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Testing for seasonal unit roots in heterogeneous panels using monthly data in the presence of cross sectional dependence

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Abstract

This paper generalises the monthly seasonal unit root tests of Franses (1991) for a heterogeneous panel following the work of Im, Pesaran, and Shin (2003), which we refer to as the F-IPS tests. The paper presents the mean and variance necessary to yield a standard normal distribution for the tests, for different number of time observations, T , and lag lengths. However, these tests are only applicable in the absence of cross-sectional dependence. Two alternative methods for modifying these F-IPS tests in the presence of cross-sectional dependency are presented: the first is the cross-sectionally augmented test, denoted CF-IPS, following Pesaran (2007), the other is a bootstrap method, denoted BF-IPS. In general, the BF-IPS tests have greater power than the CF-IPS tests, although for large T and high degree of cross-sectional dependency the CF-IPS test dominates the BF-IPS test.

JEL Classification: C12; C15; C22; C23.

Keywords: Panel unit root tests, seasonal unit roots, monthly data, cross sectional dependence, Monte Carlo

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1 Introduction

Im, Pesaran, and Shin (2003) IPS proposed a test for the presence of unit roots in dynamic heterogeneous panels, that combines information from the time-series dimension with that from the cross-section dimension, so that fewer time series observations are required for the test to have power. The IPS test was developed to test for the presence of unit roots in non-seasonal time series. However, many macroeconomic time series display seasonal behaviour and several tests have been proposed to test for the presence of unit roots at seasonal frequencies; see for example Ghysels and Osborn (2001) for a review of these tests. Of the tests that have been proposed in the literature, the one by Hylleberg, Engle, Granger, and Yoo (1990) HEGY has proved to be the most popular when dealing with quarterly time series and this test has been extended by Franses (1991) and Beaulieu and Miron (1993) to the case of monthly data.

The objective of this paper is to generalise the tests of Franses (1991) to cover a heterogenous panel, in line with previous work by Dreger and Reimers (2005), Otero, Smith, and Giullietti (2005) and Otero, Smith, and Giullietti (2007), who test for panel seasonal unit roots using quarterly data.

The paper is organised as follows. Section 2 sets up the model used to develop the panel version of the Franses (1991) monthly seasonal unit root test, which we shall refer to as the Franses-IPS (F-IPS) test. The proposed F-IPS test is based on the Franses statistics averaged across the individuals of the panel, and the mean and variance required for standardisation are obtained by Monte Carlo simulation. Section 3 considers the potential effect of cross-sectional dependence on the F-IPS test. We find that the test suffers from size distortions in the presence of cross section dependence, and so we consider two alternative procedures to correct for these distortions: the first one uses a generalisation of the cross sectionally augmented IPS (CIPS) test put forward by Pesaran (2007), and the second one applies a bootstrap methodology advocated by Maddala and Wu (1999). Section 4 offers some concluding remarks.

2 Franses-IPS panel seasonal unit root test

IPS consider a sample of N cross section units observed over T time periods. The IPS test averages the (augmented) Dickey-Fuller (Dickey and Fuller (1979)) statistic obtained across the N cross-sectional units of the panel, and show that after a suitable standardisation the resulting statistic follows a standard normal distribution.

Generalising the Franses (1991) test to a panel in which there is a sample of N cross sections observed over T monthly time periods:

$$\begin{aligned} \varphi_i(L)y_{8it} &= \pi_{1i}y_{1it-1} + \pi_{2i}y_{2it-1} + \pi_{3i}y_{3it-1} + \pi_{4i}y_{3it-2} + \pi_{5i}y_{4it-1} + \pi_{6i}y_{4it-2} \\ &\quad + \pi_{7i}y_{5it-1} + \pi_{8i}y_{5it-2} + \pi_{9i}y_{6it-1} + \pi_{10i}y_{6it-2} + \pi_{11i}y_{7it-1} + \pi_{12i}y_{7it-2} + \mu_{it} + \varepsilon_{it}, \end{aligned} \quad (1)$$

where $i = 1, \dots, N$, $t = 1, \dots, T$, $\mu_{it} = \alpha_i + \beta_i t + \sum_{j=1}^{s-1} \gamma_{ij} D_{jt}$, D_{jt} are monthly seasonal dummy variables, $\varphi_i(L)$ is a p_i^{th} ordered polynomial in the lag operator, L , $\varepsilon_{it} \sim N(0, \sigma_{\varepsilon_i}^2)$, and:

$$\begin{aligned} y_{1it} &= (1+L)(1+L^2)(1+L^4+L^8)y_{it}, \\ y_{2it} &= -(1-L)(1+L^2)(1+L^4+L^8)y_{it}, \\ y_{3it} &= -(1-L^2)(1+L^4+L^8)y_{it}, \\ y_{4it} &= -(1-L^4)\left(1-L\sqrt{3}+L^2\right)(1+L^2+L^4)y_{it}, \\ y_{5it} &= -(1-L^4)\left(1+L\sqrt{3}+L^2\right)(1+L^2+L^4)y_{it}, \\ y_{6it} &= -(1-L^4)(1-L^2+L^4)(1-L+L^2)y_{it}, \\ y_{7it} &= -(1-L^4)(1-L^2+L^4)(1+L+L^2)y_{it}, \\ y_{8it} &= (1-L^{12})y_{it}. \end{aligned}$$

The parameters of (1) can be estimated by ordinary least squares. Franses (1991) shows that testing the significance of the π -coefficients is equivalent to testing for seasonal and non-seasonal unit roots, so that in estimating equation (1) for the i^{th} group, the t statistic on π_{1i} tests the existence of the non-seasonal unit root 1, while the t statistic on π_{2i} tests the presence of the bimonthly (seasonal) unit root -1 ; in turn, the F statistics on $\{\pi_{3i}, \pi_{4i}\}$, $\{\pi_{5i}, \pi_{6i}\}$, $\{\pi_{7i}, \pi_{8i}\}$, $\{\pi_{9i}, \pi_{10i}\}$, and $\{\pi_{11i}, \pi_{12i}\}$ test the presence of the other complex seasonal unit roots. Furthermore, Franses (1991) considers a joint test for the presence of the complex unit roots, i.e. $\{\pi_{3i}, \dots, \pi_{12i}\}$, and subsequent work by Franses and Hobijn (1997) suggest a joint test for the presence of seasonal unit roots, i.e. $\{\pi_{2i}, \dots, \pi_{12i}\}$.

Within a panel data context, and following IPS, the null hypothesis to test, for example, the presence of the zero frequency (non-seasonal) unit root 1 becomes $H_0 : \pi_{1i} = 0 \quad \forall i$ against $H_1 : \pi_{1i} < 0$ for $i = 1, 2, \dots, N_1$, $\pi_{1i} = 0$ for $i = N_1 + 1, N_1 + 2, \dots, N$. Notice that under the alternative hypothesis, this specification allows some, but not all, of the individual series to have a unit root at the zero frequency. To test the existence of the bimonthly (seasonal) unit root -1 , the null hypothesis becomes $H_0 : \pi_{2i} = 0 \quad \forall i$, and similarly to test for the presence of the other seasonal unit roots.

Denote in (1) the estimated t statistics as \tilde{t}_{jiT} ($j = 1, 2$), and the corresponding F statistics as $\tilde{F}_{\{3,4\}iT}$, $\tilde{F}_{\{5,6\}iT}$, $\tilde{F}_{\{7,8\}iT}$, $\tilde{F}_{\{9,10\}iT}$, $\tilde{F}_{\{11,12\}iT}$, $\tilde{F}_{\{2,\dots,12\}iT}$ and $\tilde{F}_{\{3,\dots,12\}iT}$. For a fixed T define the average statistics:

$$\tilde{t}_j \text{bar}_{NT} = \frac{1}{N} \sum_{i=1}^N \tilde{t}_{jiT}, \quad j = 1, 2,$$

and

$$\tilde{F}_j \text{bar}_{NT} = \frac{1}{N} \sum_{i=1}^N \tilde{F}_{jiT}, \quad j = \{3, 4\}, \{5, 6\}, \{7, 8\}, \{9, 10\}, \{11, 12\}, \{2, \dots, 12\}, \{3, \dots, 12\}.$$

Following IPS, consider the standardised statistics:

$$\text{F-IPS}_{t_j} = \frac{\sqrt{N} \left\{ \tilde{t}_j \text{bar}_{NT} - \frac{1}{N} \sum_{i=1}^N E [\tilde{t}_{jiT}(p_i, 0 | \pi_i = 0)] \right\}}{\sqrt{\frac{1}{N} \sum_{i=1}^N \text{Var} [\tilde{t}_{jiT}(p_i, 0 | \pi_i = 0)]}} \Rightarrow N(0, 1), \quad (2)$$

for $j = 1, 2$, and

$$\text{F-IPS}_{F_j} = \frac{\sqrt{N} \left\{ \tilde{F}_j \text{bar}_{NT} - \frac{1}{N} \sum_{i=1}^N E [\tilde{F}_{jiT}(p_i, 0 | \pi_i = 0)] \right\}}{\sqrt{\frac{1}{N} \sum_{i=1}^N \text{Var} [\tilde{F}_{jiT}(p_i, 0 | \pi_i = 0)]}} \Rightarrow N(0, 1), \quad (3)$$

for $j = \{3, 4\}, \{5, 6\}, \{7, 8\}, \{9, 10\}, \{11, 12\}, \{2, \dots, 12\}, \{3, \dots, 12\}$. In (2), $E [\tilde{t}_{jiT}(p_i, 0 | \pi_i = 0)]$ and $\text{Var} [\tilde{t}_{jiT}(p_i, 0 | \pi_i = 0)]$ denote the mean and variance of \tilde{t}_{jiT} , when $\pi_{1i} = \dots = \pi_{12i} = 0$ in the (1). Similarly, in (3), $E [\tilde{F}_{jiT}(p_i, 0 | \pi_i = 0)]$ and $\text{Var} [\tilde{F}_{jiT}(p_i, 0 | \pi_i = 0)]$ correspond to the mean and variance of \tilde{F}_{jiT} .

Table 1 reports the means and variances required to standardise $\tilde{t}_j \text{bar}_{NT}$, for $j = 1, 2$, and $\tilde{F}_j \text{bar}_{NT}$, $j = \{3, 4\}, \{5, 6\}, \{7, 8\}, \{9, 10\}, \{11, 12\}, \{2, \dots, 12\}, \{3, \dots, 12\}$. As in IPS, these moments have been computed via Monte Carlo simulations with 20,000 replications, for different values of T and p_i , and for different combinations of deterministic components, namely constant (c), constant and trend (c,t), constant and seasonal dummy variables (c,s), and constant, trend and seasonal dummy variables (c,s,t).¹ The simulation experiments were carried out for data generated by $y_{8it} \equiv y_t - y_{t-12} = \varepsilon_{it}$, where $i = 1$, $t = 1, \dots, T$ and $\varepsilon_{it} \sim N(0, 1)$. From the simulation experiments it appears that for the first and second moments of \tilde{t}_{jiT} and \tilde{F}_{jiT} to exist (when $p_i = 0, \dots, 12$), it is required that $T \geq 48$.

To examine the size (at the 5% significance level) of the F-IPS tests, we carry out simulations under the null hypothesis $\pi_{1i} = \dots = \pi_{12i} = 0$ in the equation:

$$y_{8it} = y_{it} - y_{it-12} = \mu_{it} + \rho y_{it-12} + \sum_{j=1}^{p_i} \varphi_{ji} y_{8i,t-j} + \varepsilon_{it}, \quad (4)$$

¹It should be noted that the results for the specification with no constant, no trend and no seasonal dummy variables are not reported since it is too restrictive for practical purposes.

where $\rho = 0$, $p_i = 0$, and $\varepsilon_{it} \sim N(0, 1)$. The simulation experiments are based on 2,000 replications, and were carried out for values of $N = 5, 15, 25, 40$ and $T = 48, 60, 96, 120, 240, 360, 480$, with the first 100 time observations for each cross-sectional unit being discarded.

Table 2 reports the size and power of the tests when there is no serial correlation and the model includes a constant and a constant and a trend as deterministic components. Both the F-IPS_{t1} and F-IPS_{t2} tests are approximately correctly sized. However, both the F-IPS_{F{2,...,12}} and the F-IPS_{F{3,...,12}} tests are slightly over-sized especially for smaller N and T . To calculate power, the data are generated as:

$$y_{it} = 0.9y_{it-12} + \varepsilon_{it}.$$

As expected, the results in Table 2 show that for given N power increases with T . Also, it can be seen that for fixed T , power increases with N .²

3 Cross sectional dependence

An important assumption underlying the F-IPS tests is that of cross section independence among the individual time series in the panel. Table 3 shows the empirical size results of the F-IPS test based on equation (4) when, as in O'Connell (1998), $E(\varepsilon_{it}\varepsilon_{jt}) = \omega = (0.3, 0.5, 0.7, 0.9)$ for $i \neq j$. As can be seen from the Table, the F-IPS tests suffer from severe size distortions in the presence of cross-sectional dependence, the magnitude of which increases as the strength of the cross-sectional dependence increases.

A number of procedures have been suggested to allow for cross-sectional dependence in panel unit root tests that focus on the zero or long run frequency. In this paper we consider two such approaches. First, we follow Pesaran (2007), who augments the standard ADF regressions with the cross section averages of lagged levels and first-differences of the individual series in the panel. The corresponding cross-sectionally augmented Franses regression is given by:

$$\begin{aligned} y_{8it} = & \pi_{1i}y_{1it-1} + \pi_{2i}y_{2it-1} + \pi_{3i}y_{3it-1} + \pi_{4i}y_{3it-2} + \pi_{5i}y_{4it-1} + \pi_{6i}y_{4it-2} \\ & + \pi_{7i}y_{5it-1} + \pi_{8i}y_{5it-2} + \pi_{9i}y_{6it-1} + \pi_{10i}y_{6it-2} + \pi_{11i}y_{7it-1} + \pi_{12i}y_{7it-2} \\ & + \theta_{1i}\bar{y}_{1t-1} + \theta_{2i}\bar{y}_{2t-1} + \theta_{3i}\bar{y}_{3t-2} + \theta_{4i}\bar{y}_{3t-1} + \theta_{5i}\bar{y}_{4t-1} + \theta_{6i}\bar{y}_{4t-1} \\ & + \theta_{7i}\bar{y}_{5t-1} + \theta_{8i}\bar{y}_{5t-1} + \theta_{9i}\bar{y}_{6t-2} + \theta_{10i}\bar{y}_{6t-1} + \theta_{11i}\bar{y}_{7t-1} + \theta_{12i}\bar{y}_{7t-1} \\ & + \sum_{j=0}^p \delta_{ij}\bar{y}_{8t-j} + \sum_{j=1}^p \varphi_{ij}y_{8i,t-j} + \mu_{it} + \varepsilon_{it}, \end{aligned} \tag{5}$$

where \bar{y}_{1t} is the cross section mean of y_{1it} , defined as $\bar{y}_{1t} = (N)^{-1} \sum_{i=1}^N y_{1it}$, and similarly for $\bar{y}_{2t}, \dots, \bar{y}_{8t}$. The cross-sectionally augmented versions of the Franses-IPS tests, denoted as CF-IPS, are then:

²We only report the power probabilities of the $\tilde{F}_{2,\dots,12}bar_{NT}$ and $\tilde{F}_{3,\dots,12}bar_{NT}$ tests because they exhibit more power than the other joint F tests.

$$\text{CF-IPS}_{t_j} = N^{-1} \sum_{i=1}^N t_{\pi_{ji}}, \quad j = 1, 2,$$

where $t_{\pi_{ji}}$ denotes the t -ratio on π_{ji} in equation (5) and

$$\text{CF-IPS}_{F_j} = N^{-1} \sum_{i=1}^N F_{\pi_{ji}}, \quad j = \{3, 4\}, \{5, 6\}, \{7, 8\}, \{9, 10\}, \{11, 12\}, \{2, \dots, 12\}, \{3, \dots, 12\},$$

where $F_{\pi_{ji}}$ denotes the F -test of the joint significance of $\{\pi_{3i}, \pi_{4i}\}$, $\{\pi_{5i}, \pi_{6i}\}$, $\{\pi_{7i}, \pi_{8i}\}$, $\{\pi_{9i}, \pi_{10i}\}$, $\{\pi_{11i}, \pi_{12i}\}$, $\{\pi_{2i}, \dots, \pi_{12i}\}$ and $\{\pi_{3i}, \dots, \pi_{12i}\}$, also in equation (5).

Critical values of the CF-IPS_{t_j} and CF-IPS_{F_j} tests are reported in Table 4, for different combinations of deterministic components, based on a Monte Carlo simulation (with 20,000 replications) when the underlying data are generated as in (4), with $\rho = 0$, $p_i = 0$, $N = 5, 15, 25, 40$, $T = 48, 60, 96, 120, 240, 360, 480$ and $\varepsilon_{it} \sim N(0, 1)$.

