Plant level analysis using the ARD: Another Look at Gibrat's Law

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Introduction

Panel micro-data offers potential to investigate issues that previously have been hampered by the availability of only aggregate data sources

The ARD

(1) Previous work covering such areas as:

- Entry, exit
- FDI and takeovers
- TFP and impact of government incentives

(2) Issues using the database

- Access (ONS restrictions)
- Plant vs. establishment data
- Weighting
- Measuring capital stock and TFP
- Non-stationarity, selectivity and endogeneity issues (including appropriate econometric estimators)
- Limitations of the data (output price data, lack of exports, R&D etc.)

Gibrat's Law

Conclusion

Shall emphasise the strength of using plant-level panel micro-data. Opportunities for further research.

Gibrat's Law

The law of proportionate effect, which considers whether the growth of a plant (or firm) is independent of its size, has received significant attention in the literature. Testing of this law amounts to a consideration of whether plants (or firms) converge towards a geometric mean size over time, i.e. whether smaller plants grow faster than larger plants, as opposed to the alternative proposition that growth follows a random walk (i.e. Gibrat's law). The implications of whether growth is convergent or not will be considered later, after considering how we can econometrically model plant (or firm) growth.

The most common approach used to model growth is

$$\Delta y_{it} = \rho_i y_{i,t-1} + z_{it}^{'}\gamma + u_{it} \qquad (1)$$

where y is a measure (in natural logs) of the size of the plant i at time t; z_{it} includes any deterministic terms that allow for plant level heterogeneity through separate (fixed effect) intercept terms and/or time trends (i.e., $z_{it} = \alpha_i$ or $z_{it} = \alpha_i + \eta_i t$); and u_{it} is an i.i.d process that picks up all other (unanticipated) shocks that determine growth.

Essentially, the null hypothesis that y_{it} contains a unit root (and therefore a stochastic trend) comprises testing $\rho = 0$ against the alternative that Gibrat's law can be rejected in favour of $\rho < 0$ (the existence of mean reversion).[1] There are several approaches in the literature that have been used to test models that are similar to that set out in equation (1). Some have imposed homogeneity across plants (firms) by setting $\rho_i = \rho$, $\alpha_i = \alpha$, and $\eta_i = \eta$ for all i. This is generally rejected by the data since plants have been found to exhibit a high degree of heterogeneity (Hart and Oulton, 2001; Caves, 1998), and thus imposing common steady state sizes, or speeds at which

[1] If $\rho > 0$, then plant sizes will diverge as larger plants grow faster than smaller ones.

they converge to such equilibria, might be expected to be biased towards accepting the null hypothesis when it is not true.

Others have used cross-sectional (rather than panel) approaches to estimating models like (1) – *cf.* Hart and Oulton (1996, 1999, 2001). The argument for doing so seems to be (as noted above) that firms are heterogeneous and thus in particular $\rho_i \neq \rho$ and $\alpha_i \neq \alpha$ for all *i* (see Hart and Oulton, 1998, p. 41). However, estimating firm growth only using cross-sectional data (based on what is termed Galtonian regressions) means that a lot of (time-series) data is lost, which presumably will lower the power of any test. In any case, homogeneity does not need to be imposed in (1) as panel unit root tests have moved on considerably since those first devised by, for example, Levin and Lin (1992).

Some tests of equation (1) have a relatively large number of observations on the cross-sectional dimension *N*, but far fewer observations over time, *T*. As Geroski, *et. al*. (2003) point out, when only short panels are available this may lead to a rejection of the convergence hypothesis if the catch-process is slow. Since we have 25 years of data for modelling Gibrat's law, it is unlikely that we face this same problem.

Turning now to some of the implications of not being able to reject Gibrat's law using equation (1), this would suggest that increases in plant (or firm) size are driven by unexpected shocks which have a permanent effect on the size of the plant (or firm). As Geroski (1999) puts it: "… this means that corporate growth cannot be thought of as a process composed of a deterministic trend with some noise superimposed on it. The trend itself is stochastic" (p. 4). This can be seen (cf. Harris and Sollis, 2003, Box 2.1) by for simplicity setting $\gamma = 0$ and rewriting equation (1), as:

$$y_t = y_{t-n} + \sum_{j=0}^{n-1} u_{t-j} \tag{2}$$

Note, this is a path dependent (albeit an idiosyncratic) process, but one that comprises the sum of past shocks received since the plant (firm) was founded in period $t - n$. These shocks may be to some extent observable by the plant (or firm), but they are sufficiently idiosyncratic that they are hard to observe by those outside the firm, and thus the growth process appears random to, say, the policy-maker in terms of those variables that can be observed or influenced. Thus, acceptance of Gibrat's law might call into question say policies aimed at the small firm sector, when it is being assumed that (i) small firms grow faster than larger ones (especially in employment terms; and (ii) instruments of policy exist with which to influence the grow level of such firms.[2]

Panel unit root tests

The testing procedure used here is based on the analogous Levin and Lin (1993) tests (hereafter LL) and Im, Pesaran and Shin (2003) test (hereafter IPS) as implemented by Pedroni (1999) when using unbalanced data.[3] Three forms of the LL test are used, based on the following maintained model:

$$\Delta y_{it} = \rho_i y_{i,t-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{i,t-L} + z_{it}^{'} \gamma + u_{it} \qquad u_{it} \sim \text{i.i.d}(0, \sigma_u^2)^4 \tag{3}$$

[2] Note, Geroski (1999) provides two major reasons why firm size may follow a stochastic trend: (i) if adjustment costs are fixed then firms will 'save up' desired changes in terms of their size, and make these changes in one step; and (ii) most firms are irregular innovators. Both factors will produce an adjustment process that mimics a stochastic process.

[3] The original tests have been implemented in packages such as NPT 1.3 by Chiang and Kao (2002) but this requires balanced panel data where all cross-sections have the same number of time-series observations. Pedroni (1999) has modified his unbalanced data cointegration tests to allow for unit root testing.

[4] Note, this assumes that individual processes for each *i* are cross-sectionally independent which is to ensure that there is no cointegration between pairs or groups of plants in the cross sections. Banerjee, Cockerill and Russell (2001) have examined the implications of imposing this assumption, finding that the panel unit root tests considered here often over-reject the null of non-stationarity (i.e. these tests have poor size properties).

with the null hypothesis being H_0: $\rho_i = \rho = 0$ against the alternative H_1: $\rho_i = \rho < 0$ (all individual series are non-stationary). Deterministic terms are included in *z* (specifically, we shall allow $z_{it} = \alpha_i$ or $z_{it} = \alpha_i + \eta_i t$). The first two forms of the LL tests both use non-parametric estimators, based on the Phillips and Perron (1988) rho- and *t*-statistics. That is, they deal with potential autocorrelation not by including higher-order AR lags to 'whiten' the error term (as in equation 3) but rather by making a non-parametric correction to account for any autocorrelation that would be present if the underlying d.g.p. is not AR(1). The third form of the LL test is based on an ADF-type test that allows the number of lags in the model to be estimated directly (with each cross-section in the panel allowed to have different lag-lengths).[5] All test values are one-sided and asymptotically distributed under the standard normal distribution, using the negative tail.

