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UNIT ROOTS AND THE DYNAMICS OF MARKET SHARES: AN ANALYSIS USING ITALIAN BANKING MICRO-PANEL

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Unit Roots and the Dynamics of Market Shares: an analysis using Italian Banking micro-panel

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Abstract

The paper proposes the use of panel data unit root tests to assess market share instability in order to have (preliminary) indications of the industry dynamic. The idea is to consider the movements in market shares not only as element of the market structure but rather reflecting conduct that arise from that market. If shares are mean-reverting, the firm actions only have a temporary effect on shares. On the other hand, if they are evolving, as signaled by the presence of unit roots, the gain in shares respect with the competitors could be long-term. To illustrate the potential of unit roots tests, I consider an application to the Italian retail banking industry.

Keywords: turbulence, cross-section dependence.

JEL Classification: C23; D40.

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1 Introduction

In order to get an understanding of the dynamic of an industry, a first step could be to examine whether the market shares are stationary or evolving. If shares are mean-reverting, the firm actions only have a temporary effect on shares. On the contrary, if they are evolving, as signaled by the presence of unit roots, the gain (or loss) in shares respect with the competitors could be long-term. In the first case, it is reasonable to infer that the industry is rather stable - or mature - where actors reached positions difficult to overcome. In the second case, instead, the possibility for a competitor to become permanently a leader (or to loose the leadership) could be a signal that the industry experienced the displacement of existing technology by alternative ones and/or the displacement of existing products by new and superior substitutes. In other words, by considering the movements in market shares not only as elements of the market structure but rather reflecting competitors' conduct that arise from the market (Matraves and Rondi (2007); Asplund and Nocke (2006); Uchida and Cook (2005); Sutton (2004); Caves (1998)), unit root tests could be a way to empirically test the influence of industry characteristics on the degree of turbulence (Sutton (1997); Davies and Geroski (1997)).

An important characteristic of market share data sets is the logical consistency requirement in market share models. In fact, market shares are bounded between 0 and 1 and they sum to unity. This relationship must be take into account if one want to study all the actors in the market[1]. Another possibility is to consider only few actors in the market.

According to this latter procedure, this paper proposes the use of micro-panel data unit root models to assess market share instability in the Italian Banking Industry for a sample of firms made of the first 5 banks in each province. On the one hand, the assessment of the competitive conditions of the Italian banking industry is of interest since the industry has known a marked consolidation

[1]An interesting approach is presented in the work of Franses et al. (2001). They exploit the consistency requirement to apply the Johansen test, relying on a system-based test rather than a single equation test. In addition, the fact that the data are bounded from below and above renders a deterministic model implausible.

process along with a remarkable deregulation process since the beginning of the nineties. To the best of my knowledge, this paper is the first to apply this methodology to test banking competition. On the other hand, given the well-known low power of conventional unit root tests when applied to single short time series, panel unit root tests can be fruitfully employed in analysis of firms or industries that rely on micro-panels, where the time dimension may be of limited length but observed across several units. One of the main advantages of panel unit root tests is that their asymptotic distribution is standard normal. This is in contrast to individual time series unit roots which are non-standard normal asymptotic distributions. However, these tests are not exempt from critics. In particular, few tests consider the possibility of cross-section correlation and spillovers amongst countries, regions or provinces (Baltagi et al. (2007)). In this regard, Pesaran (2004) suggests a test for cross-sectional dependence and way of getting rid of it by augmenting the usual ADF regression with lagged cross-sectional mean and its first-difference to capture the cross-sectional dependence that arises through a single factor model. Other important aspects concerning panel unit roots are related to their asymptotic behavior under the two dimension of the panel, N and T and their requirement for a balanced panel (no missing data for any i not t).