As an alternative procedure to test for the presence of unit roots in panels that exhibit cross-sectional dependency, Maddala and Wu (1999) and more recently Chang (2004) have considered bootstrapping unit root tests which, in the context of the F-IPS test, denoted as BF-IPS. In order to implement this procedure, we start off by resampling the restricted residuals $y_{8it} \equiv y_{it} - y_{i,t-12} = \varepsilon_{it}$ after centering, since y_{it} is assumed to be a seasonally integrated series under the null hypothesis; this is what Li and Maddala (1996) refer to as the sampling scheme S_3 which is appropriate in the unit root case. To preserve the cross-correlation structure of the error term within each cross section i , and following Maddala and Wu (1999), we resample the restricted residuals with the cross-section index fixed. Also, in order to ensure that initialisation of ε_{it}^* , i.e. the bootstrap samples of ε_{it} , becomes unimportant, we follow Chang (2004) who advocates generating a large number of ε_{it}^* , say $T + Q$ values and discard the first Q values of ε_{it}^* (in our simulations we choose Q equal to 100). Lastly, the bootstrap samples of y_{it}^* are calculated by taking partial sums of ε_{it}^* . These Monte Carlo simulation results are based on 2,000 replications each of which uses 200 bootstrap repetitions.

With dependent data, serial correlation can be accounted for by resampling from the restricted residuals (after centring) that result from fitting to each individual series AR processes, that is:

$$y_{8it} = \sum_{r=1}^p \gamma_{ir} y_{8i,t-r} + \varepsilon_{it}. \quad (6)$$

Next, $y_{8i,t}^*$ is generated recursively from $\varepsilon_{i,t}^*$ as:

$$y_{8it}^* = \sum_{r=1}^p \hat{\gamma}_{ir} y_{8i,t-r}^* + \varepsilon_{it}^*, \quad (7)$$

where $\hat{\gamma}_{ir}$ are the coefficient estimates from the fitted regressions (6). Once again, to minimise the effects of initial values in equation (7), we follow Chang (2004) by setting them equal to zero, generating a

larger number of $\varepsilon_{i,t}^*$ (say $T + Q$ values), and discarding the first Q values. The bootstrap samples of y_{it}^* are calculated as $y_{it}^* = y_{i0}^* + \sum_{k=1}^t \varepsilon_{ik}^*$.

The empirical size of the CF-IPS and BF-IPS tests when $E(\varepsilon_{it}\varepsilon_{jt}) = \omega = (0.3, 0.5, 0.7, 0.9)$ for $i \neq j$, are approximately correct (with 95% critical values of 4.04-5.96 for an empirical 5% significance level), and a subset of these tests for F-IPS $_{t1}$, F-IPS $_{t2}$, F-IPS $_{F\{2,\dots,12\}}$ and F-IPS $_{F\{3,\dots,12\}}$ are reported in Tables 5 and 6 for the cases with only a constant and a constant and trend, respectively. These tables also report the power of these tests at the 5% significance level when in equation (4) $\rho = -0.1$. In general, we observe that the BF-IPS test outperforms the CF-IPS test. However, the extent of this dominance falls as the degree of cross-sectional correlation increases and as N increases. For large T and high ω there are cases in which the CF-IPS test dominates. Similar results are observed when other deterministic components are included in the test regressions.

4 Concluding remarks

In this paper the seasonal unit root test of Franses (1991) is generalised to cover a heterogenous panel. In particular, following the lines of Im, Pesaran, and Shin (2003), the testing procedure proposes standardised t_{bar} and F_{bar} statistics, denoted F-IPS tests, based on the Franses statistics averaged across the individuals of the panel. The mean and variance required to standardise the test statistics are obtained by Monte Carlo simulation. In addition, the size and power properties of the tests are analysed for different deterministic components.

Monte Carlo simulation results show that the F-IPS tests suffer from severe size distortions in the presence of cross sectional dependence. To correct for this, we consider two alternative methods for modifying the F-IPS tests. The first one is the cross-sectionally augmented approach, denoted CF-IPS, following Pesaran (2007), and the second one is the bootstrap approach, following Maddala and Wu (1999), denoted BF-IPS. In general, the BF-IPS tests have greater power than the method CF-IPS tests, although for large T and high degree of cross-sectional dependency the CF-IPS test dominates the BF-IPS test.

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Table 1 (continued). Mean and Variance correction for F-IPS_{F(3,4)}.

p	Model	T=48	60	96	120	240	360	480	Model	T=48	60	96	120	240	360	480
0	Mean	c	0.927	0.955	0.982	0.994	1.027	1.024	c,s	1.955	2.139	2.472	2.596	2.790	2.895	2.922
	Variance		0.913	0.930	0.957	0.958	1.050	1.033		2.240	2.379	2.803	3.114	3.280	3.450	3.599
1	Mean		0.935	0.963	0.985	0.995	1.025	1.044		1.895	2.095	2.447	2.572	2.778	2.888	2.914
	Variance		0.936	0.944	0.960	0.964	1.046	1.027		2.188	2.336	2.763	3.076	3.279	3.444	3.579
2	Mean		0.923	0.962	0.987	0.998	1.027	1.046		1.800	2.017	2.394	2.523	2.751	2.870	2.901
	Variance		0.914	0.962	0.971	0.977	1.051	1.038		2.062	2.250	2.724	2.994	3.255	3.429	3.569
3	Mean		0.926	0.963	0.987	0.997	1.027	1.044		1.754	1.971	2.363	2.498	2.744	2.865	2.896
	Variance		0.927	0.966	0.971	0.980	1.059	1.038		1.992	2.195	2.702	2.927	3.259	3.429	3.574
4	Mean		0.880	0.922	0.960	0.976	1.019	1.041		1.728	1.955	2.355	2.494	2.743	2.865	2.895
	Variance		0.831	0.890	0.915	0.931	1.042	1.028		1.986	2.188	2.682	2.942	3.264	3.433	3.570
5	Mean		0.875	0.921	0.959	0.976	1.020	1.041		1.683	1.915	2.327	2.472	2.734	2.860	2.890
	Variance		0.817	0.895	0.909	0.925	1.045	1.029		1.991	2.126	2.652	2.896	3.267	3.425	3.573
6	Mean		0.872	0.922	0.961	0.977	1.021	1.041		1.614	1.850	2.282	2.435	2.714	2.844	2.880
	Variance		0.815	0.886	0.900	0.922	1.031	1.030		1.936	2.044	2.617	2.867	3.248	3.413	3.557
7	Mean		0.877	0.921	0.962	0.978	1.020	1.040		1.580	1.823	2.258	2.414	2.703	2.838	2.874
	Variance		0.830	0.888	0.903	0.924	1.029	1.025		1.912	2.036	2.593	2.831	3.227	3.407	3.548
8	Mean		0.838	0.886	0.941	0.964	1.013	1.014		1.557	1.810	2.256	2.410	2.701	2.836	2.874
	Variance		0.732	0.801	0.859	0.902	1.009	1.010		1.914	2.049	2.608	2.836	3.214	3.402	3.537
9	Mean		0.836	0.883	0.940	0.962	1.011	1.035		1.520	1.775	2.236	2.387	2.689	2.824	2.868
	Variance		0.739	0.790	0.856	0.897	1.000	0.998		1.868	1.993	2.583	2.792	3.197	3.386	3.528
10	Mean		0.839	0.889	0.944	0.964	1.012	1.032		1.470	1.734	2.195	2.350	2.671	2.812	2.857
	Variance		0.735	0.796	0.860	0.896	1.006	0.999		1.838	1.970	2.549	2.757	3.184	3.386	3.521
11	Mean		0.845	0.894	0.944	0.963	1.012	1.035		1.445	1.713	2.174	2.335	2.662	2.807	2.854
	Variance		0.765	0.816	0.863	0.891	1.007	1.000		1.852	1.966	2.506	2.736	3.165	3.379	3.527
12	Mean		0.926	0.965	0.980	0.992	1.020	1.015		1.443	1.700	2.174	2.343	2.673	2.814	2.859
	Variance		0.915	0.963	0.925	0.953	1.015	1.001		2.042	1.969	2.491	2.751	3.185	3.391	3.538
0	Mean	c,t	0.892	0.928	0.964	0.980	1.019	1.020	c,s,t	1.908	2.111	2.456	2.585	2.784	2.892	2.919
	Variance		0.850	0.872	0.923	0.929	1.036	1.024		2.156	2.327	2.755	3.078	3.255	3.436	3.587
1	Mean		0.893	0.930	0.966	0.980	1.018	1.019		1.854	2.071	2.432	2.562	2.773	2.885	2.912
	Variance		0.847	0.878	0.923	0.934	1.031	1.019		2.112	2.292	2.718	3.040	3.251	3.430	3.569
2	Mean		0.916	0.958	0.984	0.996	1.025	1.023		1.719	1.953	2.348	2.486	2.731	2.857	2.891
	Variance		0.905	0.966	0.965	0.973	1.048	1.036		1.932	2.164	2.643	2.932	3.215	3.405	3.553
3	Mean		0.923	0.962	0.985	0.996	1.025	1.024		1.667	1.902	2.317	2.460	2.723	2.852	2.886
	Variance		0.930	0.974	0.970	0.979	1.056	1.036		1.844	2.097	2.627	2.863	3.222	3.403	3.556
4	Mean		0.849	0.896	0.943	0.962	1.012	1.016		1.681	1.922	2.338	2.481	2.737	2.862	2.892
	Variance		0.780	0.837	0.885	0.904	1.028	1.019		1.922	2.139	2.637	2.898	3.238	3.419	3.558
5	Mean		0.839	0.892	0.940	0.961	1.013	1.017		1.638	1.887	2.310	2.460	2.728	2.857	2.888
	Variance		0.757	0.839	0.874	0.895	1.031	1.021		1.921	2.085	2.603	2.854	3.238	3.411	3.562
6	Mean		0.862	0.917	0.957	0.974	1.019	1.020		1.537	1.791	2.238	2.399	2.694	2.832	2.871
	Variance		0.807	0.882	0.891	0.916	1.027	1.028		1.802	1.957	2.541	2.804	3.209	3.388	3.540
7	Mean		0.871	0.918	0.960	0.976	1.019	1.019		1.499	1.758	2.214	2.377	2.683	2.824	2.865
	Variance		0.836	0.894	0.898	0.919	1.025	1.022		1.774	1.946	2.515	2.767	3.189	3.381	3.530
8	Mean		0.810	0.862	0.924	0.950	1.006	1.010		1.504	1.772	2.237	2.395	2.694	2.832	2.872
	Variance		0.697	0.761	0.830	0.878	0.997	1.002		1.814	1.990	2.555	2.794	3.188	3.387	3.526
9	Mean		0.804	0.857	0.922	0.948	1.004	1.007		1.467	1.740	2.218	2.373	2.683	2.821	2.866
	Variance		0.690	0.746	0.822	0.872	0.987	0.990		1.758	1.937	2.530	2.752	3.169	3.372	3.516
10	Mean		0.832	0.884	0.940	0.960	1.010	1.011		1.394	1.674	2.155	2.316	2.652	2.799	2.847
	Variance		0.729	0.792	0.852	0.890	1.002	0.997		1.710	1.877	2.476	2.700	3.145	3.360	3.504
11	Mean		0.846	0.892	0.941	0.960	1.010	1.011		1.362	1.648	2.131	2.299	2.642	2.794	2.844
	Variance		0.779	0.812	0.857	0.886	1.004	0.998		1.700	1.866	2.426	2.676	3.130	3.353	3.510
12	Mean		0.892	0.938	0.962	0.978	1.013	1.011		1.368	1.655	2.153	2.328	2.666	2.811	2.856
	Variance		0.861	0.910	0.891	0.925	1.002	0.992		1.846	1.885	2.433	2.711	3.159	3.376	3.527

Table 1 (continued): Mean and Variance correction for F-IPSF_(7,8)

p	Model	T=48	60	96	120	240	360	480	Model	T=48	60	96	120	240	360	480
0	Mean	c	0.984	0.985	0.986	0.992	1.017	1.035	c,s	1.944	2.150	2.488	2.583	2.807	2.871	2.910
	Variance		1.068	1.041	0.990	0.977	0.985	1.002		2.260	2.389	2.898	2.968	3.360	3.354	3.506
1	Mean		0.923	0.938	0.964	0.975	1.012	1.032		1.894	2.106	2.456	2.553	2.796	2.862	2.905
	Variance		0.940	0.950	0.944	0.944	0.973	1.019		2.203	2.372	2.855	2.913	3.349	3.338	3.512
2	Mean		0.900	0.920	0.952	0.963	1.007	1.034		1.851	2.077	2.437	2.542	2.792	2.859	2.903
	Variance		0.920	0.917	0.914	0.925	0.964	1.010		2.145	2.321	2.790	2.906	3.362	3.341	3.508
3	Mean		0.895	0.919	0.952	0.962	1.008	1.028		1.791	2.032	2.413	2.519	2.783	2.850	2.898
	Variance		0.905	0.911	0.908	0.921	0.967	1.008		2.061	2.252	2.755	2.885	3.355	3.323	3.501
4	Mean		0.905	0.926	0.957	0.963	1.008	1.029		1.720	1.981	2.371	2.491	2.767	2.839	2.890
	Variance		0.927	0.917	0.926	0.915	0.965	1.008		1.965	2.229	2.700	2.872	3.329	3.328	3.490
5	Mean		0.914	0.935	0.960	0.965	1.007	1.028		1.672	1.939	2.344	2.466	2.754	2.830	2.884
	Variance		0.930	0.925	0.934	0.916	0.962	1.014		1.947	2.172	2.658	2.829	3.317	3.330	3.488
6	Mean		0.914	0.939	0.959	0.966	1.011	1.031		1.607	1.878	2.296	2.424	2.733	2.816	2.872
	Variance		0.921	0.926	0.918	0.919	0.972	1.021		1.930	2.113	2.614	2.785	3.301	3.326	3.467
7	Mean		0.915	0.934	0.915	0.918	0.975	1.029		1.565	1.851	2.274	2.405	2.723	2.810	2.867
	Variance		0.915	0.946	0.963	0.971	1.010	1.032		1.884	2.103	2.619	2.766	3.289	3.324	3.458
8	Mean		0.897	0.935	0.919	0.923	0.981	1.026		1.787	2.076	2.594	2.743	3.283	3.312	3.456
	Variance		0.922	0.949	0.965	0.971	1.010	1.032		1.485	1.780	2.227	2.361	2.692	2.789	2.854
9	Mean		0.910	0.930	0.927	0.916	0.971	1.027		1.839	2.018	2.589	2.719	3.271	3.310	3.449
	Variance		0.915	0.940	0.960	0.967	1.007	1.030		1.457	1.753	2.217	2.351	2.686	2.788	2.851
10	Mean		0.899	0.904	0.914	0.908	0.965	1.021		1.771	1.990	2.564	2.709	3.251	3.314	3.445
	Variance		0.907	0.926	0.948	0.957	1.004	1.026		1.433	1.720	2.196	2.331	2.676	2.781	2.845
11	Mean		0.902	0.879	0.879	0.889	0.953	1.011		1.865	1.964	2.526	2.695	3.256	3.300	3.432
	Variance		0.979	0.992	0.985	0.984	1.012	1.031		1.419	1.709	2.203	2.343	2.688	2.792	2.852
12	Mean		1.002	1.012	0.944	0.935	0.967	1.015		1.927	1.956	2.555	2.723	3.286	3.317	3.436
	Variance	c,t	1.054	1.019	0.994	0.991	1.014	1.032	c,s,t	1.943	2.140	2.478	2.575	2.805	2.869	2.908
0	Mean		1.267	1.132	1.013	0.984	0.983	1.021		2.463	2.485	2.908	2.978	3.350	3.347	3.501
	Variance		0.959	0.943	0.954	0.961	1.004	1.026		1.931	2.136	2.476	2.571	2.807	2.868	2.909
1	Mean		1.040	0.971	0.928	0.924	0.960	1.010		2.437	2.511	2.890	2.943	3.353	3.339	3.512
	Variance		0.901	0.899	0.928	0.940	0.995	1.021		1.922	2.138	2.478	2.576	2.810	2.871	2.911
2	Mean		0.934	0.882	0.873	0.883	0.945	0.996		2.406	2.509	2.849	2.941	3.373	3.345	3.511
	Variance		0.872	0.884	0.922	0.935	0.995	1.020		1.868	2.100	2.455	2.555	2.802	2.862	2.906
3	Mean		0.852	0.844	0.856	0.872	0.945	0.992		2.207	2.469	2.817	2.927	3.369	3.326	3.504
	Variance		0.880	0.892	0.930	0.940	0.997	1.021		1.800	2.041	2.404	2.517	2.779	2.846	2.895
4	Mean		0.867	0.849	0.877	0.876	0.946	0.994		2.217	2.438	2.757	2.912	3.341	3.326	3.488
	Variance		0.905	0.917	0.945	0.951	1.001	1.024		1.731	1.975	2.355	2.472	2.754	2.829	2.882
5	Mean		0.908	0.889	0.906	0.894	0.949	1.006		2.212	2.360	2.699	2.860	3.317	3.319	3.479
	Variance		0.933	0.942	0.959	0.963	1.009	1.030		1.647	1.886	2.281	2.407	2.720	2.806	2.863
6	Mean		0.974	0.930	0.916	0.916	0.967	1.018		2.189	2.251	2.629	2.796	3.286	3.305	3.452
	Variance		0.958	0.965	0.973	0.976	1.014	1.035		1.886	1.833	2.234	2.367	2.697	2.792	2.852
7	Mean		1.029	0.982	0.938	0.938	0.979	1.032		2.138	2.209	2.608	2.759	3.295	3.295	3.436
	Variance		0.978	0.989	0.987	0.987	1.016	1.036		1.520	1.776	2.189	2.326	2.672	2.775	2.841
8	Mean		1.038	1.018	0.964	0.959	0.990	1.033		2.021	2.168	2.564	2.723	3.243	3.281	3.429
	Variance		1.002	1.005	0.994	0.990	1.016	1.036		1.491	1.746	2.172	2.308	2.659	2.766	2.835
9	Mean		1.088	1.044	0.988	0.983	1.035	1.035		2.078	2.122	2.571	2.696	3.230	3.281	3.423
	Variance		1.013	1.003	0.990	0.984	1.012	1.033		1.476	1.726	2.171	2.305	2.658	2.769	2.835
10	Mean		1.119	1.039	0.977	0.946	0.976	1.028		2.039	2.097	2.561	2.679	3.217	3.292	3.425
	Variance		1.026	0.991	0.973	0.968	1.006	1.027		1.471	1.713	2.170	2.303	2.661	2.769	2.835
11	Mean		1.194	1.037	0.939	0.914	0.959	1.014		2.199	2.105	2.540	2.682	3.232	3.284	3.418
	Variance		1.069	1.032	0.996	0.984	1.009	1.028		1.470	1.719	2.199	2.336	2.685	2.789	2.849
12	Mean		1.256	1.117	0.977	0.938	0.965	1.011		2.306	2.104	2.590	2.725	3.274	3.310	3.431
	Variance															