An issue with the LL tests is concerned with the methods used to estimate panel models with fixed effects (i.e. where $\alpha_i > 0$). Generally, if heterogeneity is allowed (α_i and/or η_i feature in the model) then the usual panel estimators based on the 'within group' estimator (such as the least squares dummy variable – or LSDV – model[6]) need to be corrected for bias that arises from using such within-groups estimators. Breitung (2000) shows that this correction can lead to significant under-rejection of the null when it is false (i.e. a severe loss of power).

Furthermore, a major assumption of the LL tests is the imposition of homogeneity by setting $\rho_i = \rho$ in equation (3). The alternative hypothesis that is tested

[5] The issue of which is the best way to correct for serial correlation depends on the data distribution of the series being tested. Essentially, the PP tests are likely to be more robust to the problem of "fat tails" in the data (i.e. severe outlier problems), although imposing parametric restrictions will add to the power of the test when these are valid. As to the size of the test, when the time-series *T* is relative short compared to the cross-section *N*, then parametric tests are often sensitive to the choice of lag used, whereas the non-parametric tests have problems with the size of the test if there are large negative MA components in the dynamics of the model (as is often the case with macro time-series data).

[6] See Greene (2000, pp. 560-64) for a clear overview of this approach.

is therefore H_1: $\rho < 1$, which is that *all i* cross-sections are stationary. Thus, IPS (2003) relax the homogeneity constraint by estimating equation (3) with ρ_i free to vary across the *i* individual series in the panel.[7] Thus, the null hypothesis (H_0: $\rho_i = 0$) is that each series in the panel contains a unit root for all *i* and the alternative hypothesis (H_1: $\rho_i < 0$ for at least one *i*) is that at least one of the individual series in the panel is stationary. Essentially, the IPS test averages the ADF-individual unit root test statistics that are obtained from estimating (3) for each *i* (allowing each series to have different lag lengths *L*, if necessary); i.e.

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{\rho_i} \qquad (4)$$

The IPS test is a generalisation of the LL tests in that it relaxes the form of the alternative hypothesis, H_1. However, it also suffers from the loss of power if used with a "within-group" estimator of the fixed effects. In contrast, the group-means estimator is less restrictive in that it allows for potential heterogeneity across individual plants in the panel, while Pedroni (1999) has found that the group-means estimators typically have lower small-sample size distortions then within-groups estimators. Thus, he has developed a version of the IPS test based on the group-means approach, and this makes up the fourth test statistics that will used here. As with the LL tests, the IPS test is one-sided and asymptotically distributed under the standard normal distribution, using the negative tail.

Data Description

As discussed earlier, the ARD is an extremely comprehensive dataset currently containing annual information at plant level for manufacturing from 1973 to 2001

[7] They also allow for different lags for the *i* cross-sections in the model (as do LL, 1993)

(although data to 1998 was only available for this study). For the purpose of this paper we have selected a sub-set of 26 (from over 200) 4-digit manufacturing industries; the criterion for inclusion was based on looking at the proportionate change in the share of manufacturing gross output between 1973 and 1998, excluding the very smallest industries (i.e. those with less than 0.5 percentage share of total manufacturing output in both years). The 26 industries that were selected were those that fell in the top, middle and bottom deciles of this growth distribution. They ranged from high growth technology-based sectors through to declining traditional industries such as sugar and tobacco; in total, our sample of 26 industries accounted for about one-third of total manufacturing real gross output throughout the 1973-1998 period (Table 1).

Table 1 around here

Before providing the results from testing for unit roots in the data for each industry, Table 2 indicates whether plants that dominated each industry in 1973 also continued to dominate in subsequent years (or whether other – smaller plants – had become more important over the years). By ranking plants (in terms of their real gross output) from highest to lowest for the years covered, and then calculating the mean rank for each year, it can be seen that in most instances those plants that were the largest and dominated in 1973 became less important (in terms of size) over time. This would suggest that for many industries that mean reversion had been occurring.

Further information is provided in Table 3 where the relative growth of large and small plants within each industry for various 5 year periods is compared. Mean revision occurs when smaller plants grow faster than larger plants, and Table 3 suggests this occurred in less than half of the sub-periods by industry. Thus, this type of evidence is at best inconclusive and more formal testing is required.

The 4 panel unit root tests described in the last section are applied to plant level data[8] for the 26 industries selected using three measures of firm size: employment, gross output and gross value added. Gross output and gross value added were measured at 1990 prices.[9] In the small number of instances where the plant-level gross value added data were negative, we have set these observations as equal to the minimum value for the year and industry concerned rather than excluding the plants from our analysis.

In addition to testing for the presence of unit roots in each of the industries, we have also explored whether Gibrat's law holds for different groupings of plants. For each of the industries, the dataset was divided into two size categories - small and large plants, and also split into two time periods namely, 1973-86 and 1987-98. For each measure of size, plants were classified as small if at any time between 1973 and 1998 the value of the measure fell below the industry-specific median value. Hence, an individual plant may be categorised as large in terms of employment but as small when considering gross output. The year 1987 was chosen as the time-break to allow for the effects of the early 1980s energy crisis and manufacturing downsizing to even out.

Two issues when using the ARD for this type of analysis needed to be confronted. Firstly, the ARD is biased towards larger establishments, and thus it is important to weight the data to reflect the underlying distribution that comprises the population of plants (see section x above). Thus, we have weighted each of the measures prior to testing. Secondly, the ARD does not contain complete information

[8] Firm level data could have been used, but since the vast majority of firms are single plant enterprises, it is possible that both sets of results are likely to be similar. However, this is untested and future work will involve the use of firm level data to see if this produces different outcomes to those reported in the next section.

[9] Deflators at the 4-digit 1980 SIC level were used, with separate price indices used for outputs and intermediate inputs. Thus, GVA is double-deflated.

for every year that the plant was operating. For example, for a plant that existed in both 1973 and 1998 there may be no data observations between, say, 1990 and 1994. Related to this lack of information in the panel was the issue of how to handle plant openings and closures during this lengthy time period. By considering just the balanced plants, i.e. those that can be observed continually over the 26 year period, the number of plants in the study would have substantially reduced (for our industry sample there would have been an overall loss of about 97 per cent of plants). This raises the issue of sample selection in balanced panels, which we have avoided by basing our tests on unbalanced panel data (although in order that sufficient time was allowed for a plant to evolve and possibly converge to a mean value we have restricted our sample to those plants that had survived for at least 8 years.)[10] Other studies of firm growth, such as Geroski et al. (2003) and Chen and Lu (2003), have used balanced panel data for companies in their analysis, which potentially biases any attempt to test Gibrat's law. To see if using balanced versus unbalanced data has any major effect in this study, for completeness we also used balanced panels (where data considerations permitted) for a small selection of our sample industries.