Clearly, the use of panel unit root tests can only offer (preliminary) indications of the dynamic in the industry. As any other statistical test, there is a risk of incorrect inference but it could be minimized by properly selecting the test in relation to main features of the dataset used. In any case, results must be supported by other qualitative - and if it is feasible - quantitative evidence. However, the existence of dynamic in the positions of the first 5 banks - as signalled by the presence of unit roots in the market shares - suggests that the Italian retail banking industry experienced overtime a movement towards higher level of competition. In particular, in the same spirit of Kim et al. (2003), a dynamic in market shares could be interpreted as an indirect signal for a reduction of switching costs that make easier to consumers to move to different banks and, consequently, for banks to acquire new customers.

The structure of the paper is as follows. The next section briefly introduce the data and the main features of the industry under investigation. Section 3 presents the model for micro-panels, whereas in section 4 panel unit roots tests are computed for the first 5 banks in every Italian province. Section 5 provides the Pesaran's test of cross-section dependence. The following section, taking into account these results, computes the unit root test proposed by Pesaran which deals with the cross-section dependence. The conclusions are presented in the final section.

2 Characteristic and construction of the dataset

A peculiarity of the Italian banking industry is the presence of different territorial dynamics (Guiso et al. (2006, 2004); Colombo and Turati (2004)). In particular, the retail Italian Banking Industry can be viewed as made of a large number of local markets corresponding to different geographical locations. In each one of these submarkets, there are several branches of different banks competing against each other. The Italian territory is divided into 20 regions and 103 provinces, which are geographical units close to US counties. In accordance with the Italian Antitrust Authority, the presumption is that the province is the relevant market.

Given the widespread differences in local economic conditions and their influence on the competition process, I will focus on local markets by measuring market shares at the provincial level using data on branches as proxies for the market share of individual (or group of) banks. The choice to compute market shares relying on this variable are various. First of all, the number of branches (or branch density) is commonly used in the empirical literature on local banking competition (see, for instance, Degryse and Ongena (2005)). Secondly, it captures the dimension of banking competition that has been more heavily affected by the deregulation process. Since March 1990, the establishment of new branches has been completely liberalized. The number of branches increased steadily, up to 32.337 in 2007, as well as the number of people served by each branch, 47 per 100.000 inhabitants in 2004 (compared to 59 EU mean)[2]. In ad-

[2]Beginning in the 1980s, the Italian Banking system underwent a series of reforms aimed at increasing the competition in the market through liberalizing branching and easing the geographical restrictions on lending. In fact, the opening of new branches had been regulated

dition, this measure is made freely available, without any break, for long period of time by the Italian Central Bank (Banca d'Italia) [3].

Hence, the (unbalanced) dataset is composed of 103 Italian provinces. For each province I computed the market shares for the first 5 individual banks (or group of banks) from the year 1993 to 2006. The majority of Italian banks do not belong to any groups.

Table 1: Market Share Summary statistics

Year	**Mean**	**Std. Dev.**	**Min.**	**Max.**
1993	0.136	0.11	0.017	0.707
1994	0.136	0.11	0.016	0.683
1995	0.138	0.107	0.016	0.672
1996	0.137	0.105	0.016	0.646
1997	0.138	0.106	0.023	0.643
1998	0.140	0.112	0.023	0.849
1999	0.145	0.111	0.025	0.843
2000	0.143	0.108	0.024	0.836
2001	0.139	0.102	0.024	0.829
2002	0.139	0.1	0.024	0.807
2003	0.137	0.099	0.024	0.808
2004	0.135	0.098	0.024	0.808
2005	0.133	0.095	0.024	0.807
2006	0.131	0.093	0.025	0.802
N		515		

In this work, the unit of observation is the bank (or group of banks) in each province and year. This means that I treat the share of the same banks (or group of banks) in a different province as pertaining to a different bank. In order to consider the dynamics at (higher) regional level, tests will also be performed by grouping the different provinces according to different macro-region: North, Centre and South. As Guiso et al. (2006, 2004) showed, while there is a considerable variation in the degree of banking competition across local markets, the North-Centre/South divide is a clear feature of the Italian banking Industry.