Table 1 (continued). Mean and Variance correction for F-IPS $_{F(9,10)}$.

p		T=48			T=48			T=48			T=48			
	Model	96	120	240	360	480	Model	96	120	240	360	480		
0	Mean	0.927	0.947	0.968	1.011	1.031	c, s	1.966	2.168	2.498	2.805	2.868	2.890	
	Variance	0.958	0.965	0.925	0.967	0.995	c, s	2.307	2.535	2.896	3.301	3.388	3.515	
1	Mean	0.946	0.960	0.973	0.988	1.010	c, s	1.913	2.117	2.464	2.556	2.792	2.859	2.884
	Variance	1.004	0.997	0.979	0.975	0.983	c, s	2.252	2.459	2.818	2.932	3.277	3.376	3.509
2	Mean	0.949	0.967	0.979	0.994	1.012	c, s	1.829	2.057	2.423	2.524	2.777	2.846	2.876
	Variance	1.012	1.014	0.953	0.984	0.991	c, s	2.085	2.375	2.761	2.892	3.274	3.359	3.500
3	Mean	0.886	0.922	0.956	0.975	1.007	c, s	1.779	2.012	2.397	2.505	2.767	2.838	2.870
	Variance	0.861	0.904	0.915	0.941	0.972	c, s	2.056	2.301	2.739	2.908	3.274	3.353	3.490
4	Mean	0.890	0.930	0.959	0.978	1.006	c, s	1.714	1.965	2.360	2.478	2.828	2.861	2.861
	Variance	0.859	0.923	0.920	0.947	0.971	c, s	1.995	2.296	2.680	2.891	3.247	3.342	3.471
5	Mean	0.895	0.935	0.963	0.980	1.006	c, s	1.678	1.924	2.333	2.456	2.736	2.821	2.856
	Variance	0.875	0.938	0.924	0.950	0.970	c, s	1.981	2.252	2.662	2.847	3.230	3.344	3.466
6	Mean	0.850	0.900	0.942	0.964	0.998	c, s	1.645	1.906	2.326	2.452	2.735	2.821	2.854
	Variance	0.795	0.869	0.889	0.920	0.949	c, s	1.944	2.222	2.664	2.847	3.234	3.338	3.459
7	Mean	0.859	0.906	0.945	0.965	0.997	c, s	1.604	1.874	2.299	2.435	2.724	2.813	2.850
	Variance	0.794	0.883	0.892	0.915	0.946	c, s	1.900	2.171	2.614	2.831	3.226	3.326	3.453
8	Mean	0.866	0.910	0.949	0.967	0.997	c, s	1.556	1.827	2.267	2.402	2.709	2.799	2.841
	Variance	0.811	0.898	0.897	0.912	0.947	c, s	1.940	2.115	2.580	2.787	3.204	3.304	3.446
9	Mean	0.827	0.877	0.929	0.953	0.992	c, s	1.523	1.794	2.246	2.380	2.700	2.793	2.836
	Variance	0.718	0.815	0.847	0.887	0.932	c, s	1.850	2.088	2.582	2.751	3.200	3.290	3.432
10	Mean	0.832	0.878	0.933	0.955	0.991	c, s	1.478	1.755	2.218	2.357	2.683	2.782	2.828
	Variance	0.732	0.809	0.849	0.893	0.929	c, s	1.818	2.060	2.545	2.728	3.168	3.264	3.430
11	Mean	0.833	0.880	0.935	0.958	0.990	c, s	1.450	1.719	2.197	2.344	2.671	2.774	2.821
	Variance	0.719	0.811	0.850	0.900	0.923	c, s	1.843	2.007	2.512	2.714	3.168	3.264	3.428
12	Mean	0.917	0.953	0.973	0.984	1.000	c, s	1.443	1.714	2.200	2.355	2.684	2.784	2.828
	Variance	0.880	0.953	0.937	0.950	0.947	c, s	1.977	2.055	2.498	2.715	3.191	3.280	3.437
0	Mean	0.887	0.914	0.949	0.970	1.004	c, s, t	1.919	2.134	2.482	2.571	2.800	2.865	2.888
	Variance	0.877	0.893	0.888	0.938	0.980	c, s, t	2.190	2.443	2.844	2.931	3.279	3.374	3.503
1	Mean	0.921	0.941	0.961	0.979	1.006	c, s, t	1.842	2.064	2.433	2.530	2.779	2.851	2.878
	Variance	0.952	0.961	0.913	0.957	0.975	c, s, t	2.113	2.343	2.753	2.876	3.256	3.358	3.493
2	Mean	0.941	0.963	0.976	0.993	1.011	c, s, t	1.733	1.981	2.375	2.486	2.756	2.833	2.866
	Variance	0.991	1.011	0.951	0.982	0.989	c, s, t	1.917	2.243	2.681	2.828	3.238	3.336	3.480
3	Mean	0.849	0.890	0.937	0.960	1.000	c, s, t	1.724	1.973	2.379	2.493	2.762	2.835	2.867
	Variance	0.790	0.838	0.877	0.913	0.959	c, s, t	1.941	2.211	2.686	2.869	3.254	3.340	3.478
4	Mean	0.865	0.910	0.947	0.968	1.001	c, s, t	1.646	1.910	2.329	2.451	2.735	2.820	2.855
	Variance	0.820	0.886	0.897	0.931	0.962	c, s, t	1.873	2.183	2.614	2.834	3.216	3.324	3.456
5	Mean	0.885	0.930	0.959	0.978	1.004	c, s, t	1.585	1.852	2.286	2.419	2.716	2.808	2.846
	Variance	0.860	0.927	0.923	0.949	0.968	c, s, t	1.800	2.110	2.585	2.779	3.193	3.321	3.447
6	Mean	0.815	0.870	0.923	0.950	0.991	c, s, t	1.585	1.863	2.306	2.439	2.729	2.818	2.852
	Variance	0.729	0.809	0.854	0.893	0.936	c, s, t	1.833	2.116	2.609	2.808	3.214	3.324	3.448
7	Mean	0.834	0.886	0.934	0.956	0.993	c, s, t	1.531	1.817	2.268	2.409	2.710	2.804	2.843
	Variance	0.750	0.851	0.871	0.899	0.938	c, s, t	1.779	2.049	2.549	2.777	3.196	3.308	3.438
8	Mean	0.852	0.902	0.945	0.964	0.996	c, s, t	1.462	1.754	2.221	2.366	2.689	2.786	2.831
	Variance	0.788	0.881	0.893	0.909	0.944	c, s, t	1.709	1.973	2.503	2.722	3.167	3.281	3.427
9	Mean	0.792	0.847	0.912	0.939	0.985	c, s, t	1.456	1.747	2.224	2.366	2.694	2.790	2.834
	Variance	0.657	0.761	0.816	0.863	0.920	c, s, t	1.724	1.979	2.527	2.712	3.180	3.276	3.420
10	Mean	0.806	0.858	0.921	0.945	0.987	c, s, t	1.401	1.697	2.185	2.330	2.670	2.774	2.822
	Variance	0.692	0.776	0.829	0.877	0.921	c, s, t	1.696	1.942	2.477	2.668	3.138	3.245	3.414
11	Mean	0.823	0.873	0.931	0.955	0.988	c, s, t	1.351	1.648	2.152	2.310	2.652	2.761	2.811
	Variance	0.705	0.802	0.847	0.896	0.920	c, s, t	1.664	1.871	2.430	2.646	3.131	3.241	3.409
12	Mean	0.874	0.920	0.954	0.970	0.994	c, s, t	1.359	1.662	2.178	2.341	2.678	2.781	2.826
	Variance	0.797	0.890	0.898	0.922	0.935	c, s, t	1.786	1.940	2.443	2.675	3.170	3.266	3.425

Table 1 (continued). Mean and Variance correction for F-IPS $F_{(3, \dots, 12)}$

p	Model	T=48	60	96	120	240	360	480	Model	T=48	60	96	120	240	360	480
0	Mean	c	0.979	0.992	1.009	1.015	1.034	1.049	c,s	2.446	2.567	2.761	2.809	2.917	2.960	2.970
	Variance		0.255	0.239	0.226	0.218	0.213	0.214		1.231	1.074	0.943	0.899	0.809	0.786	0.791
1	Mean	c	0.977	0.991	1.008	1.013	1.033	1.048		2.403	2.534	2.742	2.791	2.910	2.954	2.966
	Variance		0.258	0.241	0.226	0.218	0.212	0.210		1.202	1.051	0.933	0.887	0.808	0.782	0.789
2	Mean	c	0.978	0.993	1.008	1.013	1.032	1.047		2.350	2.492	2.712	2.768	2.899	2.947	2.960
	Variance		0.263	0.245	0.226	0.218	0.213	0.212		1.160	1.031	0.915	0.878	0.803	0.782	0.786
3	Mean	c	0.974	0.991	1.006	1.012	1.032	1.046		2.306	2.458	2.692	2.754	2.893	2.942	2.957
	Variance		0.260	0.244	0.225	0.218	0.212	0.209		1.135	1.010	0.908	0.871	0.803	0.777	0.785
4	Mean	c	0.976	0.993	1.005	1.011	1.031	1.046		2.254	2.415	2.662	2.731	2.882	2.935	2.952
	Variance		0.264	0.244	0.224	0.217	0.211	0.210		1.138	0.996	0.894	0.869	0.798	0.777	0.783
5	Mean	c	0.974	0.992	1.005	1.010	1.031	1.046		2.211	2.382	2.641	2.714	2.874	2.931	2.949
	Variance		0.262	0.245	0.225	0.218	0.211	0.210		1.131	0.985	0.890	0.857	0.798	0.776	0.780
6	Mean	c	0.964	0.987	1.001	1.007	1.030	1.045		2.173	2.355	2.624	2.703	2.869	2.928	2.947
	Variance		0.256	0.243	0.222	0.216	0.209	0.210		1.139	0.971	0.881	0.852	0.793	0.775	0.777
7	Mean	c	0.960	0.984	0.999	1.006	1.028	1.045		2.142	2.332	2.607	2.690	2.863	2.924	2.944
	Variance		0.255	0.244	0.221	0.215	0.209	0.211		1.149	0.963	0.869	0.844	0.789	0.773	0.777
8	Mean	c	0.959	0.984	0.999	1.006	1.027	1.044		2.089	2.288	2.581	2.667	2.852	2.916	2.939
	Variance		0.256	0.245	0.221	0.215	0.209	0.211		1.143	0.944	0.860	0.835	0.785	0.771	0.776
9	Mean	c	0.958	0.982	0.998	1.004	1.026	1.044		2.059	2.262	2.569	2.653	2.845	2.911	2.936
	Variance		0.258	0.243	0.219	0.213	0.207	0.210		1.157	0.943	0.863	0.826	0.784	0.768	0.775
10	Mean	c	0.958	0.982	0.999	1.005	1.025	1.043		1.998	2.213	2.541	2.631	2.833	2.903	2.929
	Variance		0.261	0.242	0.221	0.215	0.207	0.209		1.170	0.935	0.856	0.817	0.780	0.767	0.774
11	Mean	c	0.960	0.982	0.998	1.004	1.024	1.042		1.974	2.184	2.525	2.621	2.827	2.899	2.926
	Variance		0.268	0.246	0.220	0.214	0.206	0.208		1.233	0.924	0.848	0.818	0.777	0.766	0.774
12	Mean	c	1.013	1.027	1.019	1.018	1.028	1.036		1.872	2.082	2.455	2.566	2.799	2.880	2.911
	Variance		0.285	0.266	0.228	0.219	0.207	0.209		1.271	0.931	0.855	0.834	0.788	0.772	0.774
0	Mean	c,t	0.968	0.977	0.996	1.003	1.028	1.039	c,s,t	2.405	2.535	2.744	2.797	2.912	2.957	2.967
	Variance		0.255	0.232	0.221	0.213	0.211	0.212		1.237	1.058	0.934	0.893	0.803	0.784	0.789
1	Mean	c,t	0.960	0.973	0.993	1.000	1.026	1.037		2.364	2.506	2.726	2.779	2.905	2.951	2.963
	Variance		0.251	0.233	0.220	0.212	0.209	0.211		1.216	1.040	0.922	0.881	0.803	0.780	0.787
2	Mean	c,t	0.964	0.976	0.995	1.002	1.027	1.038		2.314	2.464	2.694	2.754	2.891	2.942	2.956
	Variance		0.257	0.237	0.220	0.214	0.211	0.209		1.172	1.023	0.903	0.869	0.798	0.779	0.784
3	Mean	c,t	0.955	0.971	0.993	1.000	1.027	1.036		2.273	2.430	2.674	2.740	2.886	2.937	2.953
	Variance		0.250	0.234	0.219	0.213	0.210	0.210		1.156	1.000	0.897	0.862	0.798	0.774	0.783
4	Mean	c,t	0.959	0.976	0.994	1.001	1.026	1.037		2.220	2.382	2.640	2.712	2.872	2.928	2.946
	Variance		0.257	0.237	0.219	0.214	0.209	0.211		1.161	0.987	0.883	0.858	0.793	0.773	0.779
5	Mean	c,t	0.956	0.975	0.993	1.000	1.026	1.036		2.176	2.350	2.618	2.696	2.864	2.924	2.944
	Variance		0.256	0.238	0.220	0.214	0.209	0.211		1.142	0.975	0.879	0.849	0.792	0.772	0.776
6	Mean	c,t	0.953	0.975	0.992	1.000	1.026	1.037		2.131	2.314	2.595	2.679	2.856	2.919	2.940
	Variance		0.255	0.239	0.218	0.213	0.208	0.210		1.148	0.958	0.867	0.841	0.786	0.771	0.774
7	Mean	c,t	0.949	0.971	0.990	0.998	1.024	1.036		2.105	2.292	2.578	2.665	2.850	2.916	2.937
	Variance		0.255	0.239	0.217	0.212	0.207	0.210		1.172	0.951	0.855	0.831	0.782	0.769	0.773
8	Mean	c,t	0.954	0.978	0.994	1.001	1.025	1.036		2.040	2.236	2.544	2.636	2.836	2.905	2.930
	Variance		0.260	0.244	0.218	0.213	0.207	0.210		1.152	0.926	0.843	0.821	0.777	0.766	0.772
9	Mean	c,t	0.957	0.978	0.995	1.001	1.024	1.034		2.011	2.211	2.531	2.622	2.829	2.900	2.927
	Variance		0.264	0.244	0.218	0.212	0.206	0.210		1.181	0.927	0.846	0.812	0.776	0.764	0.771
10	Mean	c,t	0.972	0.987	1.000	1.004	1.024	1.034		1.926	2.141	2.493	2.591	2.813	2.890	2.919
	Variance		0.277	0.250	0.222	0.215	0.206	0.209		1.169	0.909	0.835	0.801	0.771	0.762	0.770
11	Mean	c,t	0.989	0.996	1.001	1.005	1.023	1.033		1.888	2.106	2.475	2.579	2.806	2.885	2.915
	Variance		0.296	0.258	0.223	0.214	0.206	0.208		1.240	0.902	0.829	0.800	0.768	0.761	0.770
12	Mean	c,t	1.010	1.012	1.006	1.007	1.022	1.032		1.830	2.043	2.435	2.551	2.793	2.876	2.908
	Variance		0.295	0.262	0.224	0.214	0.205	0.207		1.318	0.925	0.846	0.825	0.782	0.769	0.772