Results

The results of applying the panel unit root test to plant level real gross output data, broken down into plant size and sub-periods, for each of our sample industries are given in Tables 4 to 8. In almost every instance the null hypothesis supporting Gibrat's law is rejected. Table 4 provides test statistics based on all plants during the 1973-98 period, and the unit root hypothesis is rejected in only 4 (out of 208)

[10] We also chose this cut-off point to ensure that there was sufficient information available for calculating lag-lengths in the ADF versions of our panel tests.

instances, based on using the LL *t*-rho and ADF-tests omitting the time trend. This was for the other printing & publishing sector (where there is some support for rejecting the null based on the Kruskall-Wallis mean ranks reported in Table 2), and the chemical industry machinery, etc industry.

In Table 5, the tests were computed using data for small plants only. Again, the null hypothesis was always rejected when the panel test including heterogeneous deterministic trends was used. However, there are a number of instances when the LL *t*-rho and ADF tests fail to reject, and two occasions when the IPS ADF test fails to reject (for copper, brass etc. and chemical industry machinery etc.). On balance though, there is overwhelming evidence when using data for the smaller plants that Gibrat's law should be rejected.

Table 6 provides fewer examples of failure to reject the null hypothesis when data for only the large plants is used. There are only 5 instances from 208 when Gibrat's law cannot be rejected. Splitting the data into two time periods also resulted in few failures to reject the null; Table 7 considers plants operating in the 1973-86 period (6 failures to reject) and Table 8 covers the 1987-1998 period (with 11 failures to reject).

Comparable tables to Tables 4 – 8 covering the results for gross value added and employment are available on request (but not presented here). They show a very similar picture to the one that emerges using real gross output data. Finally, Table 9 presents the results for a select group of industries (were data permitted) based on balanced panel datasets. Only one industry fails to reject the null that plant growth is stochastic, and that is the tobacco industry. However, this result is based on 18 plants that survived throughout the 1973-98 period, compared to the 53 plants included in

Table 4. The results for the electronic data processing industry (where failure to reject the null is relatively common) are only based on 7 observations.

Lastly, Table 10 presents for each industry the median values obtained for ρ_i when applying the IPS panel unit root test (see equation 3). The relatively large (absolute) values of the 'speed of adjustment' coefficients indicates that mean reversion is quite fast in all the industries studied, although different plants may be converging on different steady-states given that the testing procedure allows for heterogeneity when each $\alpha_i \neq 0$.[11]

Conclusions

This study has tested for Gibrat's law using plant level data for a diverse group of 26 (4-digit) UK manufacturing industries covering the 1973-1998 period, finding strong evidence that Gibrat's law can be conclusively rejected. Various analyses using different sub-periods, small versus large plants, and four different panel unit root tests, as well as data on gross output, gross value added and employment data, reached a fairly unanimous conclusion that plant size growth was mean reverting in the ARD dataset.

In contrast Geroski *et. al*. (2003) used a sample of 147 large, UK registered firms observed continuously throughout the 1955 – 1985 period and found that the growth rates of these firms was random, i.e. Gibrat's law held. Hart and Oulton in various analyses (e.g. Hart and Oulton, 2001) used employment data from the much larger OneSource database (e.g. some 8,000 companies covering 1986-95 in their 2001 paper) and conclusively reject Gibrat's law. Most studies (e.g., Mansfield, 1962;

[11] When $\rho_i < 0$, plants converge towards a long run size of $\alpha_i / -\rho_i$.

Hall, 1987; Evans, 1987; Audretsch *et. al.*, 1999 and a summaries in Sutton, 1997 and Caves, 1998) tend to support the view that firm growth decreases with size. Recent work concentrating on firm start-ups (e.g. Almus and Nerlinger, 2000; Lotti *et. al.*, 2001) also suggests that for such firms Gibrat's law can be rejected (although possibly not for firms once they have reached a certain size and age). Our own results confirm that we find little evidence for accepting that the growth of UK manufacturing plants follows a random walk. In future work we intend to look at *firms* using the ARD to consider whether aggregating up to the firm level alters our conclusions.[12]

In terms of the use of the ARD in general…

[12] But given the dominance in most industries of single-plant enterprises, we suspect that firm level data will give similar results.

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Table 1. Selected Industries

Industry	SIC (1980)	Change [a] 1973-1998	GO share [b] 1973 (%)	GO share [b] 1998 (%)
Electronic data processing equipment	3302	12.61	0.33	4.54
Radio & electronic capital goods	3443	2.65	0.58	2.11
Electronic consumer goods & other electronic equipment nes	3454	2.22	0.33	1.05
Mechanical, marine & precision engineering nes	3289	2.07	0.48	1.48
Other printing & publishing (excluding books & periodicals)	4754	1.91	1.02	2.98
Active components & electronic sub-assemblies	3453	1.81	0.44	1.24
Basic electrical equipment	3420	1.76	1.29	3.55
Motor vehicles	3510	0.07	5.30	5.67
Printing & publishing of newspapers	4751	0.02	1.79	1.83
Cocoa, chocolate & sugar confectionary	4214	0.00	0.83	0.83
Bread and flour confectionary	4196	-0.01	1.08	1.07
Fruit & vegetable processing	4147	-0.03	0.50	0.49
Forging, pressing and stamping	3120	-0.07	0.60	0.56
Other rubber products (excluding tyres & tubes)	4812	-0.14	0.63	0.54
Pulp, paper & board	4710	-0.16	1.02	0.86
Bacon curing & meat processing	4122	-0.16	1.31	1.10
Other building products of concrete, cement or plaster	2437	-0.18	0.92	0.75
Finished metal products nes	3169	-0.25	1.23	0.92
Stationery	4723	-0.66	0.73	0.25
Pile carpets, carpeting & rugs	4384	-0.67	0.57	0.19
Brewing & malting	4270	-0.74	2.89	0.76
Copper, brass and other copper alloys	2246	-0.79	0.79	0.17
Chemical industry machinery, furnaces etc	3245	-0.83	0.55	0.09
Sawmilling, planing of wood	4610	-0.84	1.22	0.20
Sugar & sugar by-products	4200	-0.84	1.31	0.20
Tobacco	4290	-0.89	3.73	0.41

Source: weighted data from the ARD

[a] Proportionate change in the share of manufacturing gross output between 1973 and 1998 i.e. (y98−y73)/y73.

[b] Gross output as a percentage share of total manufacturing output.

