT})']$ $(s = 1, \ldots, T-2)$.
(iv) AHd and AHl are the Anderson-Hsiao stacked—IV estimators of the equation in first differences that use $\Delta y_{i(t-2)}$ and $y_{i(t-2)}$ as an instrument for $\Delta y_{i(t-1)}$ respectively.
(v) One Step ASE and Robust One Step ASE are estimates of the asymptotic standard errors of GMM1. The former are only valid for i.i.d. errors while the latter are robust to general heteroskedasticity over individuals and over time. Two step ASE is a robust estimate of the asymptotic standard errors of GMM2.

6. The optimal instrument set for the system of first difference equations would be $z_i = \text{diag}\,(y_{i1} \cdots y_{is}, x_{i1}, \ldots, x_{iT})$.