Table 2. Size and power of the Franses-IPS test (nominal 5% significance level): No serial correlation

T	N	F-IPS _{t1}				F-IPS _{t2}				F-IPS _{F{2,...,12}}				F-IPS _{F{3,...,12}}			
		Model: c	Model: c,t	Size	Power	Model: c	Model: c,t	Size	Power	Model: c	Model: c,t	Size	Power	Model: c	Model: c,t	Size	Power
48	5	5.8	7.4	4.5	5.0	19.1	5.0	19.4	7.4	18.3	7.8	19.3	7.0	17.3	7.1	17.5	
	15	6.2	8.7	5.1	6.1	4.7	41.0	4.8	41.0	7.4	30.5	7.3	29.8	6.7	29.0	6.2	29.0
	25	5.7	10.6	4.7	6.7	4.4	62.5	4.3	63.0	7.3	43.7	7.2	42.6	8.0	40.8	7.3	39.7
	40	5.8	11.9	4.9	7.4	4.5	80.8	4.6	81.3	7.0	57.6	6.3	55.3	6.3	53.3	5.8	50.3
60	5	4.9	6.5	5.7	6.4	5.4	19.5	4.7	19.2	5.1	22.2	5.6	22.0	5.0	20.9	5.4	20.5
	15	5.3	8.2	5.8	9.0	4.7	52.0	4.5	51.3	5.4	41.4	5.3	42.3	5.7	38.6	5.1	38.7
	25	4.7	10.4	5.6	7.7	4.4	71.6	4.7	72.0	5.8	58.3	5.1	59.0	5.7	54.6	5.3	55.5
	40	4.1	12.1	6.2	9.9	5.0	90.8	5.1	90.8	5.8	75.8	5.9	76.3	5.7	71.8	6.0	71.9
96	5	4.7	7.1	5.0	5.5	4.3	28.0	4.3	28.3	6.3	43.3	6.5	44.1	6.2	43.7	6.4	44.3
	15	4.2	9.9	3.7	6.7	3.9	69.8	3.9	69.6	7.7	82.5	7.3	83.2	6.2	80.8	6.3	81.4
	25	4.5	13.6	4.8	7.6	4.9	89.1	4.8	89.3	5.2	95.2	5.4	95.6	5.3	93.7	5.2	93.9
	40	4.4	15.0	4.6	8.3	4.2	98.4	4.3	98.4	4.9	99.7	5.0	99.8	4.5	99.3	4.5	99.6
120	5	5.5	7.1	5.0	6.3	4.1	35.3	4.2	35.5	6.7	63.1	6.6	64.2	6.8	61.8	6.9	62.3
	15	5.3	14.0	6.3	7.7	5.8	80.3	5.8	80.2	5.6	95.7	5.8	95.9	5.3	94.3	5.2	94.9
	25	5.3	15.7	3.7	7.6	5.0	95.9	4.9	95.8	5.4	99.8	5.4	99.8	5.1	99.7	5.5	99.7
	40	4.2	21.2	4.1	8.7	4.2	99.8	4.4	99.7	5.1	99.9	5.4	100.0	5.5	99.9	5.5	100.0
240	5	3.7	13.8	5.2	8.3	5.3	67.1	5.4	66.8	5.9	99.4	5.8	99.4	6.6	99.0	6.8	99.1
	15	4.8	30.7	4.9	10.5	4.1	99.4	4.1	99.4	5.8	100.0	6.0	100.0	6.3	100.0	6.3	100.0
	25	5.2	48.3	5.4	15.7	4.7	100.0	4.6	100.0	6.5	100.0	6.7	100.0	5.9	100.0	5.8	100.0
	40	4.9	65.7	6.0	18.9	5.4	100.0	5.4	100.0	5.7	100.0	5.8	100.0	6.2	100.0	6.2	100.0
360	5	5.3	26.2	6.3	11.3	3.7	88.9	3.7	88.9	5.7	100.0	5.7	100.0	5.9	100.0	5.9	100.0
	15	5.1	57.7	6.4	20.0	4.4	100.0	4.3	100.0	5.2	100.0	5.2	100.0	6.0	100.0	6.1	100.0
	25	4.2	79.3	4.6	28.0	5.1	100.0	5.1	100.0	4.4	100.0	4.2	100.0	4.4	100.0	4.3	100.0
	40	5.0	93.6	4.7	34.6	6.0	100.0	6.1	100.0	4.9	100.0	5.0	100.0	5.3	100.0	5.2	100.0
480	5	5.5	35.5	5.1	15.4	4.2	96.9	4.2	96.9	5.3	100.0	5.4	100.0	6.1	100.0	6.0	100.0
	15	4.6	82.8	6.0	35.2	4.7	100.0	4.7	100.0	4.4	100.0	4.7	100.0	4.8	100.0	4.9	100.0
	25	5.2	97.1	4.8	50.3	4.6	100.0	4.6	100.0	4.8	100.0	4.7	100.0	5.9	100.0	6.2	100.0
	40	4.1	99.6	4.9	63.0	5.6	100.0	5.6	100.0	4.7	100.0	4.9	100.0	5.0	100.0	5.2	100.0

Table 3. Size of the Franes-IPS test in the presence of cross section dependence (nominal 5% significance level). Model includes constant

T	ω	F-IPSt1			F-IPSt2			F-IPSF{2,...,12}			F-IPSF{3,...,12}						
		N=5	15	25	40	N=5	15	25	40	N=5	15	25	40				
48	0.3	6.0	12.6	14.3	18.7	7.0	8.9	12.4	15.3	9.7	11.6	13.1	14.2	9.8	11.7	14.0	15.9
	0.5	10.2	19.4	24.3	32.4	9.7	16.1	22.6	26.6	11.1	15.7	20.2	22.6	10.6	16.0	20.7	22.2
	0.7	14.9	25.3	34.6	40.2	13.8	25.6	32.9	38.3	15.6	18.8	26.7	26.7	14.3	19.7	26.6	26.1
	0.9	20.7	31.1	37.0	42.0	22.8	34.9	39.6	44.6	19.3	23.7	30.0	30.8	19.0	24.5	30.1	29.3
60	0.3	6.6	10.7	15.0	15.3	6.8	9.0	11.3	19.2	5.5	10.2	9.3	12.6	5.6	9.5	10.6	13.3
	0.5	8.9	17.4	24.8	28.9	7.6	18.1	22.1	30.5	7.8	14.6	16.4	20.9	7.7	15.0	16.5	20.9
	0.7	14.9	27.2	33.1	39.5	11.7	26.3	33.4	40.0	11.6	18.2	22.4	25.8	11.4	18.3	23.1	26.3
	0.9	19.8	31.9	38.1	43.4	18.7	36.1	42.1	44.1	15.7	23.1	27.3	31.4	14.8	22.9	27.7	31.1
96	0.3	4.9	9.4	11.9	13.7	5.3	7.4	11.0	16.6	7.7	10.3	10.5	13.1	8.2	10.9	9.4	13.5
	0.5	7.2	16.7	24.2	27.1	7.2	14.4	22.2	30.6	8.8	14.6	14.4	21.2	10.5	15.9	14.7	20.7
	0.7	11.7	25.6	33.8	36.3	10.5	25.5	35.6	39.9	11.6	19.8	22.0	27.4	12.8	20.5	22.3	27.3
	0.9	18.3	30.5	36.7	40.4	18.0	34.6	43.6	44.0	15.6	26.4	28.0	30.5	17.0	26.1	28.0	30.3
120	0.3	7.7	9.5	14.3	15.2	5.0	9.1	11.1	15.0	7.3	9.8	10.6	12.7	8.2	9.1	10.6	12.8
	0.5	10.5	16.3	23.7	30.3	7.7	16.0	22.9	30.9	9.0	12.9	15.7	19.2	9.2	13.0	16.1	19.6
	0.7	15.0	24.6	32.5	40.2	11.6	23.9	33.3	41.1	12.1	19.5	21.7	25.5	12.4	18.8	21.1	25.7
	0.9	18.0	30.2	36.6	42.4	19.1	31.4	39.0	43.4	15.3	25.6	27.9	32.0	15.9	25.2	29.1	32.2
240	0.3	6.1	9.3	14.2	18.4	6.1	8.0	12.0	16.3	6.5	7.7	9.0	11.0	6.6	7.2	9.4	11.4
	0.5	9.3	18.1	24.6	29.1	7.1	17.2	22.6	31.3	7.9	11.6	14.2	18.0	8.6	12.3	14.5	17.3
	0.7	14.1	28.5	33.0	36.8	11.7	28.1	33.6	43.3	10.9	18.1	20.2	26.4	12.3	18.0	20.9	26.3
	0.9	19.9	33.7	36.0	38.8	19.4	36.0	40.1	45.3	18.0	26.6	26.5	35.1	17.8	26.9	27.0	33.6
360	0.3	7.0	10.3	11.8	17.2	5.3	9.2	13.6	16.8	6.2	8.5	7.2	9.6	6.4	8.2	7.0	10.5
	0.5	9.5	19.4	25.0	29.8	6.3	16.5	25.7	33.1	7.7	11.5	12.9	17.6	7.8	11.4	13.6	18.4
	0.7	13.9	27.7	35.1	37.1	10.9	27.1	36.4	43.5	10.0	17.8	23.2	26.9	10.9	18.8	22.9	27.5
	0.9	20.3	34.0	37.3	39.5	16.2	35.6	40.6	44.0	16.0	27.4	30.5	34.8	17.3	27.6	30.9	33.9
480	0.3	7.6	10.2	13.3	17.9	5.2	9.2	11.8	15.9	6.2	7.5	8.2	9.6	6.5	7.2	8.6	10.0
	0.5	10.2	18.1	25.6	30.3	7.2	17.2	24.0	33.4	7.0	10.6	15.4	17.3	8.1	11.1	15.2	17.1
	0.7	15.0	27.5	35.2	37.0	11.8	28.7	37.1	43.5	10.5	16.7	22.0	23.9	12.1	17.1	20.4	23.9
	0.9	22.7	34.1	37.7	40.2	19.5	37.4	41.0	46.3	18.2	25.7	29.9	30.1	18.8	25.5	28.0	30.2

Table 3 (continued). Size of the Franeses-IPS test in the presence of cross section dependence (nominal 5% significance level). Model includes constant and trend

T	ω	F-IPS _{t1}			F-IPS _{t2}			F-IPS _{F{2,...,12}}			F-IPS _{F{3,...,12}}						
		N=5	15	25	40	N=5	15	25	40	N=5	15	25	40				
48	0.3	6.9	9.1	12.5	15.8	7.2	9.4	12.3	15.2	10.4	10.7	12.7	14.5	8.6	11.4	14.5	14.5
	0.5	10.4	16.9	23.6	27.7	10.1	16.1	23.5	27.1	11.5	14.5	19.3	22.0	11.0	14.6	20.2	21.3
	0.7	15.0	25.4	32.3	34.3	13.8	25.6	33.4	38.9	14.9	19.5	25.7	25.3	14.2	19.9	25.9	25.9
	0.9	20.3	30.0	35.7	36.7	22.8	35.3	39.7	44.1	19.6	25.3	29.3	29.0	19.2	25.4	30.5	27.9
60	0.3	8.1	12.6	13.5	19.5	6.6	9.5	11.4	19.6	5.2	10.1	10.7	12.6	6.0	9.9	10.6	12.6
	0.5	10.2	19.7	24.4	30.1	7.9	17.9	21.7	30.8	7.7	13.7	17.4	21.2	8.0	14.5	16.7	20.5
	0.7	14.8	28.2	30.2	35.9	11.8	26.5	34.2	40.1	11.6	19.2	22.8	25.1	12.5	18.7	23.7	25.3
	0.9	19.7	31.7	34.2	35.9	19.0	35.5	42.0	44.1	15.2	23.4	28.9	30.5	15.8	22.9	29.1	30.4
96	0.3	5.2	9.6	15.6	16.6	5.4	7.1	10.8	16.4	7.4	10.2	9.6	13.4	7.9	10.7	9.5	13.3
	0.5	9.7	17.5	27.4	29.0	7.3	14.4	21.9	30.4	9.0	14.1	14.6	21.2	10.2	14.5	14.0	21.3
	0.7	15.4	26.5	37.1	36.0	10.5	25.7	35.3	40.0	11.5	19.6	21.7	27.8	12.9	19.5	22.3	27.4
	0.9	20.6	31.9	35.4	39.0	18.0	34.7	43.4	43.6	15.8	26.2	27.8	30.9	16.4	26.1	27.2	30.5
120	0.3	6.7	10.2	13.9	17.3	5.0	9.2	11.1	15.4	7.0	9.6	11.1	13.3	7.3	9.0	10.7	13.4
	0.5	9.1	18.3	24.4	30.0	7.5	15.8	22.7	31.1	9.2	12.6	15.8	19.9	8.9	13.0	15.9	19.4
	0.7	15.6	26.2	33.1	37.9	11.7	24.0	32.9	41.0	11.7	18.3	21.7	25.2	12.7	18.8	21.8	25.1
	0.9	21.4	30.9	35.7	39.8	19.0	31.6	39.1	43.8	15.7	25.7	28.5	31.9	15.8	25.0	28.7	32.2
240	0.3	6.5	11.7	13.5	20.8	6.1	8.0	12.0	16.5	6.5	7.7	9.4	11.4	6.6	7.1	9.4	11.1
	0.5	9.7	19.9	25.4	32.9	7.2	17.4	22.7	31.4	7.7	11.8	14.3	18.3	8.7	12.3	14.8	17.7
	0.7	15.5	26.4	33.1	38.1	11.8	28.4	33.6	43.1	10.7	18.3	20.0	25.9	12.6	18.4	21.3	26.6
	0.9	22.2	31.5	35.3	40.1	19.3	35.9	40.1	45.0	17.8	27.0	27.1	35.0	17.9	26.5	27.8	34.2
360	0.3	8.0	13.1	14.7	20.6	5.3	9.1	13.6	16.6	6.2	8.4	7.1	10.0	6.4	8.3	6.8	10.5
	0.5	11.4	21.7	25.9	32.6	6.3	16.4	25.5	33.0	7.8	11.3	13.0	17.9	7.6	11.7	13.4	18.5
	0.7	15.6	29.2	32.5	39.1	11.0	27.1	36.5	43.3	10.1	17.9	23.1	26.7	10.8	18.6	22.8	27.8
	0.9	21.4	33.0	35.8	40.0	16.3	35.6	40.6	44.0	15.8	27.5	30.3	35.1	17.1	27.6	30.8	34.0
480	0.3	6.5	13.5	14.5	18.0	5.1	9.1	11.8	15.8	6.1	7.4	8.6	10.0	6.5	7.3	8.8	10.3
	0.5	10.0	22.8	28.1	31.7	7.3	17.4	24.1	33.3	7.1	10.7	15.2	17.6	8.1	11.0	15.0	17.1
	0.7	16.3	31.3	35.8	37.3	11.7	28.6	37.2	43.6	11.1	16.8	22.1	23.9	12.0	16.9	20.6	23.9
	0.9	23.4	34.5	39.3	38.0	19.6	37.3	41.0	46.3	18.0	25.7	30.1	30.2	19.2	25.5	28.1	30.5