Table 2: Kruskall-Wallis test* of plant mean ranks 1973-1998 (based on real gross output) by industry

Industry	SIC80	1973	1983	1993	1998
Electronic data processing equipment	3302	114.6	147.8	292.0	232.0
Radio & electronic capital goods	3443	644.5	367.6	581.0	541.2
Electronic consumer goods & other electronic equipment nes	3454	78.6	149.6	139.1	115.6
Mechanical, marine & precision engineering nes	3289	1225.7	980.3	1131.7	867.1
Other printing & publishing (excluding books & periodicals)	4754	1819.6	1957.3	2528.6	2112.9
Active components & electronic sub-assemblies	3453	240.6	133.6	276.5	166.9
Basic electrical equipment	3420	885.7	602.3	793.0	770.5
Motor vehicles	3510	276.7	229.8	477.8	355.4
Printing & publishing of newspapers	4751	2084.7	1074.5	1247.8	1512.2
Cocoa, chocolate & sugar confectionary	4214	220.1	149.8	169.5	135.2
Bread and flour confectionary	4196	1527.7	1206.7	1718.1	1027.2
Fruit & vegetable processing	4147	179.1	161.8	195.6	168.9
Forging, pressing and stamping	3120	546.7	430.7	516.5	387.0
Other rubber products (excluding tyres & tubes)	4812	305.9	396.0	444.8	404.3
Pulp, paper & board	4710	304.9	338.0	251.0	136.2
Bacon curing & meat processing	4122	463.7	439.5	632.4	402.1
Other building products of concrete, cement etc	2437	803.2	495.0	436.3	504.7
Finished metal products nes	3169	1214.5	1115.4	1125.8	939.8
Stationery	4723	469.5	444.8	584.8	409.0
Pile carpets, carpeting & rugs	4384	193.9	128.7	222.1	127.4
Brewing & malting	4270	276.7	391.8	459.3	128.6
Copper, brass and other copper alloys	2246	150.0	83.3	173.0	119.0
Chemical industry machinery, furnaces etc	3245	238.8	216.4	274.9	183.5
Sawmilling, planing of wood	4610	752.7	488.7	906.6	393.4
Sugar & sugar by-products	4200	46.4	62.2	57.9	16.0
Tobacco	4290	74.7	55.3	82.2	18.6

* for each industry plant real gross output is ranked from highest to lowest (based on the 4 years data) and then mean ranks across the years are tested under the null that they is no significance difference in rankings. In All cases (except SIC4147), the null is rejected at better than the 5% significance level.

Table 3: Relative real gross output growth of large to small plants during various sub-periods by industry*

Industry	SIC80	1993-98	1988-93	1983-88	1978-83	1973-78
Electronic data processing equipment	3302	*-0.10*	0.36	0.94	*-0.82*	*-0.01*
Radio & electronic capital goods	3443	*-0.05*	0.61	0.27	0.33	0.06
Electronic consumer goods & other electronic equipment nes	3454	0.07	0.13	0.55	*-5.95*	*-0.96*
Mechanical, marine & precision engineering nes	3289	0.58	*-0.30*	0.05	*-0.09*	0.17
Other printing & publishing (excluding books & periodicals)	4754	0.56	*-0.43*	*-0.09*	*-0.01*	0.04
Active components & electronic sub-assemblies	3453	0.05	0.39	0.14	*-1.36*	0.02
Basic electrical equipment	3420	0.09	0.18	*-0.13*	*-0.48*	*-0.03*
Motor vehicles	3510	*-0.48*	0.43	*-0.49*	3.52	0.19
Printing & publishing of newspapers	4751	0.48	0.52	0.03	0.16	0.09
Cocoa, chocolate & sugar confectionary	4214	*-0.01*	0.21	0.14	*-0.80*	*-0.21*
Bread and flour confectionary	4196	0.25	0.44	*-0.09*	0.05	0.03
Fruit & vegetable processing	4147	*-0.22*	*-0.89*	*-0.08*	0.37	0.30
Forging, pressing and stamping	3120	*-0.16*	0.18	*-0.17*	*-0.10*	0.06
Other rubber products (excluding tyres & tubes)	4812	0.21	0.00	*-0.04*	*-0.71*	0.00
Pulp, paper & board	4710	0.23	0.40	0.08	*-0.18*	*-0.06*
Bacon curing & meat processing	4122	0.05	*-0.12*	0.11	*-0.43*	0.03
Other building products of concrete, cement etc	2437	*-0.18*	0.19	0.18	*-0.17*	0.01
Finished metal products nes	3169	0.64	0.08	*-0.34*	*-0.25*	*-0.10*
Stationery	4723	0.21	*-0.51*	0.02	0.05	0.15
Pile carpets, carpeting & rugs	4384	*-0.25*	0.09	-0.09	*-0.71*	0.08
Brewing & malting	4270	0.12	0.45	-0.02	*-0.31*	0.07
Copper, brass and other copper alloys	2246	*-0.02*	0.11	0.05	*-0.50*	*-0.16*
Chemical industry machinery, furnaces etc	3245	*-0.47*	*-0.31*	0.52	*-0.29*	0.37
Sawmilling, planing of wood	4610	0.77	*-0.23*	-0.30	*-0.20*	0.05
Sugar & sugar by-products	4200	*-0.30*	0.07	0.06	*-0.20*	0.27
Tobacco	4290	*-0.26*	*-0.50*	0.58	*-0.05*	*-0.05*

* Average growth of large plants (measured as the proportionate change during the period) *minus* the average growth of small plants. Negative values in italics dente small plants did better. Plants were classified as small if at any time between 1973 and 1998 the value of real gross output fell below the industry-specific median value

Table 4. Panel unit root tests: Gross Output: All Plants

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Electronic data processing equipment	3302	94	-18.23**	-11.20**	-9.61**	-17.14**	-9.00**	-3.42**	-2.30*	-15.46**
Radio & electronic capital goods	3443	349	-36.86**	-16.74**	-15.70**	-25.00**	-25.26**	-8.25**	-7.00**	-17.63**
Electronic consumer goods & other electronic nes	3454	57	-12.44**	-6.53**	-5.70**	-9.31**	-5.11**	-1.91*	-0.82	-5.49**
Mechanical, marine & precision engineering nes	3289	307	-23.15**	-16.27**	-14.58**	-22.69**	-15.72**	-5.13**	-4.25**	-14.95**
Other printing & publishing (excluding books & periodicals)	4754	734	-32.82**	-20.72**	-18.36**	-36.33**	-15.84**	-0.56	1.02	-12.44**
Active components & electronic sub-assemblies	3453	133	-18.10**	-8.69**	-8.18**	-15.23**	-13.72**	-4.78**	-3.64**	-8.85**
Basic electrical equipment	3420	502	-42.37**	-19.88**	-17.04**	-29.86**	-25.83**	-7.11**	-4.49**	-19.70**
Motor vehicles	3510	177	-25.96**	-11.04**	-10.18**	-16.76**	-20.48**	-7.80**	-7.11**	-15.54**
Printing & publishing of newspapers	4751	936	-66.51**	-27.96**	-24.61**	-40.14**	-50.06**	-18.41**	-15.94**	-34.49**
Cocoa, chocolate & sugar confectionary	4214	148	-37.21**	-16.45**	-14.11**	-22.88**	-23.12**	-9.81**	-8.70**	-16.41**
Bread and flour confectionary	4196	601	-47.05**	-25.26**	-22.85**	-34.26**	-34.22**	-12.61**	-10.02**	-21.99**
Fruit & vegetable processing	4147	101	-23.79**	-12.03**	-9.13**	-13.92**	-14.12**	-4.55**	-3.65**	-8.44**
Forging, pressing and stamping	3120	324	-25.75**	-15.94**	-14.43**	-25.08**	-17.17**	-4.49**	-3.15**	-14.21**
Other rubber products (excluding tyres & tubes)	4812	274	-32.57**	-13.88**	-12.86**	-19.89**	-18.96**	-4.54**	-3.37**	-12.04**
Pulp, paper & board	4710	185	-40.08**	-19.71**	-16.62**	-27.02**	-25.28**	-8.96**	-7.83**	-18.42**

Table 4 ctd.