Table (1) and (2) report the summary statistics of the market share of the

by the branch distribution plan, issued every four years. The last distribution plan was issued in 1986.

[3] `http://siotec.bancaditalia.it/sportelli/main.do?function=language\&language=ita`.

first five banks in the sample. A closer look at these tables seem to reveal a stable pattern over time and the North-Centre/South divide. However, they may indicate little since there might be an intensive switching among banks' positions and a greater variability at local level. The challenge of the proposed methodology is to find out the underlying dynamic of banks at provincial level.

Table 2: Market Share Summary statistics

	Mean	**Std. Dev.**	**Min.**	**Max.**	**N**
NATIONAL	0.138	0.104	0.016	0.849	7210
NORTH	0.135	0.092	0.016	0.525	2590
CENTRE	0.14	0.102	0.026	0.548	2100
SOUTH	0.138	0.117	0.024	0.849	2520

North: Friuli-Venezia Giulia, Liguria, Lombardia, Piemonte, Trentino Alto-Adige,Veneto
Centre:Emilia Romagna, Lazio, Marche, Toscana, Umbria
South: Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardegna, Sicilia

3 Tests for unit roots: the model

In this paper I consider micro-panel data models where the cross-section dimension is much larger than the time series dimension. Reviews of the literature on dynamic micro-panels are provided in Baltagi (2005) and Arellano (2003). For a general survey of the literature about unit root tests see Breitung and Pesaran (2006).

Let s_{it} be the market share of bank i in period t in each province. The model could be represented by a dynamic AR(1) panel data model allowing for heterogeneity in the intercept but not in the autoregressive parameter

$$
\begin{aligned}
s_{i0} &= \delta_0 + \delta_1 \eta_i + v_{i0} \\
s_{it} &= \alpha_i s_{i,t-1} + u_{it} \\
u_{it} &= (1-\alpha_i)\eta_i + v_{it}
\end{aligned}
\tag{1}
$$

where $\alpha_1 = \cdots = \alpha_N = \alpha$ for each $i = 1 \ldots N$, $t = 2 \ldots T$, and where N is large and T is fixed. The series have a unit root (or are integrated of order one) if $\alpha_i = 1$ and are stationary if $\alpha_i < 1$. A test for the presence of a unit root in the panel is presented by the null hypothesis $H_0 : \alpha = 1$ in equation (1).

In case of independence across firms, the error term satisfies

$$E(\eta_i) = 0, \quad E(v_{it}) = 0 \tag{2}$$

for $i = 1, \ldots, N$ and $t = 2, \ldots, T$ and

$$E(v_{it} v_{is}) = 0 \tag{3}$$

for $i = 1, \ldots, N$ and $t \neq s$.

In the literature two types of panel unit root tests can be distinguished, dependent on the alternative under consideration. The first type of test considers a homogeneous alternative, i.e $H_0 = \alpha_1 = \cdots = \alpha_N = \alpha < 1$. An example is Levin et al. (2002). The idea of this approach is to perform a pooled Dickey-Fuller (DF) test with the residuals. The second type of test allow for heterogeneity of all parameters. Im et al. (2003) criticize the assumption of common root under the alternative and they require $|\alpha_i| < 1$ for a sufficiently large number of units. Consequently in this case, it is natural to perform N tests individually and to average over individual DF statistics.

In that model there are two sources of persistency. One is the autoregressive mechanism, which is the same for all cross-section units, and the other is the unobserved individual-specific term. The unit root hypothesis can be considered as an extreme case where all the presistency is caused by the autoregressive mechanism. In this context, the time dimension of the panel dataset is an important issue to look at, as well as the specification of the initial value.