Table 4. Critical values of the cross-sectionally augmented F-IPS test

N	Level	CF-IPS _{t1}							CF-IPS _{t2}						
		T=48	60	96	120	240	360	480	T=48	60	96	120	240	360	480
Model: c															
5	1%	-2.21	-2.31	-2.49	-2.56	-2.69	-2.72	-2.76	-1.69	-1.78	-1.93	-2.01	-2.11	-2.13	-2.14
	5%	-1.91	-2.04	-2.20	-2.28	-2.41	-2.44	-2.46	-1.40	-1.49	-1.63	-1.70	-1.80	-1.81	-1.84
	10%	-1.76	-1.88	-2.06	-2.12	-2.25	-2.30	-2.30	-1.24	-1.33	-1.48	-1.53	-1.62	-1.65	-1.67
15	1%	-1.80	-1.92	-2.09	-2.17	-2.30	-2.35	-2.35	-1.32	-1.41	-1.57	-1.61	-1.73	-1.77	-1.78
	5%	-1.63	-1.75	-1.93	-2.00	-2.12	-2.17	-2.19	-1.15	-1.24	-1.39	-1.43	-1.54	-1.58	-1.60
	10%	-1.55	-1.66	-1.85	-1.91	-2.03	-2.08	-2.09	-1.05	-1.14	-1.29	-1.33	-1.43	-1.46	-1.48
25	1%	-1.70	-1.81	-2.00	-2.07	-2.20	-2.24	-2.26	-1.22	-1.31	-1.47	-1.53	-1.64	-1.68	-1.69
	5%	-1.56	-1.68	-1.87	-1.93	-2.05	-2.10	-2.12	-1.09	-1.18	-1.33	-1.38	-1.49	-1.53	-1.54
	10%	-1.48	-1.60	-1.79	-1.85	-1.98	-2.02	-2.04	-1.01	-1.10	-1.25	-1.30	-1.39	-1.43	-1.44
40	1%	-1.64	-1.75	-1.94	-2.00	-2.13	-2.17	-2.19	-1.16	-1.26	-1.42	-1.47	-1.58	-1.62	-1.63
	5%	-1.52	-1.64	-1.82	-1.89	-2.02	-2.06	-2.08	-1.04	-1.14	-1.29	-1.34	-1.45	-1.48	-1.50
	10%	-1.45	-1.57	-1.76	-1.82	-1.95	-1.99	-2.01	-0.98	-1.07	-1.22	-1.27	-1.37	-1.40	-1.41
Model: c,t															
5	1%	-2.67	-2.73	-2.91	-3.00	-3.16	-3.19	-3.22	-1.67	-1.77	-1.93	-2.00	-2.11	-2.13	-2.14
	5%	-2.33	-2.44	-2.64	-2.72	-2.89	-2.92	-2.95	-1.38	-1.48	-1.63	-1.69	-1.80	-1.81	-1.84
	10%	-2.16	-2.29	-2.49	-2.58	-2.74	-2.78	-2.80	-1.22	-1.33	-1.47	-1.53	-1.62	-1.65	-1.66
15	1%	-2.22	-2.32	-2.52	-2.61	-2.76	-2.80	-2.82	-1.31	-1.41	-1.56	-1.61	-1.73	-1.77	-1.78
	5%	-2.04	-2.16	-2.37	-2.45	-2.60	-2.65	-2.67	-1.13	-1.23	-1.39	-1.43	-1.54	-1.58	-1.60
	10%	-1.94	-2.07	-2.29	-2.37	-2.52	-2.57	-2.60	-1.04	-1.14	-1.29	-1.33	-1.43	-1.46	-1.48
25	1%	-2.11	-2.23	-2.42	-2.50	-2.65	-2.70	-2.73	-1.21	-1.31	-1.46	-1.53	-1.64	-1.69	-1.70
	5%	-1.96	-2.09	-2.30	-2.38	-2.53	-2.58	-2.60	-1.07	-1.18	-1.33	-1.38	-1.49	-1.53	-1.54
	10%	-1.88	-2.02	-2.23	-2.31	-2.46	-2.51	-2.54	-0.99	-1.10	-1.25	-1.30	-1.39	-1.43	-1.44
40	1%	-2.03	-2.16	-2.37	-2.44	-2.59	-2.64	-2.66	-1.15	-1.25	-1.42	-1.46	-1.58	-1.62	-1.63
	5%	-1.92	-2.05	-2.26	-2.33	-2.48	-2.54	-2.56	-1.03	-1.14	-1.29	-1.34	-1.45	-1.48	-1.50
	10%	-1.85	-1.98	-2.20	-2.27	-2.42	-2.48	-2.50	-0.97	-1.07	-1.22	-1.27	-1.37	-1.40	-1.41
Model: c, s															
5	1%	-2.02	-2.18	-2.41	-2.50	-2.66	-2.70	-2.74	-2.03	-2.17	-2.40	-2.52	-2.65	-2.71	-2.75
	5%	-1.70	-1.89	-2.13	-2.22	-2.38	-2.42	-2.45	-1.71	-1.88	-2.12	-2.22	-2.37	-2.42	-2.45
	10%	-1.53	-1.73	-1.98	-2.07	-2.22	-2.27	-2.29	-1.54	-1.72	-1.98	-2.07	-2.22	-2.27	-2.29
15	1%	-1.62	-1.78	-2.03	-2.12	-2.27	-2.33	-2.34	-1.61	-1.79	-2.04	-2.13	-2.28	-2.31	-2.34
	5%	-1.43	-1.61	-1.87	-1.95	-2.10	-2.15	-2.17	-1.43	-1.62	-1.87	-1.95	-2.10	-2.15	-2.17
	10%	-1.34	-1.53	-1.79	-1.86	-2.01	-2.06	-2.08	-1.33	-1.53	-1.79	-1.86	-2.01	-2.06	-2.08
25	1%	-1.51	-1.69	-1.95	-2.02	-2.18	-2.22	-2.25	-1.51	-1.70	-1.95	-2.02	-2.17	-2.22	-2.25
	5%	-1.36	-1.55	-1.81	-1.88	-2.03	-2.08	-2.11	-1.36	-1.56	-1.81	-1.89	-2.04	-2.08	-2.11
	10%	-1.28	-1.48	-1.73	-1.81	-1.96	-2.01	-2.03	-1.28	-1.48	-1.74	-1.81	-1.96	-2.01	-2.03
40	1%	-1.45	-1.64	-1.88	-1.96	-2.10	-2.15	-2.18	-1.44	-1.63	-1.89	-1.95	-2.11	-2.15	-2.18
	5%	-1.31	-1.52	-1.77	-1.85	-2.00	-2.04	-2.07	-1.31	-1.51	-1.78	-1.85	-1.99	-2.04	-2.06
	10%	-1.24	-1.45	-1.70	-1.78	-1.93	-1.98	-2.00	-1.24	-1.45	-1.71	-1.78	-1.93	-1.97	-1.99
Model: c,s,t															
5	1%	-2.46	-2.58	-2.81	-2.94	-3.13	-3.16	-3.20	-1.99	-2.16	-2.39	-2.51	-2.65	-2.71	-2.75
	5%	-2.07	-2.27	-2.55	-2.66	-2.86	-2.89	-2.93	-1.67	-1.87	-2.12	-2.22	-2.37	-2.42	-2.45
	10%	-1.88	-2.11	-2.41	-2.51	-2.71	-2.76	-2.79	-1.50	-1.71	-1.98	-2.07	-2.22	-2.27	-2.29
15	1%	-1.98	-2.18	-2.46	-2.55	-2.73	-2.78	-2.80	-1.59	-1.78	-2.04	-2.12	-2.28	-2.31	-2.34
	5%	-1.78	-1.99	-2.30	-2.40	-2.57	-2.63	-2.66	-1.40	-1.61	-1.87	-1.95	-2.10	-2.15	-2.17
	10%	-1.67	-1.90	-2.21	-2.32	-2.49	-2.55	-2.58	-1.30	-1.52	-1.78	-1.86	-2.02	-2.06	-2.08
25	1%	-1.86	-2.08	-2.36	-2.45	-2.62	-2.68	-2.71	-1.48	-1.69	-1.95	-2.01	-2.17	-2.23	-2.25
	5%	-1.69	-1.93	-2.23	-2.32	-2.50	-2.56	-2.59	-1.33	-1.55	-1.81	-1.89	-2.04	-2.09	-2.11
	10%	-1.59	-1.85	-2.16	-2.26	-2.43	-2.49	-2.52	-1.25	-1.47	-1.74	-1.81	-1.96	-2.01	-2.03
40	1%	-1.80	-2.02	-2.30	-2.39	-2.56	-2.62	-2.65	-1.42	-1.62	-1.89	-1.96	-2.11	-2.15	-2.18
	5%	-1.64	-1.88	-2.19	-2.28	-2.45	-2.52	-2.54	-1.28	-1.50	-1.78	-1.85	-1.99	-2.04	-2.06
	10%	-1.57	-1.82	-2.13	-2.22	-2.40	-2.46	-2.49	-1.21	-1.44	-1.71	-1.78	-1.93	-1.98	-2.00

Table 4 (continued). Critical values of the cross-sectionally augmented F-IPS test

N	Level	CF-IPS _{F{3,4}}							CF-IPS _{F{5,6}}						
		T=48	60	96	120	240	360	480	T=48	60	96	120	240	360	480
Model: c															
5	1%	3.22	3.37	3.71	3.85	4.18	4.36	4.38	3.26	3.37	3.73	3.83	4.17	4.27	4.34
	5%	2.49	2.66	2.97	3.11	3.37	3.49	3.52	2.53	2.67	2.97	3.08	3.38	3.46	3.53
	10%	2.15	2.33	2.61	2.72	2.97	3.06	3.10	2.17	2.31	2.61	2.71	2.98	3.06	3.10
15	1%	2.44	2.55	2.87	3.00	3.32	3.41	3.50	2.38	2.55	2.87	3.01	3.31	3.38	3.50
	5%	2.03	2.18	2.49	2.60	2.87	2.96	3.00	2.01	2.19	2.49	2.61	2.87	2.94	3.01
	10%	1.85	2.00	2.28	2.39	2.63	2.71	2.75	1.83	2.00	2.28	2.40	2.63	2.71	2.77
25	1%	2.19	2.36	2.69	2.81	3.12	3.20	3.27	2.17	2.35	2.67	2.80	3.08	3.20	3.28
	5%	1.91	2.06	2.37	2.49	2.73	2.83	2.89	1.90	2.06	2.36	2.49	2.73	2.84	2.90
	10%	1.76	1.92	2.21	2.31	2.54	2.63	2.67	1.76	1.91	2.19	2.31	2.55	2.64	2.69
40	1%	2.08	2.23	2.55	2.65	2.95	3.09	3.13	2.04	2.23	2.56	2.68	2.97	3.06	3.14
	5%	1.84	1.99	2.30	2.41	2.65	2.76	2.81	1.82	1.99	2.29	2.40	2.67	2.76	2.82
	10%	1.72	1.87	2.15	2.25	2.49	2.58	2.63	1.70	1.86	2.15	2.26	2.50	2.59	2.64
Model: c,t															
5	1%	3.17	3.32	3.68	3.82	4.15	4.34	4.37	3.14	3.28	3.68	3.82	4.17	4.25	4.34
	5%	2.43	2.62	2.93	3.08	3.35	3.49	3.51	2.43	2.61	2.94	3.06	3.36	3.45	3.53
	10%	2.10	2.28	2.57	2.70	2.96	3.05	3.09	2.08	2.26	2.58	2.69	2.97	3.06	3.09
15	1%	2.38	2.49	2.83	2.98	3.31	3.41	3.50	2.30	2.50	2.84	2.99	3.30	3.38	3.50
	5%	1.99	2.14	2.46	2.58	2.86	2.96	3.00	1.94	2.13	2.46	2.59	2.86	2.93	3.01
	10%	1.80	1.96	2.26	2.37	2.63	2.71	2.75	1.77	1.95	2.25	2.38	2.63	2.70	2.76
25	1%	2.13	2.31	2.66	2.79	3.12	3.20	3.26	2.09	2.29	2.64	2.78	3.07	3.19	3.28
	5%	1.86	2.03	2.34	2.47	2.72	2.82	2.88	1.84	2.01	2.33	2.47	2.72	2.84	2.90
	10%	1.72	1.88	2.18	2.30	2.53	2.62	2.67	1.70	1.87	2.17	2.29	2.54	2.64	2.69
40	1%	2.03	2.19	2.53	2.63	2.95	3.08	3.13	1.97	2.18	2.53	2.66	2.96	3.06	3.14
	5%	1.79	1.95	2.27	2.39	2.65	2.75	2.81	1.75	1.94	2.27	2.38	2.66	2.76	2.82
	10%	1.68	1.83	2.13	2.24	2.48	2.58	2.62	1.65	1.82	2.12	2.24	2.49	2.59	2.64
Model: c, s															
5	1%	4.61	4.78	5.48	5.64	6.33	6.64	6.76	4.56	4.70	5.42	5.75	6.43	6.61	6.70
	5%	3.45	3.80	4.56	4.77	5.42	5.65	5.75	3.39	3.79	4.55	4.80	5.47	5.65	5.78
	10%	2.94	3.35	4.12	4.35	4.96	5.16	5.29	2.91	3.35	4.11	4.38	4.99	5.16	5.29
15	1%	3.40	3.63	4.35	4.61	5.23	5.46	5.55	3.32	3.57	4.34	4.63	5.18	5.43	5.54
	5%	2.81	3.15	3.87	4.13	4.71	4.90	5.00	2.75	3.12	3.86	4.14	4.70	4.90	4.99
	10%	2.54	2.89	3.63	3.87	4.42	4.62	4.71	2.50	2.89	3.61	3.89	4.43	4.61	4.70
25	1%	3.12	3.36	4.10	4.37	4.95	5.17	5.26	3.00	3.34	4.11	4.36	4.94	5.13	5.26
	5%	2.64	2.98	3.70	3.98	4.53	4.72	4.81	2.58	2.97	3.72	3.97	4.53	4.71	4.82
	10%	2.42	2.78	3.51	3.78	4.29	4.49	4.57	2.38	2.79	3.50	3.76	4.30	4.48	4.59
40	1%	2.84	3.17	3.94	4.22	4.77	4.97	5.07	2.83	3.18	3.93	4.20	4.79	4.97	5.08
	5%	2.51	2.86	3.62	3.87	4.41	4.61	4.70	2.47	2.87	3.61	3.88	4.44	4.61	4.72
	10%	2.33	2.71	3.44	3.69	4.22	4.40	4.49	2.30	2.71	3.44	3.70	4.23	4.40	4.51
Model: c,s,t															
5	1%	4.67	4.71	5.44	5.62	6.34	6.64	6.75	4.42	4.62	5.38	5.72	6.40	6.61	6.69
	5%	3.39	3.73	4.53	4.76	5.41	5.64	5.76	3.25	3.70	4.51	4.78	5.46	5.64	5.78
	10%	2.89	3.28	4.09	4.34	4.96	5.15	5.28	2.79	3.27	4.07	4.36	4.98	5.15	5.29
15	1%	3.39	3.57	4.33	4.60	5.23	5.46	5.54	3.23	3.50	4.31	4.60	5.18	5.42	5.53
	5%	2.76	3.08	3.85	4.11	4.70	4.89	4.99	2.66	3.05	3.84	4.12	4.70	4.90	4.99
	10%	2.48	2.84	3.60	3.86	4.41	4.61	4.71	2.39	2.82	3.58	3.88	4.43	4.61	4.70
25	1%	3.07	3.29	4.09	4.35	4.94	5.17	5.25	2.92	3.28	4.08	4.35	4.95	5.13	5.26
	5%	2.58	2.93	3.68	3.97	4.53	4.72	4.81	2.47	2.90	3.69	3.96	4.52	4.70	4.81
	10%	2.36	2.73	3.49	3.76	4.29	4.48	4.57	2.27	2.72	3.48	3.74	4.29	4.48	4.59
40	1%	2.78	3.14	3.92	4.21	4.77	4.97	5.07	2.73	3.12	3.90	4.18	4.79	4.96	5.08
	5%	2.45	2.81	3.59	3.86	4.41	4.60	4.69	2.38	2.81	3.58	3.86	4.43	4.61	4.72
	10%	2.28	2.66	3.42	3.68	4.22	4.40	4.49	2.21	2.65	3.42	3.69	4.23	4.40	4.52

Table 4 (continued). Critical values of the cross-sectionally augmented F-IPS test