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Bacon curing & meat processing	4122	360	-35.01**	-15.89**	-14.19**	-21.24**	-27.49**	-8.92**	-7.18**	-16.45**
Other building products of concrete, cement or plaster	2437	413	-42.91**	-20.87**	-19.84**	-31.36**	-36.24**	-14.02**	-12.42**	-25.55**
Finished metal products nes	3169	507	-29.38**	-19.24**	-17.45**	-32.63**	-23.36**	-7.64**	-5.68**	-18.54**
Stationery	4723	306	-33.63**	-18.28**	-17.26**	-26.88**	-22.78**	-9.06**	-8.31**	-19.12**
Pile carpets, carpeting & rugs	4384	114	-18.98**	-8.00**	-7.58**	-13.38**	-15.42**	-5.48**	-4.83**	-12.50**
Brewing & malting	4270	279	-39.43**	-18.52**	-16.00**	-23.92**	-24.58**	-8.43**	-6.57**	-15.34**
Copper, brass and other copper alloys	2246	81	-19.17**	-8.68**	-8.16**	-13.34**	-10.30**	-2.98**	-2.93**	-5.34**
Chemical industry machinery, furnaces etc	3245	89	-8.59**	-5.38**	-4.55**	-9.22**	-9.83**	-1.52	-1.62	-4.91**
Sawmilling, planing of wood	4610	356	-24.70**	-17.16**	-14.62**	-24.99**	-20.76**	-9.36**	-6.55**	-15.83**
Sugar & sugar by-products	4200	32	-15.48**	-5.31**	-4.94**	-8.46**	-17.41**	-6.13**	-5.72**	-9.24**
Tobacco	4290	53	-18.96**	-8.21**	-7.37**	-12.41**	-15.82**	-6.48**	-5.73**	-9.79**

* significant at 5%; ** significant at 1%

Table 5. Panel unit root tests: Gross Output: Small Plants

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Electronic data processing equipment	3302	33	-9.67**	-6.07**	-6.14**	-11.73**	-5.12**	-1.25	-0.61	-6.77**
Radio & electronic capital goods	3443	128	-20.44**	-9.77**	-8.47**	-12.97**	-13.99**	-5.02**	-4.09**	-11.68**
Electronic consumer goods & other electronic nes	3454	22	-4.42**	-3.22**	-2.75**	-4.92**	-1.70*	-0.17	0.43	-2.90**
Mechanical, marine & precision engineering nes	3289	101	-10.93**	-8.39**	-6.81**	-10.19**	-7.57**	-1.95*	-1.19	-7.33**
Other printing & publishing (excluding books & periodicals)	4754	238	-21.80**	-15.29**	-13.43**	-32.91**	-13.05**	-3.51**	-2.41**	-9.90**
Active components & electronic sub-assemblies	3453	55	-11.62**	-5.05**	-4.60**	-7.24**	-7.60**	-2.18*	-1.45	-4.40**
Basic electrical equipment	3420	226	-29.52**	-14.47**	-12.16**	-22.33**	-19.69**	-4.45**	-1.94*	-13.82**
Motor vehicles	3510	27	-1.84*	-2.91**	-3.23**	-5.53**	-3.35**	-0.24	-0.76	-3.35**
Printing & publishing of newspapers	4751	527	-48.06**	-20.29**	-17.96**	-29.42**	-35.64**	-13.80**	-11.63**	-24.76**
Cocoa, chocolate & sugar confectionary	4214	72	-15.75**	-7.69**	-6.88**	-12.89**	-11.04**	-4.15**	3.22**	-9.61**
Bread and flour confectionary	4196	152	-20.04**	-14.52**	-13.21**	-18.44**	-18.92**	-9.56**	-8.08**	-14.78**
Fruit & vegetable processing	4147	16	-3.47**	-2.46**	-2.34**	-2.86**	-2.21*	-0.04	-0.02	-1.68*
Forging, pressing and stamping	3120	120	-15.27**	-11.06**	-9.97**	-14.51**	-9.98**	-2.78**	-1.62	-6.55**
Other rubber products (excluding tyres & tubes)	4812	79	-16.08**	-7.91**	-7.18**	-10.32**	-11.60**	-2.84**	-1.56	-6.99**
Pulp, paper & board	4710	56	-15.29**	-8.74**	-6.59**	-12.70**	-13.24**	-3.93**	-3.61**	-8.39**

Table 5. ctd.

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Bacon curing & meat processing	4122	118	-20.04**	-10.23**	-9.41**	-13.65**	-17.95**	-6.31**	-5.33**	-11.14**
Other building products of concrete, cement or plaster	2437	183	-22.31**	-11.72**	-10.16**	-16.36**	-19.29**	-6.30**	-5.42**	-12.86**
Finished metal products nes	3169	198	-19.30**	-13.50**	-13.35**	-24.80**	-16.49**	-4.48**	-3.44**	-11.26**
Stationery	4723	97	-15.37**	-12.88**	-12.14**	-17.55**	-13.83**	-7.99**	-8.39**	-15.99**
Pile carpets, carpeting & rugs	4384	56	-12.36**	-6.20**	-5.08**	-9.59**	-10.26**	-4.26**	-3.31**	-8.86**
Brewing & malting	4270	85	-17.87**	-12.34**	-11.26**	-15.45**	-14.36**	-7.47**	-6.18**	-11.43**
Copper, brass and other copper alloys	2246	26	-9.55**	-4.85**	-4.61**	-8.51**	-10.50**	-3.85**	-4.00**	-1.62
Chemical industry machinery, furnaces etc	3245	21	-2.10*	-3.28**	-2.77**	-3.21**	-2.66**	0.66	0.34	0.11
Sawmilling, planing of wood	4610	143	-18.49**	-11.18**	-9.58**	-15.50**	-13.48**	-5.87**	-4.06**	-9.98**
Sugar & sugar by-products	4200	23	-12.07**	-4.35**	-3.92**	-6.83**	-15.10**	-5.26**	-5.19**	-8.61**
Tobacco	4290	19	-9.63**	-4.91**	-3.79**	-7.09**	-6.78**	-1.88*	-1.65*	-3.78**