N	Level	CF-IPS $_{F\{\tau,8\}}$							CF-IPS $_{F\{9,10\}}$						
		T=48	60	96	120	240	360	480	T=48	60	96	120	240	360	480
Model: c															
5	1%	3.56	3.57	3.77	3.92	4.22	4.30	4.32	3.23	3.35	3.72	3.86	4.19	4.35	4.31
	5%	2.69	2.79	3.01	3.14	3.38	3.46	3.51	2.50	2.65	2.95	3.10	3.36	3.45	3.53
	10%	2.32	2.42	2.63	2.76	2.98	3.06	3.11	2.15	2.30	2.60	2.73	2.97	3.06	3.12
15	1%	2.59	2.66	2.92	3.04	3.32	3.41	3.47	2.39	2.55	2.89	3.00	3.28	3.43	3.45
	5%	2.16	2.26	2.52	2.62	2.85	2.94	3.00	2.02	2.18	2.49	2.60	2.86	2.96	3.00
	10%	1.98	2.07	2.32	2.41	2.62	2.71	2.75	1.84	1.99	2.28	2.39	2.63	2.71	2.75
25	1%	2.34	2.45	2.71	2.85	3.09	3.20	3.28	2.18	2.33	2.68	2.80	3.12	3.20	3.26
	5%	2.04	2.14	2.40	2.50	2.74	2.82	2.89	1.90	2.07	2.37	2.47	2.73	2.84	2.88
	10%	1.89	1.99	2.22	2.32	2.54	2.63	2.68	1.76	1.92	2.21	2.30	2.54	2.63	2.68
40	1%	2.17	2.31	2.58	2.69	2.96	3.08	3.14	2.03	2.22	2.54	2.68	2.97	3.07	3.14
	5%	1.94	2.06	2.31	2.42	2.67	2.76	2.81	1.82	1.99	2.28	2.40	2.68	2.76	2.82
	10%	1.82	1.93	2.17	2.27	2.50	2.58	2.62	1.71	1.87	2.15	2.25	2.50	2.59	2.63
Model: c,t															
5	1%	3.80	3.69	3.82	3.93	4.22	4.29	4.34	3.11	3.29	3.71	3.82	4.18	4.34	4.31
	5%	2.88	2.88	3.02	3.15	3.39	3.45	3.51	2.41	2.58	2.92	3.08	3.34	3.44	3.53
	10%	2.46	2.49	2.66	2.76	2.98	3.06	3.10	2.07	2.25	2.57	2.70	2.96	3.06	3.12
15	1%	2.76	2.73	2.96	3.04	3.31	3.40	3.47	2.32	2.50	2.86	2.97	3.28	3.43	3.45
	5%	2.31	2.33	2.53	2.62	2.86	2.94	3.00	1.96	2.13	2.47	2.58	2.86	2.95	3.00
	10%	2.09	2.13	2.32	2.41	2.61	2.71	2.75	1.78	1.95	2.26	2.37	2.62	2.71	2.75
25	1%	2.46	2.51	2.72	2.84	3.09	3.19	3.27	2.12	2.28	2.64	2.79	3.11	3.19	3.25
	5%	2.14	2.19	2.40	2.51	2.74	2.82	2.89	1.84	2.02	2.35	2.46	2.73	2.83	2.88
	10%	1.99	2.03	2.23	2.33	2.54	2.63	2.68	1.70	1.87	2.18	2.28	2.53	2.63	2.68
40	1%	2.29	2.35	2.58	2.70	2.96	3.08	3.13	1.97	2.17	2.51	2.66	2.96	3.07	3.14
	5%	2.04	2.10	2.32	2.42	2.67	2.75	2.81	1.76	1.94	2.26	2.39	2.67	2.76	2.82
	10%	1.91	1.98	2.17	2.27	2.50	2.58	2.62	1.65	1.82	2.12	2.24	2.49	2.59	2.63
Model: c, s															
5	1%	4.49	4.67	5.47	5.69	6.41	6.71	6.81	4.71	4.80	5.47	5.72	6.49	6.62	6.81
	5%	3.40	3.76	4.55	4.80	5.51	5.65	5.77	3.45	3.82	4.53	4.85	5.46	5.64	5.79
	10%	2.93	3.32	4.11	4.39	5.00	5.15	5.27	2.94	3.35	4.10	4.39	4.98	5.17	5.25
15	1%	3.33	3.56	4.34	4.62	5.26	5.47	5.55	3.35	3.64	4.36	4.61	5.24	5.41	5.54
	5%	2.76	3.11	3.88	4.13	4.73	4.89	4.99	2.78	3.13	3.88	4.14	4.71	4.90	5.00
	10%	2.50	2.88	3.63	3.90	4.43	4.61	4.71	2.52	2.89	3.64	3.88	4.43	4.62	4.71
25	1%	3.01	3.34	4.08	4.37	4.94	5.17	5.26	3.01	3.38	4.10	4.36	4.97	5.19	5.24
	5%	2.59	2.98	3.72	3.98	4.52	4.72	4.82	2.61	2.99	3.71	3.98	4.53	4.73	4.81
	10%	2.39	2.79	3.51	3.78	4.31	4.49	4.58	2.41	2.81	3.50	3.77	4.31	4.48	4.58
40	1%	2.81	3.17	3.94	4.19	4.78	4.95	5.05	2.87	3.22	3.95	4.24	4.78	4.97	5.09
	5%	2.47	2.87	3.61	3.87	4.42	4.60	4.69	2.51	2.89	3.60	3.89	4.42	4.60	4.71
	10%	2.30	2.71	3.43	3.69	4.23	4.40	4.49	2.33	2.72	3.44	3.71	4.22	4.40	4.50
Model: c,s,t															
5	1%	4.97	4.81	5.50	5.73	6.38	6.71	6.78	4.60	4.68	5.42	5.68	6.48	6.62	6.80
	5%	3.61	3.84	4.56	4.80	5.49	5.65	5.78	3.31	3.74	4.49	4.82	5.44	5.63	5.78
	10%	3.10	3.39	4.11	4.39	5.00	5.14	5.26	2.84	3.29	4.07	4.37	4.97	5.16	5.25
15	1%	3.61	3.67	4.35	4.61	5.25	5.46	5.54	3.29	3.54	4.32	4.59	5.23	5.41	5.54
	5%	2.94	3.18	3.88	4.13	4.71	4.88	4.99	2.69	3.06	3.85	4.12	4.70	4.90	5.00
	10%	2.65	2.92	3.64	3.89	4.43	4.61	4.71	2.43	2.83	3.61	3.86	4.42	4.61	4.70
25	1%	3.23	3.42	4.07	4.37	4.94	5.16	5.26	2.94	3.30	4.07	4.34	4.96	5.18	5.24
	5%	2.74	3.02	3.72	3.98	4.52	4.72	4.81	2.53	2.92	3.68	3.97	4.53	4.72	4.81
	10%	2.52	2.83	3.52	3.77	4.30	4.48	4.57	2.32	2.74	3.48	3.75	4.30	4.48	4.57
40	1%	2.98	3.23	3.94	4.19	4.78	4.95	5.04	2.79	3.15	3.93	4.22	4.78	4.97	5.09
	5%	2.59	2.90	3.61	3.87	4.42	4.59	4.69	2.41	2.82	3.58	3.87	4.42	4.60	4.70
	10%	2.41	2.74	3.44	3.69	4.23	4.40	4.49	2.24	2.67	3.42	3.69	4.22	4.40	4.50

Table 4 (continued). Critical values of the cross-sectionally augmented F-IPS test

N	Level	CF-IPS $_{F\{11,12\}}$							CF-IPS $_{F\{2,\dots,12\}}$						
		T=48	60	96	120	240	360	480	T=48	60	96	120	240	360	480
Model: c															
5	1%	3.26	3.44	3.71	3.83	4.21	4.32	4.33	2.74	2.72	2.77	2.80	2.92	2.93	2.97
	5%	2.53	2.69	2.97	3.09	3.39	3.48	3.52	2.32	2.34	2.43	2.47	2.58	2.60	2.63
	10%	2.18	2.35	2.61	2.72	2.98	3.06	3.11	2.11	2.16	2.26	2.31	2.41	2.45	2.47
15	1%	2.41	2.58	2.90	3.00	3.31	3.43	3.48	2.26	2.30	2.41	2.46	2.56	2.59	2.62
	5%	2.05	2.20	2.49	2.59	2.84	2.96	3.01	2.03	2.08	2.21	2.25	2.37	2.40	2.43
	10%	1.87	2.02	2.29	2.39	2.62	2.72	2.77	1.92	1.98	2.10	2.15	2.26	2.30	2.32
25	1%	2.25	2.36	2.67	2.82	3.07	3.20	3.27	2.14	2.20	2.32	2.38	2.49	2.54	2.55
	5%	1.95	2.08	2.36	2.49	2.74	2.83	2.89	1.97	2.02	2.15	2.20	2.31	2.35	2.37
	10%	1.79	1.92	2.21	2.31	2.54	2.63	2.68	1.87	1.93	2.06	2.11	2.21	2.26	2.28
40	1%	2.09	2.24	2.54	2.69	2.94	3.07	3.13	2.07	2.13	2.26	2.32	2.44	2.48	2.51
	5%	1.86	2.01	2.29	2.41	2.66	2.76	2.81	1.92	1.98	2.11	2.17	2.29	2.32	2.35
	10%	1.74	1.88	2.15	2.26	2.49	2.58	2.63	1.84	1.91	2.03	2.08	2.20	2.24	2.26
Model: c,t															
5	1%	3.28	3.41	3.69	3.81	4.21	4.31	4.31	2.75	2.71	2.76	2.79	2.91	2.92	2.96
	5%	2.52	2.67	2.95	3.07	3.38	3.47	3.52	2.32	2.32	2.42	2.46	2.57	2.60	2.63
	10%	2.18	2.32	2.59	2.71	2.97	3.05	3.10	2.11	2.14	2.25	2.30	2.41	2.44	2.47
15	1%	2.41	2.56	2.88	2.99	3.31	3.43	3.48	2.25	2.27	2.39	2.45	2.56	2.59	2.62
	5%	2.03	2.17	2.48	2.58	2.84	2.95	3.01	2.03	2.06	2.20	2.24	2.36	2.39	2.42
	10%	1.86	1.99	2.27	2.37	2.61	2.72	2.76	1.91	1.96	2.08	2.14	2.26	2.29	2.32
25	1%	2.24	2.33	2.66	2.80	3.06	3.20	3.26	2.14	2.18	2.30	2.37	2.48	2.53	2.55
	5%	1.94	2.05	2.35	2.48	2.73	2.83	2.89	1.96	2.00	2.13	2.19	2.30	2.35	2.37
	10%	1.78	1.91	2.19	2.30	2.53	2.62	2.68	1.86	1.91	2.05	2.10	2.21	2.25	2.28
40	1%	2.08	2.22	2.52	2.67	2.94	3.06	3.13	2.07	2.11	2.25	2.31	2.43	2.48	2.51
	5%	1.85	1.98	2.27	2.39	2.65	2.75	2.81	1.91	1.96	2.10	2.16	2.28	2.32	2.35
	10%	1.73	1.85	2.13	2.24	2.48	2.58	2.63	1.83	1.88	2.01	2.07	2.19	2.24	2.26
Model: c, s															
5	1%	4.66	4.71	5.44	5.75	6.41	6.60	6.71	4.99	4.62	4.78	4.86	5.07	5.13	5.14
	5%	3.45	3.80	4.56	4.85	5.50	5.64	5.73	4.04	3.97	4.27	4.38	4.64	4.71	4.75
	10%	2.95	3.36	4.12	4.38	4.99	5.15	5.24	3.59	3.67	4.02	4.14	4.43	4.50	4.54
15	1%	3.36	3.58	4.37	4.64	5.23	5.40	5.53	3.95	3.88	4.14	4.30	4.55	4.61	4.64
	5%	2.80	3.12	3.88	4.13	4.72	4.89	4.99	3.45	3.50	3.87	4.01	4.29	4.37	4.41
	10%	2.54	2.89	3.63	3.88	4.43	4.60	4.71	3.21	3.32	3.73	3.87	4.16	4.24	4.28
25	1%	3.07	3.35	4.11	4.34	4.92	5.13	5.24	3.66	3.68	4.02	4.14	4.40	4.50	4.53
	5%	2.61	2.98	3.71	3.97	4.53	4.71	4.80	3.28	3.39	3.77	3.92	4.20	4.29	4.33
	10%	2.41	2.78	3.51	3.77	4.30	4.48	4.58	3.09	3.25	3.65	3.81	4.09	4.19	4.24
40	1%	2.85	3.18	3.93	4.21	4.77	4.96	5.07	3.51	3.54	3.93	4.07	4.35	4.42	4.47
	5%	2.51	2.87	3.62	3.87	4.43	4.60	4.71	3.19	3.31	3.72	3.87	4.15	4.24	4.28
	10%	2.34	2.71	3.44	3.69	4.23	4.40	4.50	3.04	3.19	3.62	3.76	4.05	4.14	4.20
Model: c,s,t															
5	1%	4.80	4.67	5.42	5.72	6.40	6.59	6.72	5.11	4.59	4.76	4.83	5.06	5.13	5.14
	5%	3.50	3.76	4.54	4.84	5.49	5.63	5.74	4.06	3.95	4.25	4.36	4.63	4.71	4.75
	10%	2.95	3.31	4.08	4.37	4.98	5.15	5.24	3.61	3.63	4.00	4.12	4.42	4.50	4.54
15	1%	3.41	3.57	4.34	4.61	5.23	5.40	5.54	4.00	3.83	4.13	4.27	4.54	4.61	4.64
	5%	2.81	3.09	3.86	4.11	4.71	4.88	4.99	3.47	3.47	3.85	4.00	4.29	4.37	4.41
	10%	2.54	2.86	3.61	3.87	4.43	4.59	4.71	3.21	3.29	3.71	3.85	4.15	4.24	4.28
25	1%	3.08	3.32	4.08	4.33	4.92	5.13	5.23	3.69	3.65	3.99	4.13	4.39	4.49	4.53
	5%	2.62	2.95	3.68	3.96	4.52	4.70	4.80	3.27	3.35	3.75	3.91	4.20	4.29	4.33
	10%	2.41	2.76	3.49	3.75	4.30	4.48	4.58	3.09	3.22	3.64	3.80	4.09	4.18	4.23
40	1%	2.86	3.15	3.91	4.20	4.77	4.95	5.07	3.50	3.50	3.91	4.06	4.34	4.42	4.47
	5%	2.51	2.84	3.60	3.86	4.42	4.59	4.71	3.19	3.28	3.70	3.86	4.15	4.24	4.28
	10%	2.33	2.68	3.42	3.68	4.23	4.40	4.50	3.03	3.16	3.59	3.75	4.05	4.14	4.19

Table 4 (continued). Critical values of the cross-sectionally augmented F-IPS test

N	Level	CF-IPS _{F{3,...,12}}						
		T=48	60	96	120	240	360	480
Model: c								
5	1%	2.74	2.75	2.79	2.81	2.95	2.99	3.00
	5%	2.31	2.34	2.44	2.50	2.60	2.64	2.66
	10%	2.11	2.15	2.27	2.32	2.42	2.47	2.49
15	1%	2.25	2.29	2.42	2.47	2.59	2.62	2.66
	5%	2.02	2.08	2.21	2.26	2.38	2.41	2.45
	10%	1.91	1.97	2.10	2.15	2.27	2.31	2.34
25	1%	2.14	2.19	2.33	2.39	2.51	2.56	2.59
	5%	1.96	2.01	2.15	2.21	2.32	2.37	2.40
	10%	1.86	1.92	2.06	2.12	2.22	2.27	2.29
40	1%	2.07	2.13	2.26	2.33	2.46	2.51	2.54
	5%	1.90	1.98	2.11	2.17	2.30	2.34	2.37
	10%	1.83	1.90	2.03	2.08	2.21	2.25	2.28
Model: c,t								
5	1%	2.74	2.73	2.78	2.80	2.95	2.97	2.99
	5%	2.32	2.32	2.42	2.48	2.59	2.64	2.66
	10%	2.11	2.14	2.25	2.31	2.42	2.46	2.49
15	1%	2.25	2.28	2.40	2.45	2.59	2.61	2.65
	5%	2.02	2.06	2.20	2.25	2.38	2.41	2.45
	10%	1.90	1.95	2.09	2.14	2.26	2.30	2.33
25	1%	2.13	2.17	2.31	2.38	2.50	2.56	2.58
	5%	1.95	2.00	2.14	2.20	2.32	2.36	2.39
	10%	1.85	1.90	2.04	2.10	2.22	2.27	2.29
40	1%	2.06	2.12	2.25	2.32	2.45	2.50	2.54
	5%	1.90	1.96	2.10	2.16	2.29	2.33	2.36
	10%	1.82	1.88	2.01	2.07	2.20	2.25	2.27
Model: c, s								
5	1%	4.90	4.58	4.76	4.85	5.11	5.16	5.21
	5%	3.93	3.92	4.26	4.37	4.65	4.74	4.79
	10%	3.51	3.61	4.00	4.12	4.44	4.53	4.56
15	1%	3.88	3.83	4.13	4.29	4.57	4.64	4.67
	5%	3.37	3.46	3.85	4.00	4.30	4.39	4.43
	10%	3.14	3.27	3.71	3.85	4.16	4.26	4.30
25	1%	3.58	3.64	4.00	4.14	4.42	4.52	4.55
	5%	3.20	3.35	3.76	3.91	4.21	4.30	4.35
	10%	3.02	3.20	3.63	3.79	4.09	4.19	4.25
40	1%	3.44	3.49	3.91	4.06	4.36	4.44	4.49
	5%	3.12	3.26	3.70	3.85	4.16	4.25	4.30
	10%	2.96	3.14	3.59	3.74	4.05	4.15	4.21
Model: c,s,t								
5	1%	5.01	4.56	4.74	4.82	5.10	5.16	5.21
	5%	3.96	3.89	4.24	4.35	4.65	4.74	4.78
	10%	3.52	3.58	3.98	4.10	4.43	4.52	4.56
15	1%	3.92	3.79	4.11	4.27	4.56	4.64	4.67
	5%	3.39	3.42	3.82	3.98	4.30	4.38	4.43
	10%	3.14	3.24	3.68	3.84	4.16	4.25	4.30
25	1%	3.61	3.61	3.97	4.12	4.41	4.52	4.55
	5%	3.21	3.31	3.74	3.89	4.20	4.30	4.35
	10%	3.02	3.16	3.61	3.78	4.09	4.19	4.24
40	1%	3.43	3.46	3.88	4.05	4.36	4.43	4.49
	5%	3.12	3.23	3.68	3.84	4.15	4.24	4.30
	10%	2.95	3.11	3.57	3.73	4.05	4.14	4.20

Table 5. Size and power of the CF-IPS and BF-IPS tests (nominal 5% significance level). Model includes constant

T	ω	CF-IPS t_1			BF-IPS t_1			CF-IPS t_2			BF-IPS t_2							
		N=5	15	25	40	5	15	25	40	5	15	25	40					
Size	48	0.3	5.7	5.1	4.3	5.0	5.6	4.8	4.9	3.3	3.8	5.6	4.9	5.6	5.3	4.9	5.7	5.0
		0.5	5.5	4.9	4.5	5.1	5.9	4.7	5.5	3.6	4.8	5.8	4.5	5.8	5.1	5.8	5.6	5.3
		0.7	5.4	3.9	4.2	4.8	6.7	4.6	5.1	3.6	4.8	5.5	5.0	5.2	6.0	6.1	5.7	5.3
	60	0.3	5.9	3.9	4.6	5.7	6.5	5.8	5.4	4.5	4.8	4.6	4.9	5.7	5.5	7.1	7.0	5.5
		0.5	5.9	5.0	4.4	5.0	6.0	5.2	5.6	6.6	4.0	4.3	6.0	5.1	5.2	5.5	4.9	5.1
		0.7	5.6	4.6	5.8	5.0	5.1	4.9	4.2	5.5	3.7	3.7	5.2	5.5	5.4	5.8	5.4	5.6
	96	0.3	5.6	5.2	5.9	4.3	5.9	5.2	5.2	5.5	3.6	5.1	4.4	4.9	6.3	6.0	6.0	5.4
		0.5	5.0	4.7	5.0	4.3	4.6	6.5	5.0	5.5	6.5	4.4	6.3	6.7	5.9	5.0	5.6	4.2
		0.7	4.4	5.2	5.3	4.3	5.7	5.8	4.7	5.6	7.4	4.7	5.8	7.0	5.0	5.0	5.5	5.1
	120	0.3	3.5	4.0	4.7	6.0	5.0	5.7	4.0	5.8	5.0	5.6	5.7	6.0	6.7	4.4	6.2	4.3
		0.5	4.4	5.1	6.3	4.8	5.8	4.4	6.4	4.8	5.2	5.5	5.7	5.6	6.1	4.9	5.5	4.5
		0.7	4.2	5.3	6.4	4.9	5.0	4.0	6.5	5.4	5.8	5.7	5.2	5.5	5.9	5.5	4.9	4.5
240	0.3	3.6	5.0	5.4	4.8	5.2	4.9	4.5	3.7	5.7	6.7	3.9	6.1	6.2	4.4	5.1	5.7	
	0.5	3.5	4.6	5.6	4.7	4.9	4.8	3.9	4.6	5.8	6.5	4.4	6.5	6.2	4.7	5.4	5.9	
	0.7	4.1	5.2	5.9	5.2	4.3	5.5	4.4	5.3	5.6	5.8	4.3	6.2	5.9	6.9	5.9	5.7	
360	0.3	5.2	5.1	5.8	5.9	4.9	5.8	4.9	5.1	4.9	6.8	5.0	5.4	5.9	6.9	5.8	5.8	
	0.5	5.5	4.7	4.8	4.0	6.2	5.7	4.6	5.3	5.0	5.2	4.0	4.5	3.8	5.0	5.2	5.8	
	0.7	5.4	5.0	5.3	4.0	6.5	4.9	4.9	4.8	5.6	5.2	4.6	4.0	4.9	3.9	5.7	5.5	
480	0.3	4.7	5.9	5.7	4.2	4.5	5.2	5.4	5.8	5.2	4.5	4.4	5.2	4.6	3.7	4.6	5.8	
	0.5	4.7	5.3	5.3	4.0	5.2	5.2	5.1	5.9	5.5	4.1	5.4	5.4	4.5	5.3	3.9	5.3	
	0.7	4.5	6.0	5.7	4.0	5.4	4.0	5.0	5.7	5.7	4.4	5.0	6.1	5.8	5.0	4.7	5.0	
Power	48	0.3	6.1	5.4	6.3	5.6	6.8	7.1	6.9	6.2	5.3	8.5	8.2	9.2	19.3	30.5	42.0	47.4
		0.5	5.1	5.2	5.8	6.7	5.9	5.3	5.0	5.0	6.0	8.0	8.5	9.1	17.9	22.9	26.5	28.2
		0.7	5.5	4.8	4.6	4.5	6.9	6.5	5.5	4.6	5.7	8.6	8.6	9.1	14.4	15.4	17.0	16.6
	60	0.3	4.6	2.9	3.3	2.3	5.8	5.8	4.7	3.4	6.3	7.0	7.4	8.6	11.3	11.9	11.0	11.5
		0.5	5.8	5.2	5.5	7.3	7.8	7.6	8.5	8.8	6.5	8.6	9.7	8.8	19.0	38.2	49.2	58.8
		0.7	5.1	4.2	6.1	4.8	6.1	6.7	6.1	6.6	5.6	8.4	7.8	9.3	17.9	28.1	30.9	37.4
	96	0.3	3.6	3.4	2.3	2.6	5.3	5.4	5.0	5.2	5.3	8.7	7.6	8.2	11.1	13.5	13.4	14.7
		0.5	6.2	6.2	5.6	6.4	7.5	11.4	10.2	11.3	9.6	9.7	11.9	14.4	28.2	55.8	69.6	77.2
		0.7	6.0	6.2	5.2	5.3	7.6	9.2	8.1	7.7	10.1	9.4	11.5	14.9	25.1	41.5	49.9	54.1
	120	0.3	3.7	3.5	2.4	2.3	5.5	5.1	4.5	4.9	11.6	9.5	10.0	13.7	14.3	16.5	17.9	18.1
		0.5	7.2	7.0	8.5	6.3	6.8	8.2	9.3	7.8	8.8	13.6	16.2	16.0	30.0	47.9	55.7	63.8
		0.7	5.4	6.6	6.8	5.7	6.3	6.6	8.3	6.2	9.4	13.0	14.8	16.0	24.8	33.2	36.5	40.5
240	0.3	4.1	3.8	3.3	2.6	5.2	4.4	6.8	5.1	10.0	13.4	13.3	17.2	17.4	18.6	17.5	20.6	
	0.5	13.0	18.3	15.5	12.9	23.0	29.0	35.0	35.0	17.1	28.4	33.8	40.4	63.8	93.2	97.1	97.8	
	0.7	7.5	13.1	17.3	14.8	11.1	16.5	19.1	21.9	16.4	27.9	32.2	40.5	54.6	80.1	83.6	85.8	
360	0.3	5.8	9.9	11.7	10.1	6.6	8.5	8.3	6.9	15.1	25.9	30.9	40.3	27.9	31.1	32.9	31.5	
	0.5	23.8	31.6	36.6	22.0	44.5	53.2	62.4	28.8	54.7	64.7	78.4	83.0	98.7	99.3	99.5	99.5	
	0.7	14.7	23.6	30.6	36.5	19.0	32.0	36.8	28.0	55.5	64.1	79.5	73.4	91.9	93.1	94.4		
480	0.3	15.2	24.0	31.5	37.1	15.5	19.2	19.6	20.0	28.4	54.7	63.8	78.4	58.5	73.2	75.6	77.4	
	0.5	14.6	27.4	35.1	48.1	9.7	10.9	11.6	12.4	27.6	53.1	62.4	78.1	36.7	44.1	43.7	42.3	
	0.7	19.1	40.5	59.4	71.0	33.0	61.6	73.6	80.0	40.6	80.9	93.5	97.6	94.8	99.7	99.8	100.0	
480	0.5	18.6	41.9	60.9	71.5	28.8	43.4	51.5	52.9	39.9	80.9	93.2	98.0	88.4	95.0	97.3	98.6	
	0.7	19.6	44.4	60.4	74.2	21.8	27.0	30.3	29.6	39.8	81.1	93.0	97.8	74.4	82.4	86.1	88.6	
	0.9	24.4	53.7	70.1	88.8	15.0	13.4	15.7	15.9	39.4	79.5	92.4	97.7	49.2	55.0	53.4	57.3	

Table 5 (continued). Size and power of the CF-IPS and BF-IPS tests (nominal 5% significance level). Model includes constant

T	ω	CF-IPS $F_{\{2, \dots, 12\}}$				BF-IPS $F_{\{2, \dots, 12\}}$				CF-IPS $F_{\{3, \dots, 12\}}$				BF-IPS $F_{\{3, \dots, 12\}}$			
		5	15	25	40	5	15	25	40	5	15	25	40	5	15	25	40
48	0.3	4.7	5.6	5.6	5.7	4.5	6.3	6.5	5.2	4.6	4.8	5.6	5.4	4.5	5.5	6.6	4.8
		4.6	4.6	5.4	5.4	4.3	6.5	5.5	5.2	4.8	4.8	5.4	5.3	4.0	6.1	5.9	5.4
		5.1	4.8	6.0	5.2	5.4	6.2	5.5	5.7	5.7	4.7	5.6	5.5	5.4	5.8	5.6	5.3
	0.5	5.3	4.0	4.9	4.9	5.0	5.7	5.7	5.7	5.7	3.5	5.0	5.5	5.2	5.5	5.7	5.4
		5.3	4.7	5.8	3.3	5.8	4.5	5.0	5.4	5.7	5.1	5.0	5.2	5.8	5.1	4.4	6.0
		4.5	4.8	5.6	3.6	4.8	6.0	4.2	6.5	4.6	4.8	5.4	3.2	4.4	5.8	4.4	6.2
	0.7	4.2	4.3	4.9	3.7	4.9	5.9	5.2	6.1	5.0	4.7	5.1	3.9	5.0	6.2	5.5	5.6
		4.1	4.1	4.8	4.8	5.4	4.8	5.2	5.9	4.6	4.1	5.6	4.6	5.2	5.1	5.1	5.7
		5.3	4.0	5.5	5.6	5.9	7.5	4.4	4.2	4.7	4.1	5.0	5.3	6.0	6.7	4.1	4.9
	96	4.6	4.8	5.6	5.8	5.3	7.3	4.7	5.3	4.7	4.7	4.8	5.6	5.7	6.6	4.3	6.0
		4.7	5.1	5.5	5.7	4.5	6.7	4.4	5.4	5.0	4.9	5.0	6.1	4.4	6.3	4.3	6.1
		5.5	5.2	5.4	6.0	5.4	6.6	5.3	6.7	5.2	5.3	5.2	5.3	6.3	5.0	6.4	6.4
120	7.2	5.3	5.8	4.5	4.5	4.9	5.0	4.9	6.6	5.2	4.9	4.2	4.3	5.5	5.6	5.0	
	7.0	5.5	5.3	4.2	3.6	5.5	6.8	5.3	6.7	5.2	5.0	3.7	3.9	6.0	6.7	5.4	
	7.0	5.2	4.8	3.6	4.7	5.7	5.4	4.0	6.8	5.4	4.2	4.3	5.4	6.1	6.5	4.9	
240	6.2	5.9	5.2	4.4	5.7	5.8	5.4	6.1	6.5	4.9	4.5	4.2	6.0	6.0	5.3	5.7	
	6.1	5.3	5.3	5.4	5.5	6.1	5.1	5.1	6.1	6.6	5.2	5.8	5.8	6.4	6.1	6.2	
	5.7	5.2	5.7	6.3	5.9	5.7	5.7	5.4	6.4	5.3	6.3	6.1	6.4	5.1	5.6	6.0	
360	5.3	5.1	5.9	6.3	5.7	5.2	5.4	5.8	6.0	4.8	6.3	5.7	5.7	6.0	5.4	6.4	
	5.0	4.9	5.5	5.8	5.7	6.7	4.7	5.6	4.9	4.3	5.4	6.0	5.9	5.9	4.1	5.3	
	6.8	4.2	4.6	5.4	4.4	5.7	6.7	5.9	7.1	5.1	4.3	4.7	3.7	5.9	6.2	6.2	
480	7.0	4.8	4.6	4.8	4.1	5.5	5.8	6.5	6.8	5.0	4.5	4.8	4.4	5.0	5.7	6.4	
	6.9	4.6	5.2	5.1	4.7	5.4	6.5	6.2	6.4	5.1	5.5	4.6	5.0	5.4	5.8	5.7	
	6.0	4.3	5.8	4.9	4.7	5.0	4.9	6.4	5.3	4.3	5.5	4.2	4.9	5.4	5.0	5.6	
Power	0.3	4.8	4.7	6.4	4.9	5.9	6.3	5.1	6.5	4.9	4.4	5.5	4.6	5.1	5.6	6.2	6.0
		5.2	5.2	6.1	3.7	4.8	5.9	5.4	6.4	5.2	5.4	4.9	4.6	5.8	6.2	5.0	6.3
		5.2	6.1	6.1	3.7	4.8	5.9	5.4	6.5	5.2	5.4	4.9	4.6	5.8	6.2	5.0	6.3
48	0.3	8.3	10.4	12.3	15.1	12.7	19.8	22.1	25.1	8.4	10.5	11.4	14.9	12.1	19.0	20.1	23.8
		8.1	9.8	12.8	15.0	10.5	14.4	14.4	16.7	8.3	9.7	11.8	15.0	10.1	14.6	13.6	15.6
		7.6	9.3	11.9	15.4	9.4	10.8	11.0	12.3	7.7	9.6	10.4	15.4	8.5	11.4	10.1	11.3
	0.5	8.6	8.1	11.3	14.3	8.4	9.8	7.8	9.9	8.3	7.9	10.1	13.1	8.4	8.4	8.2	9.0
		9.3	11.8	15.9	16.5	19.9	31.2	38.0	46.0	9.2	12.0	15.7	14.5	18.8	28.0	35.4	42.3
		8.3	12.6	15.7	16.8	18.7	21.7	25.2	25.8	8.8	12.4	15.4	14.8	16.9	20.7	24.0	23.2
	0.7	9.4	12.6	15.4	16.1	14.8	17.0	17.9	17.7	8.9	10.7	14.5	14.0	14.0	14.8	16.6	17.2
		15.4	11.8	15.3	15.3	13.3	12.6	12.1	14.4	8.8	11.6	14.2	13.9	13.3	11.9	11.7	13.2
		15.4	23.1	27.2	33.3	41.3	68.8	81.5	86.8	14.3	22.1	24.7	31.1	39.2	64.3	78.5	84.0
	96	16.1	25.0	26.6	34.1	37.2	49.0	58.0	60.3	15.6	23.6	25.1	30.8	36.5	46.8	54.4	57.4
		15.8	25.0	27.6	34.2	31.3	34.1	36.8	36.2	16.3	24.1	26.2	31.9	29.0	30.0	33.8	33.0
		15.5	24.0	26.9	35.7	24.1	23.0	21.6	23.2	13.6	23.7	26.6	32.7	22.8	22.5	20.9	21.9
120	22.1	33.4	39.8	43.1	57.0	86.7	93.0	96.7	20.3	30.6	35.9	39.7	55.3	84.4	93.0	96.1	
	21.0	32.8	38.4	43.4	49.2	69.5	75.1	79.1	19.5	31.6	35.0	40.3	47.3	69.9	73.4	76.9	
	21.2	31.9	40.1	43.4	40.4	51.4	53.1	54.3	19.1	30.1	35.2	41.7	38.8	48.4	51.3	51.4	
240	21.4	32.3	37.9	42.7	30.3	30.6	30.8	30.6	19.0	30.2	33.4	39.9	29.1	29.5	28.1	29.3	
	56.8	87.8	94.4	97.2	98.0	100.0	100.0	100.0	53.5	85.3	92.3	95.7	97.5	100.0	100.0	100.0	
	55.5	86.1	94.6	97.9	95.7	99.5	99.8	99.9	52.8	84.4	92.0	96.9	94.9	99.0	99.5	99.7	
360	54.7	85.2	95.8	97.6	87.1	94.4	95.1	96.5	52.4	83.4	93.8	96.3	93.2	93.6	93.6	93.9	
	54.6	84.7	95.9	97.6	70.4	73.7	74.2	73.8	51.6	82.1	93.4	96.1	66.4	70.4	69.4	69.4	
	90.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	87.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
480	90.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	87.2	100.0	100.0	100.0	99.9	100.0	100.0	100.0	
	89.5	100.0	100.0	100.0	99.6	100.0	100.0	100.0	86.7	100.0	100.0	100.0	99.1	100.0	100.0	100.0	
	90.7	100.0	100.0	100.0	94.9	94.8	96.4	94.9	87.1	99.9	100.0	100.0	93.6	93.6	94.6	94.2	
Power	0.3	99.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		99.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		99.1	100.0	100.0	100.0	99.9	100.0	100.0	100.0	98.7	100.0	100.0	100.0	99.9	100.0	99.9	100.0
0.5	99.1	100.0	100.0	100.0	99.7	99.9	99.5	99.7	98.9	100.0	100.0	100.0	99.3	99.8	99.4	99.5	