* significant at 5%; ** significant at 1%

Table 6. Panel unit root tests: Gross Output: Large Plants

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Electronic data processing equipment	3302	61	-15.47**	-9.41**	-7.44**	-12.65**	-7.40**	-3.38**	-2.45**	-14.21**
Radio & electronic capital goods	3443	221	-30.69**	-13.62**	-13.26**	-21.55**	-21.18**	-6.54**	-5.70**	-13.27**
Electronic consumer goods & other electronic nes	3454	35	-12.33**	-5.76**	-5.06**	-7.98**	-5.25**	-2.30*	-1.40	-4.71**
Mechanical, marine & precision engineering nes	3289	206	-20.36**	-13.99**	-12.98**	-20.56**	-13.77**	-4.93**	-4.36**	-13.12**
Other printing & publishing (excluding books & periodicals)	4754	496	-25.10**	-14.80**	-13.25**	-21.40**	-10.96**	1.34	2.53	-8.28**
Active components & electronic sub-assemblies	3453	78	-13.88**	-7.12**	-6.83**	-13.81**	-11.67**	-4.48**	-3.59**	-7.85**
Basic electrical equipment	3420	276	-30.54**	-13.80**	-12.08**	-20.07**	-17.48**	-5.84**	-4.49**	-14.06**
Motor vehicles	3510	150	-26.86**	-10.71**	-9.67**	-15.86**	-20.46**	-8.37**	-7.40**	-15.47**
Printing & publishing of newspapers	4751	409	-45.94**	-19.28**	-16.81**	-27.33**	-35.30**	-12.20**	-10.93**	-24.07**
Cocoa, chocolate & sugar confectionary	4214	76	-35.57**	-15.30**	-12.90**	-19.38**	-22.08**	-9.91**	-9.19**	-13.54**
Bread and flour confectionary	4196	449	-42.32**	-20.99**	-18.98**	-28.91**	-28.91**	-9.53**	-7.37**	-16.84**
Fruit & vegetable processing	4147	85	-23.89**	-11.98**	-8.93**	-13.93**	-14.36**	-4.98**	-4.02**	-8.48**
Forging, pressing and stamping	3120	204	-20.67**	-11.81**	-10.78**	-20.48**	-13.88**	-3.64**	-2.83**	-12.88**
Other rubber products (excluding tyres & tubes)	4812	195	-28.17**	-11.51**	-10.79**	-17.02**	-15.39**	-3.76**	-3.11**	-9.82**
Pulp, paper & board	4710	129	-37.01**	-17.75**	-15.20**	-23.98**	-21.42**	-8.24**	-7.02**	-16.53**

Table 6. ctd.

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Bacon curing & meat processing	4122	242	-28.70**	-12.26**	-10.74**	-16.38**	-21.25**	-6.58**	-5.15**	-12.29**
Other building products of concrete, cement or plaster	2437	230	-36.68**	-17.48**	-17.54**	-27.42**	-30.78**	-13.20**	-11.88**	-22.77**
Finished metal products nes	3169	309	-22.35**	-14.07**	-12.15**	-21.94**	-17.24**	-6.57**	-4.89**	-14.74**
Stationery	4723	209	-29.76**	-13.57**	-12.76**	-20.56**	-18.34**	-5.93**	-4.78**	-12.24**
Pile carpets, carpeting & rugs	4384	58	-14.30**	-5.22**	-5.69**	-9.32**	-11.42**	-3.59**	-3.57**	-8.74**
Brewing & malting	4270	194	-35.20**	-14.12**	-11.89**	-18.46**	-20.08**	-5.43**	-4.13**	-10.83**
Copper, brass and other copper alloys	2246	55	-16.63**	-7.22**	-6.76**	-10.34**	-6.71**	-1.50	-1.47	-5.37**
Chemical industry machinery, furnaces etc	3245	68	-8.33**	-4.44**	-3.84**	-8.76**	-9.29**	-2.21*	-2.06*	-5.68**
Sawmilling, planing of wood	4610	213	-17.04**	-13.06**	-11.08**	-19.60**	-15.79**	-7.31**	-5.15**	-12.28**
Sugar & sugar by-products	4200	9	-10.76**	-3.25**	-3.27**	-5.04**	-8.58**	-3.14**	-2.41**	-3.66**
Tobacco	4290	34	-16.39**	-6.58**	-6.39**	-10.19**	-14.69**	-6.91**	-6.07**	-9.40**

* significant at 5%; ** significant at 1%

Table 7. Panel unit root tests: 1973 – 1986: Gross Output

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Electronic data processing equipment	3302	54	-6.45**	-5.50**	-5.71**	-8.90**	-6.72**	-1.39	-0.84	-4.57**
Radio & electronic capital goods	3443	264	-18.50**	-14.62**	-13.86**	-19.39**	-14.33**	-5.84**	-4.70**	-13.43**
Electronic consumer goods & other electronic nes	3454	40	-6.53**	-5.28**	-4.94**	-7.24**	-3.69**	-0.44	0.02	-3.22**
Mechanical, marine & precision engineering nes	3289	219	-12.31**	-14.16**	-12.98**	-20.32**	-10.29**	-4.24**	-3.45**	-11.18**
Other printing & publishing (excluding books & periodicals)	4754	514	-21.77**	-20.68**	-17.55**	-34.68**	-16.89**	-4.53**	-3.50**	-12.83**
Active components & electronic sub-assemblies	3453	92	-8.63**	-6.23**	-6.50**	-8.89**	-8.35**	-2.54**	-2.20*	-6.02**
Basic electrical equipment	3420	386	-19.59**	-16.86**	-15.55**	-24.10**	-11.02**	-2.72**	-0.57	-11.55**
Motor vehicles	3510	145	-10.41**	-8.02**	-7.25**	-11.26**	-8.95**	-3.00**	-2.41**	-7.27**
Printing & publishing of newspapers	4751	714	-32.24**	-22.46**	-20.61**	-28.71**	-30.01**	-13.72**	-11.34**	-21.30**
Cocoa, chocolate & sugar confectionary	4214	131	-24.03**	-16.09**	-14.54**	-21.38**	-20.46**	-11.04**	-9.87**	-15.84**
Bread and flour confectionary	4196	451	-29.28**	-25.85**	-23.17**	-30.73**	-22.76**	-11.87**	-10.20**	-18.81**
Fruit & vegetable processing	4147	73	-11.56**	-8.13**	-7.91**	-10.46**	-8.78**	-3.26**	-3.01**	-5.99**
Forging, pressing and stamping	3120	242	-13.41**	-14.05**	-14.23**	-22.39**	-11.06**	-3.50**	-3.36**	-10.94**
Other rubber products (excluding tyres & tubes)	4812	214	-17.00**	-12.52**	-11.75**	-18.15**	-13.46**	-4.08**	-3.40**	-10.08**
Pulp, paper & board	4710	142	-31.92**	-26.23**	-20.12**	-28.93**	-20.85**	-11.38**	-9.90**	-19.18**

Table 7. ctd.

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Bacon curing & meat processing	4122	267	-20.42**	-16.10**	-14.45**	-19.55**	-17.12**	-9.81**	-8.25**	-14.43**
Other building products of concrete, cement or plaster	2437	269	-20.53**	-18.01**	-17.23**	-25.42**	-24.27**	-14.02**	-12.60**	-21.27**
Finished metal products nes	3169	395	-17.55**	-18.17**	-17.42**	-31.21**	-15.44**	-7.14**	-5.78**	-16.98**
Stationery	4723	257	-20.71**	-18.29**	-18.52**	-26.63**	-18.78**	-11.24**	-10.44**	-17.54**
Pile carpets, carpeting & rugs	4384	93	-10.75**	-9.86**	-8.92**	-21.25**	-10.99**	-4.95**	-5.11**	-10.44**
Brewing & malting	4270	243	-19.86**	-18.13**	-16.32**	-21.55**	-17.72**	-7.96**	-6.21**	-13.22**
Copper, brass and other copper alloys	2246	71	-7.82**	-6.72**	-6.25**	-9.54**	-5.76**	-2.30*	-1.82*	-3.60**
Chemical industry machinery, furnaces etc	3245	71	-8.34**	-7.12**	-6.83**	-12.73**	-3.21**	1.06	1.08	-2.44**
Sawmilling, planing of wood	4610	314	-21.40**	-20.21**	-17.25**	-27.52**	-17.74**	-11.11**	-8.42**	-16.17**
Sugar & sugar by-products	4200	29	-6.77**	-3.92**	-4.20**	-6.05**	-9.40**	-4.11**	-4.05**	-6.61**
Tobacco	4290	47	-8.68**	-6.42**	-6.65**	-11.64**	-10.32**	-6.32**	-5.88**	-9.09**

* significant at 5%; ** significant at 1%

Table 8. Panel unit root tests: 1987 – 1998: Gross Output

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Electronic data processing equipment	3302	39	-11.06**	-13.08**	-10.36**	-20.56**	-12.55**	-9.59**	-7.87**	-18.80**
Radio & electronic capital goods	3443	91	-11.47**	-12.47**	-10.42**	-15.19**	-14.16**	-6.30**	-5.22**	-9.67**
Electronic consumer goods & other electronic nes	3454	15	-7.41**	-6.32**	-5.80**	-9.05**	-8.64**	-6.30**	-4.71**	-7.09**
Mechanical, marine & precision engineering nes	3289	37	-5.30**	-6.04**	-4.51**	-6.77**	-7.28**	-2.82**	-2.97**	-5.76**
Other printing & publishing (excluding books & periodicals)	4754	139	-10.94**	-12.26**	-11.84**	-21.55**	-15.77**	-7.37**	-6.88**	-15.17**
Active components & electronic sub-assemblies	3453	40	-3.70**	-3.99**	-3.87**	-8.04**	-6.04**	-2.51**	-1.95*	-3.69**
Basic electrical equipment	3420	165	-17.05**	-18.19**	-15.95**	-23.99**	-20.58**	-11.96**	-10.84**	-16.95**
Motor vehicles	3510	56	-12.96**	-14.31**	-11.08**	-17.71**	-14.79**	-9.55**	-7.90**	-12.15**
Printing & publishing of newspapers	4751	409	-20.24**	-20.47**	-18.01**	-26.54**	-19.83**	-6.19**	-5.80**	-17.09**
Cocoa, chocolate & sugar confectionary	4214	48	-8.15**	-9.78**	-8.98**	-12.60**	-9.37**	-5.94**	-5.60**	-8.24**
Bread and flour confectionary	4196	189	-13.94**	-16.82**	-16.10**	-27.13**	-15.06**	-7.15**	-6.66**	-12.52**
Fruit & vegetable processing	4147	29	-7.55**	-7.42**	-4.96**	-7.56**	-7.28**	-2.78**	-2.40**	-6.11**
Forging, pressing and stamping	3120	57	-6.89**	-8.70**	-8.76**	-14.75**	-12.53**	-7.09**	-6.02**	-11.05**
Other rubber products (excluding tyres & tubes)	4812	76	-9.13**	-9.40**	-8.09**	-16.21 **	-10.10**	-4.39**	-4.28**	-8.28**
Pulp, paper & board	4710	95	-5.81**	-8.37**	-6.83**	-10.32**	-9.82**	-3.83**	-3.96**	-6.77**

Table 8. ctd

Industry	SIC (1980)	No. of plants	With time trend				Without time trend			
			LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Bacon curing & meat processing	4122	125	-5.41**	-9.65**	-8.89**	-14.57**	-11.80**	-4.75**	-4.51**	-8.03**
Other building products of concrete, cement or plaster	2437	171	-10.92**	-12.62**	-11.40**	-19.33**	-15.31**	-7.90**	-7.04**	-15.09**
Finished metal products nes	3169	84	-7.32**	-9.34**	-8.54**	-11.27**	-12.32**	-5.85**	-5.83**	-9.72**
Stationery	4723	58	-5.68**	-8.21**	-6.68**	-11.54**	-9.86**	-4.48**	-4.37**	-8.33**
Pile carpets, carpeting & rugs	4384	43	-10.52**	-9.47**	-8.42**	-13.58**	-4.15**	-0.48	0.11	-2.72**
Brewing & malting	4270	88	-10.36**	-9.53**	-9.16**	-13.82**	-9.94**	-2.48**	-2.03*	-6.19**
Copper, brass and other copper alloys	2246	19	-6.19**	-4.61**	-4.62**	-6.23**	-8.07**	-4.18**	-4.80**	-5.81**
Chemical industry machinery, furnaces etc	3245	20	-0.88	-2.07*	-3.08**	-3.85**	-5.10**	-1.52	-1.99*	-4.28**
Sawmilling, planing of wood	4610	40	-7.72**	-6.36**	-5.02**	-6.18**	-3.76**	1.01	1.17	-0.14
Sugar & sugar by-products	4200	20	-4.02**	-3.86**	-3.92**	-4.92**	-2.97**	-1.03	-0.54	-1.79*
Tobacco	4290	18	-3.36**	-4.08**	-4.00**	-5.95**	-4.17**	0.90	0.56	1.15

* significant at 5%; ** significant at 1%

Table 9. Panel unit root tests: Results for a selection of balanced plants

	No. of plants	With time trend				Without time trend			
		LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Printing & publishing of newspapers									
Employment	58	-25.44**	-7.65**	-7.16**	-10.44**	-11.53**	-5.04**	-4.10**	-7.22**
Gross Output	58	-23.99**	-7.27**	-6.76**	-9.62**	-19.15**	-7.70**	-7.15**	-11.09**
Gross Value Added	58	-27.70**	-8.33**	-7.96**	-11.81**	-19.42**	-8.88**	-8.22**	-12.33**
Employment (Small Plants)	23	-18.28**	-5.76**	-5.31**	-7.69**	-8.30**	-3.90**	-2.27*	-3.69**
Gross Output (Small Plants)	23	-17.02**	-5.20**	-4.84**	-7.30**	-11.27**	-5.24**	-4.64**	-7.37**
Gross Value Added (Small Plants)	23	-19.46**	-5.90**	-5.76**	-8.71**	-10.34**	-4.94**	-4.08**	-6.71**
Employment (Large Plants)	35	-17.90**	-5.16**	-4.92**	-7.21**	-8.11**	-3.32**	-3.43**	-6.30**
Gross Output (Large Plants)	35	-17.00**	-5.11**	-4.78**	-6.47**	-15.73**	-5.68**	-5.54**	-8.30**
Gross Value Added (Large Plants)	35	-19.85**	-5.92**	-5.61**	-8.15**	-17.16**	-7.58**	-7.45**	-10.44**
Employment (1973-1986)	215	-30.63**	-17.66**	-16.26**	-21.11**	-18.36**	-8.65**	-7.34**	-12.52**
Gross Output (1973-1986)	215	-29.08**	-15.52**	-14.73**	-20.26**	-21.08**	-10.41**	-8.95**	-14.70**
Gross Value Added (1973-1986)	215	-28.79**	-15.23**	-14.77**	-20.24**	-19.26**	-8.98**	-7.57**	-12.85**
Employment (1987-1998)	114	-13.46**	-10.03**	-9.96**	-14.02**	-10.52**	-4.42**	-3.93**	-7.39**
Gross Output (1987-1998)	110	-16.30**	-12.18**	-11.26**	-16.17**	-10.72**	-3.54**	-3.21**	-6.37**
Gross Value Added (1987-1998)	110	-13.22**	-10.37**	-10.12**	-13.66**	-15.42**	-7.41**	-7.14**	-10.83**

Table 9. ctd.