Table 6. Size and power of the CF-IPS and BF-IPS tests (nominal 5% significance level). Model includes constant and trend

T	ω	CF-IPS t_1			BF-IPS t_1			CF-IPS t_2			BF-IPS t_2							
		N=5	15	25	40	5	15	25	40	5	15	25	40					
Size	48	0.3	4.6	4.4	5.1	4.2	4.6	4.9	4.9	4.0	5.8	4.8	5.3	5.2	4.9	5.7	5.1	
		0.5	4.8	4.4	5.1	3.8	5.5	6.6	5.9	5.2	4.7	5.9	4.6	5.3	5.4	5.6	5.6	4.9
		0.7	4.6	4.6	5.3	4.1	6.1	6.2	5.5	6.5	5.0	5.2	6.0	5.6	6.2	6.4	5.7	5.6
	60	0.3	5.0	4.8	5.4	4.0	6.6	6.3	5.7	5.9	4.9	5.1	5.7	6.1	5.7	7.0	7.1	5.1
		0.5	4.6	4.3	5.1	5.5	4.7	5.4	5.3	4.9	3.8	4.7	5.8	5.0	5.3	5.5	4.5	4.6
		0.7	5.3	4.7	5.6	5.4	6.5	5.2	4.8	4.7	3.4	5.1	4.4	5.0	6.5	6.1	5.6	5.4
	96	0.3	4.1	4.3	4.6	4.5	6.6	5.5	5.2	5.3	6.7	4.6	6.1	6.7	5.9	4.8	5.5	3.8
		0.5	3.3	4.5	4.9	4.4	6.0	5.7	5.7	6.0	7.3	4.9	5.7	6.6	5.0	5.1	5.9	5.0
		0.7	3.8	4.7	4.9	3.7	5.4	5.4	5.1	6.1	6.9	4.3	5.2	6.8	5.1	5.7	5.5	4.7
	120	0.3	4.9	4.6	5.3	4.5	4.8	5.1	4.9	5.8	5.7	5.5	5.8	4.8	6.5	4.4	6.2	4.4
		0.5	5.5	5.2	4.5	5.0	4.5	4.7	5.0	5.8	5.3	5.4	5.6	5.3	6.2	4.9	5.2	4.8
		0.7	5.1	5.1	4.9	5.3	4.5	4.2	6.3	6.3	5.8	5.4	5.2	5.5	6.3	5.4	4.8	4.3
240	0.3	4.0	4.0	6.2	5.0	5.3	5.4	5.1	5.3	5.7	6.6	4.2	6.1	6.2	4.6	5.3	5.9	
	0.5	4.1	3.9	6.1	4.4	5.4	5.6	5.4	5.0	5.9	6.6	4.5	6.8	6.2	4.6	5.6	6.0	
	0.7	4.5	4.4	5.8	4.8	5.1	6.3	6.5	5.4	5.7	6.0	4.5	6.1	6.0	7.1	6.0	5.8	
360	0.3	4.5	5.2	5.3	5.1	4.7	6.6	5.9	4.5	4.8	6.6	5.1	5.5	5.9	6.8	5.8	5.8	
	0.5	6.4	5.2	4.5	4.0	6.3	4.1	4.5	4.3	5.0	5.2	4.1	4.5	3.6	5.0	5.1	5.8	
	0.7	6.3	5.2	4.3	3.7	6.9	4.8	3.9	6.0	5.7	5.1	4.6	4.2	4.7	3.9	5.7	5.5	
480	0.3	4.9	6.0	5.6	3.9	5.5	6.3	5.0	5.2	5.3	4.6	4.4	5.4	4.8	3.7	4.6	5.5	
	0.5	5.0	5.9	5.7	4.5	5.2	4.6	5.3	5.5	5.4	4.1	5.4	5.4	4.5	5.2	3.8	5.3	
	0.7	5.5	5.7	5.8	4.4	5.1	4.3	4.8	5.2	5.8	4.5	5.0	6.1	5.6	5.1	4.5	5.1	
Power	48	0.3	5.0	5.6	6.9	5.6	7.6	7.0	6.4	5.6	8.8	8.3	9.7	19.6	30.6	41.6	47.8	
		0.5	5.4	5.1	6.0	5.1	6.2	6.9	6.3	6.2	5.9	8.8	9.1	9.6	17.5	23.0	26.1	28.9
		0.7	4.8	5.4	6.0	5.0	6.2	7.3	6.2	6.2	5.9	8.9	9.6	8.8	13.7	15.9	18.2	17.6
	60	0.3	4.9	5.6	6.2	6.6	6.8	7.5	6.3	6.7	7.1	8.3	9.6	8.7	19.9	38.3	50.3	58.5
		0.5	5.1	5.4	6.6	6.8	6.7	6.7	6.1	6.5	5.6	7.9	8.0	9.3	18.2	28.5	31.3	38.7
		0.7	5.5	5.1	7.0	6.8	7.2	6.2	5.5	4.9	5.0	9.2	7.6	8.8	14.0	18.9	20.0	23.8
	96	0.3	4.9	4.9	6.1	6.4	7.0	7.8	6.7	7.1	9.2	9.9	12.2	14.4	28.3	55.9	69.3	76.9
		0.5	4.8	5.0	6.9	5.5	6.6	6.6	6.8	7.5	10.4	9.6	11.2	15.5	25.2	41.7	50.0	54.5
		0.7	4.2	5.8	6.9	5.0	5.9	6.7	6.1	6.4	11.5	9.7	9.9	14.9	20.4	27.9	31.9	33.7
	120	0.3	3.9	5.4	7.4	4.7	5.8	5.6	6.0	7.0	11.8	9.8	10.0	14.3	14.3	15.9	18.1	17.9
		0.5	6.7	6.8	7.6	6.0	5.7	6.5	7.0	8.5	8.6	14.4	15.1	15.6	34.2	63.4	76.7	83.4
		0.7	6.5	7.1	6.2	7.2	4.9	5.3	6.9	6.9	9.9	13.1	14.8	16.3	29.7	48.1	56.0	64.0
240	0.3	6.2	6.6	5.1	6.6	5.8	5.5	7.0	6.3	10.5	13.5	13.5	18.0	17.7	18.4	17.8	20.9	
	0.5	6.4	7.5	10.5	10.8	6.1	8.9	10.0	12.4	17.1	28.1	33.5	40.7	63.4	93.3	97.0	97.8	
	0.7	6.1	6.8	9.9	10.3	5.9	8.4	9.1	9.9	16.3	27.9	32.7	40.7	54.6	80.3	83.9	85.8	
360	0.3	5.4	6.5	10.4	9.7	5.9	8.0	7.1	8.0	15.7	26.9	32.5	40.5	44.4	58.6	61.8	62.0	
	0.5	5.2	5.6	7.5	7.6	5.1	7.4	5.5	5.6	15.4	26.0	31.3	41.2	28.1	31.4	32.7	31.6	
	0.7	8.3	13.3	15.6	14.5	10.8	14.6	17.8	20.7	28.6	54.6	64.9	78.6	82.7	98.6	99.2	99.5	
480	0.3	8.7	13.5	15.2	14.3	9.5	11.1	13.6	14.2	28.1	55.7	64.2	79.4	73.2	91.8	93.3	94.4	
	0.5	8.6	12.8	14.5	13.0	8.5	9.7	9.4	11.1	28.1	54.5	64.1	78.6	58.2	73.0	75.5	77.0	
	0.7	7.5	11.4	10.9	10.3	6.7	6.6	6.6	6.6	27.9	53.1	62.8	78.6	36.8	44.4	43.3	42.1	
480	0.3	11.0	21.5	28.5	29.1	14.7	24.8	29.6	33.9	40.7	81.0	93.8	97.6	94.8	99.7	99.8	100.0	
	0.5	11.0	21.4	28.7	28.8	12.6	16.3	19.0	20.0	40.2	80.9	93.3	98.1	88.4	95.1	97.3	98.6	
	0.7	10.7	19.9	27.3	28.5	9.3	12.7	12.7	12.9	39.8	81.1	93.2	97.8	74.7	82.2	86.0	88.7	
0.9	9.4	19.3	23.7	26.3	8.6	8.6	9.5	9.5	39.5	79.7	92.4	97.9	49.1	55.1	53.2	57.1		

Table 6 (continued). Size and power of the CF-IPS and BF-IPS tests (nominal 5% significance level). Model includes constant and trend

T	ω	CF-IPS $F_{\{2, \dots, 12\}}$				BF-IPS $F_{\{2, \dots, 12\}}$				CF-IPS $F_{\{3, \dots, 12\}}$				BF-IPS $F_{\{3, \dots, 12\}}$			
		5	15	25	40	5	15	25	40	5	15	25	40	5	15	25	40
48	0.3	4.8	5.5	5.3	5.4	4.1	6.9	6.5	5.3	4.4	4.8	5.1	5.0	4.3	6.2	6.1	5.0
		4.8	4.6	5.5	5.2	4.3	6.5	5.5	6.0	4.6	4.9	6.2	4.9	4.5	6.7	6.0	5.6
		4.7	3.8	5.5	5.2	5.1	6.6	5.4	5.3	5.0	4.3	6.1	4.8	5.0	5.2	5.5	5.2
	0.7	5.4	3.9	5.2	4.9	4.7	6.0	5.6	5.8	5.1	3.6	5.8	4.6	4.9	5.0	5.5	5.7
		0.3	5.3	5.2	5.0	3.5	5.4	5.5	5.6	5.2	5.6	5.0	4.6	3.3	5.7	5.6	4.8
		0.5	4.2	4.7	5.3	3.6	5.0	6.3	6.7	4.4	5.4	5.4	3.4	5.0	6.1	5.1	6.8
	0.7	4.6	4.5	5.6	3.6	5.0	6.5	5.6	6.4	4.6	5.0	5.1	4.0	5.3	6.0	5.3	5.8
		0.9	4.7	4.4	5.3	4.7	5.4	5.0	5.4	5.5	4.9	4.6	4.9	4.7	5.1	5.1	5.7
		0.3	5.2	3.8	5.4	5.5	5.9	7.8	4.4	4.6	3.8	4.6	4.8	5.8	7.2	4.3	4.7
	96	4.4	4.3	5.3	5.6	5.6	6.9	4.4	5.2	4.8	4.8	4.3	5.3	5.7	6.5	4.3	5.6
		0.7	4.3	4.6	5.2	4.8	4.8	6.9	4.7	5.5	4.8	4.3	5.3	4.2	6.6	6.3	6.4
		0.9	5.5	5.2	5.5	5.2	5.4	6.9	5.6	7.2	5.5	5.0	4.7	5.1	5.8	6.3	5.4
120	0.3	7.0	5.4	5.1	4.3	4.4	4.9	5.1	4.7	6.5	5.2	5.4	4.1	4.3	5.7	6.2	
	0.5	6.5	5.3	5.4	4.0	3.8	5.4	6.9	4.8	6.8	4.5	5.3	3.5	4.0	6.1	6.8	
	0.7	6.6	5.0	4.8	3.5	4.3	6.0	6.9	4.5	6.5	4.8	4.0	4.0	5.8	6.1	6.7	
240	0.3	6.2	5.6	5.7	5.6	5.5	5.9	5.1	5.2	6.3	6.3	5.1	5.8	5.9	6.2	6.0	
	0.5	5.7	5.4	6.3	6.4	5.6	5.6	5.1	5.7	6.6	5.2	6.1	6.4	6.2	4.9	5.9	
	0.7	5.5	5.5	6.1	6.3	5.6	5.2	5.3	5.8	6.0	4.7	5.7	5.8	5.9	6.0	5.3	
360	0.3	5.2	5.0	5.6	5.9	5.3	6.6	4.5	5.4	4.9	4.2	5.0	6.1	5.8	5.9	4.1	
	0.5	6.6	5.1	4.6	4.6	4.3	5.6	5.8	6.6	6.7	5.1	4.8	4.9	4.7	5.2	5.9	
	0.7	6.6	4.9	5.0	4.8	4.9	5.6	6.4	6.2	6.3	5.0	5.9	4.7	5.0	5.5	5.6	
480	0.3	4.8	4.8	5.6	3.9	6.4	5.6	6.1	5.5	4.8	4.4	4.9	5.1	6.7	4.9	5.4	
	0.5	4.9	4.8	5.9	4.2	6.1	5.2	5.3	5.3	4.9	4.3	4.8	4.7	5.6	5.3	6.0	
	0.7	5.3	4.8	6.3	4.7	5.8	6.4	5.2	6.4	5.0	4.3	6.2	5.5	5.4	6.2	4.9	
Power	48	9.1	10.3	11.9	14.0	11.9	20.3	22.8	25.0	8.5	10.2	10.5	12.6	12.1	19.4	19.1	22.1
		8.8	9.1	12.2	14.4	10.6	15.2	13.6	16.3	8.7	9.2	11.4	13.9	10.3	13.8	13.1	16.4
		7.8	9.0	11.3	14.2	9.5	12.2	10.9	12.3	7.7	8.8	10.4	14.2	8.8	11.5	10.0	11.6
	60	0.3	9.3	11.5	16.5	15.6	20.9	32.6	39.2	46.9	9.4	12.3	15.0	13.6	18.2	30.4	36.2
		0.5	8.3	13.0	15.9	15.7	18.5	23.3	24.9	27.5	8.9	12.4	14.0	13.9	16.6	20.9	24.7
		0.7	9.3	11.9	14.7	16.0	15.2	17.2	17.4	18.1	9.5	11.2	13.9	14.6	14.5	16.1	16.6
	96	0.3	15.7	22.9	27.8	32.6	42.0	70.2	83.2	88.2	14.3	21.4	24.1	30.2	40.1	66.1	80.0
		0.5	15.9	25.0	27.3	34.5	38.1	50.4	59.1	62.0	15.3	23.1	25.0	30.4	37.5	48.0	55.3
		0.7	14.8	25.0	28.1	34.1	31.8	36.1	37.1	36.9	15.0	23.8	25.3	32.0	30.3	30.7	35.1
	120	0.3	22.0	33.4	39.2	43.4	57.2	87.6	93.7	97.7	20.4	30.5	36.3	39.3	55.2	85.1	93.0
		0.5	20.8	33.2	38.3	42.9	50.0	70.6	75.8	80.1	19.9	30.7	35.5	40.5	48.7	69.9	74.5
		0.7	20.8	31.6	39.4	43.2	42.3	51.8	54.8	54.6	19.5	29.9	35.2	41.1	40.0	48.7	52.3
240	0.3	22.0	31.7	38.3	43.1	30.9	31.3	31.7	31.1	20.0	30.2	33.6	40.8	30.0	29.7	29.0	
	0.5	57.4	88.3	94.8	97.6	98.2	100.0	100.0	100.0	53.9	84.8	91.5	96.1	97.6	100.0	100.0	
	0.7	55.8	86.8	94.7	98.0	95.6	99.6	99.9	99.9	52.7	83.9	91.7	97.0	95.4	99.1	99.6	
360	0.3	90.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	87.3	100.0	100.0	100.0	100.0	100.0	100.0	
	0.5	90.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	86.4	100.0	100.0	100.0	99.9	100.0	100.0	
	0.7	89.4	100.0	100.0	100.0	99.6	100.0	100.0	100.0	86.5	100.0	100.0	100.0	99.2	100.0	100.0	
480	0.3	99.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.0	100.0	100.0	100.0	100.0	100.0	100.0	
	0.5	99.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.9	100.0	100.0	100.0	100.0	100.0	100.0	
	0.7	99.1	100.0	100.0	100.0	99.9	100.0	100.0	100.0	98.6	100.0	100.0	100.0	99.9	100.0	100.0	
0.9	99.1	100.0	100.0	100.0	99.7	99.9	99.6	99.7	98.9	100.0	100.0	100.0	99.3	99.8	99.5	99.5	