	No. of plants	With time trend				Without time trend			
		LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Basic Electrical Equipment									
Employment	18	-6.48**	-2.61**	-1.56	-3.02**	-4.44**	-2.39**	-1.67*	-3.30**
Gross Output	12	-13.43**	-4.20**	-4.00**	-8.29**	-7.66**	-4.07**	-3.26**	-8.74**
Gross Value Added	12	-11.95**	-3.71**	-3.38**	-7.84**	-7.79**	-3.99**	-2.33**	-4.80**
Employment (Small Plants)	4	-9.90**	-3.82**	-3.39**	-5.76**	-7.34**	-3.05**	-2.47**	-3.10**
Gross Output (Small Plants)	6	-10.49**	-3.54**	-3.46**	-8.29**	-6.14**	-3.87**	-3.23**	-9.99**
Gross Value Added (Small Plants)	6	-8.55**	-3.05**	-2.86**	-8.19**	-5.61**	-3.63**	-1.24	-3.70**
Employment (Large Plants)	14	-3.34**	-1.32	-0.67	-0.34	-2.78**	-1.57	-1.05	-2.09*
Gross Output (Large Plants)	6	-8.47**	-2.41**	-2.26*	-3.44**	-4.65**	-1.96*	-1.62	-2.38**
Gross Value Added (Large Plants)	6	-8.34**	-2.20*	-2.01*	-2.90**	-5.38**	-2.10*	-2.03*	-3.10**
Employment (1973-1986)	95	-13.32**	-7.98**	-8.60**	-12.33**	-2.24*	0.56	0.76	-3.03**
Gross Output (1973-1986)	95	-5.62**	-5.05**	-4.93**	-6.56**	-5.25**	-2.06*	-1.32	-4.06**
Gross Value Added (1973-1986)	95	-15.97**	-9.02**	-8.97**	-14.12**	-6.81**	-1.51	0.02	-3.30**
Employment (1987-1998)	32	-9.76**	-7.82**	-6.33**	-9.73**	-6.71**	-3.02**	-2.45**	-4.30**
Gross Output (1987-1998)	22	-10.62**	-8.99**	-7.73**	-12.11**	-11.25**	-7.27**	-6.48**	-9.14**
Gross Value Added (1987-1998)	22	-7.56**	-5.39**	-5.00**	-7.08**	-6.64**	-2.56**	-2.36**	-3.82**

Table 9. ctd.

	No. of plants	With time trend				Without time trend			
		LL rho	LL t-rho	LL-ADF	IPS ADF	LL rho	LL t-rho	LL-ADF	IPS ADF
Radio and electronic capital goods									
Employment (1973-1986)	36	-8.37**	-4.70**	-4.57**	-5.99**	-4.71**	-1.81*	-1.39	-3.43**
Gross Output (1973-1986)	36	-10.25**	-5.59**	-5.72**	-8.01**	-8.90**	-4.29**	-3.79**	-6.01**
Gross Value Added (1973-1986)	36	-13.00**	-7.52**	-7.16**	-10.73**	-9.18**	-4.75**	-4.06**	-7.48**
Employment (1987-1998)	19	-5.28**	-4.04**	-4.68**	-6.60**	-2.81**	-1.06	-0.26	-1.59
Gross Output (1987-1998)	15	-7.54**	-6.15**	-5.20**	-7.23**	-9.58**	-7.01**	-5.64**	-7.16**
Gross Value Added (1987-1998)	15	-7.13**	-5.15**	-4.69**	-6.56**	-9.25**	-4.54**	-4.05**	-6.17**
Electronic data processing equipment									
Employment (1973-1986)	7	-3.79**	-1.86*	-1.78*	-2.00*	-0.18	0.98	0.96	0.70
Gross Output (1973-1986)	7	-2.83**	-1.35	-1.37	-1.27	-2.62**	-0.44	-0.31	-0.51
Gross Value Added (1973-1986)	7	-2.36**	-1.66*	-1.68*	-2.02*	-2.37**	-0.34	-0.22	-0.68
Employment (1987-1998)	4	-4.95**	-5.17**	-3.46**	-5.21**	-5.90**	-4.49**	-3.22**	-4.59**
Gross Output (1987-1998)	4	-5.32**	-6.04**	-3.59**	-5.34**	-5.67**	-4.08**	-3.22**	-4.35**
Gross Value Added (1987-1998)	4	-4.52**	-3.29**	-3.00**	-4.66**	-3.99**	-3.58**	-3.28**	-5.32**

* significant at 5%; ** significant at 1%

Table 10: Median value of individual plant coefficients (ρ_i), based on IPS test ($z_{it} = \alpha_I$ in equation 3)

Industry	SIC (1980)	Number of plants	Median Value
Electronic data processing equipment	3302	94	-0.5675
Radio & electronic capital goods	3443	349	-0.5768
Electronic consumer goods & other electronic equipment nes	3454	57	-0.4604
Mechanical, marine & precision engineering nes	3289	307	-0.5891
Other printing & publishing (excluding books & periodicals)	4754	734	-0.4707
Active components & electronic sub-assemblies	3453	133	-0.4876
Basic electrical equipment	3420	502	-0.5152
Motor vehicles	3510	177	-0.4993
Printing & publishing of newspapers	4751	936	-0.5331
Cocoa, chocolate & sugar confectionary	4214	148	-0.6715
Bread and flour confectionary	4196	601	-0.5659
Fruit & vegetable processing	4147	101	-0.5968
Forging, pressing and stamping	3120	324	-0.5662
Other rubber products (excluding tyres & tubes)	4812	274	-0.5120
Pulp, paper & board	4710	185	-0.6079
Bacon curing & meat processing	4122	360	-0.6028
Other building products of concrete, cement or plaster	2437	413	-0.6463
Finished metal products nes	3169	507	-0.5710
Stationery	4723	306	-0.6302
Pile carpets, carpeting & rugs	4384	114	-0.5704
Brewing & malting	4270	279	-0.5423
Copper, brass and other copper alloys	2246	81	-0.5850
Chemical industry machinery, furnaces etc	3245	89	-0.5088
Sawmilling, planing of wood	4610	356	-0.5452
Sugar & sugar by-products	4200	32	-0.5903
Tobacco	4290	53	-0.5749