In this paper, distinct regression-based test procedures will be proposed: one based on a simple OLS regression of market shares on their lagged values; the second test, proposed by Breitung and Meyer (1994), specifies the regression in terms of deviations from initial conditions and it is therefore more powerful if the variance of individual effects is high; the third test, proposed by Harris and Tzavalis (1999), also based on LS estimator of the autoregressive coefficient, corrects for the inconsistency arising from the inclusion of fixed effects. These simple t-tests based on least-squared estimators, which are consistent only under the unit root null, are shown to have good size properties and at least as high power as test based on GMM and ML estimators (Bond et al. (2005)). It is known that instrumental variable and GMM procedures provide consistent estimate of dynamic coefficients in cases where pooled least squares are inconsistent (Arellano (2003), Phillips and Sul (2007)). However, these procedures are also known to suffer bias and weak instrumentation problem when the dynamic coefficient α_i is close to unity.

However, these tests are not exempt from critics. In particular, they assume cross-section independence. Hence, the Pesaran's test for cross-section independence will be computed. The test can in fact be applied to a wide range of panel data model, including panel with short time dimension. As that test evidenced the presence of cross-section dependence, the panel unit root test allowing for cross-section dependence proposed by Pesaran will be also computed.

3.1 OLS

As Madsen (2003); Hall and Mairesse (2002); Bond et al. (2005) have shown, the t-test based on the OLS levels estimator performs much better than other estimators (GMM, FD, WG,..) in micro panels, that is when T is very small in comparison with N. Both simulation and asymptotic analysis have demonstrated that the OLS estimator has the highest power to reject alternative that are close to the null hypothesis that $\alpha = 1$.

Because the number of periods is small, properties of the initial condition are also relevant. Madsen (2003) shows that the asymptotic power of the OLS test under the alternative differs depending on the assumption made about the initial value. In particular, the advantage of using OLS is expected to be high when the initial value are such that the time-series process become covariance stationary, even for value of α close to unity[4]. In the other cases, when the initial values are such that the time-series become mean stationary and when the variation in the individual-specific terms is high, the highest power can be obtained using a t-test for the least squares estimator in the transformed model proposed by Breitung and Meyer (1994). As emerged from the previous works, these two tests must be considered jointly.

[4]Mean stationarity (constant first moment) requires $\alpha_i < 1$ and $\delta_0 = 0$ and $\delta_1 = 1$. The covariance stationarity (constant first and second moments) in addition requires homeschedatisticity over time of the v_{it} shocks (i.e. $var(v_{it}) = \sigma^2_{vi}$ for $(i = 1, \ldots, N)$ and that $var($

Under the null $H_0 : \alpha = 1$, the OLS estimator of α in model 1 is consistent. The t-test based on OLS estimator is

$$t_{OLS} = \frac{\hat{\alpha}_{OLS} - 1}{\sqrt{\hat{Var}(\hat{\alpha}_{OLS})}} \tag{4}$$

where

$$\hat{Var}(\hat{\alpha}_{OLS}) = (s'_{-1}s_{-1})^{-1} \left(\sum_{i}^{N} s'_{i,-1} e_i e'_i s_{i,-1} \right) (s'_{-1}s_{-1})^{-1} \tag{5}$$

with $e_i = s_i - s_{i,1}\hat{\alpha}_{OLS}$, $s_i = (s_{i,2}, \ldots, s_{i,T})'$, $s_{i,-1} = (s_{i,1}, \ldots, s_{i,T-1})'$, and $s_{-1} = (s'_{1,-1}, \ldots, s'_{N,-1})'$. Under the null, $\alpha = 1$, t_{OLS} has an asymptotic standard normal distribution as $N \to \infty$.

Under the alternative, the OLS estimator is biased upwards, more so when the variance of η_{it} is large relative to the variance of v_{it}. The power of this test will therefore depend on the magnitude of $Var(\eta_i)/Var(v_{it})$ (Bond et al. (2005)).

Breitung and Meyer (1994) suggest an alternative estimation approach which involves deducting the first observation s_{i0} for each firm from the right hand side of equation (1). The estimable model becomes

$$s_{it} - s_{i0} = \alpha(s_{i,t-1} - s_{i,0}) + \epsilon_{it} \tag{6}$$

$$\tilde{s}_t = \tilde{s}_{t-1} + \epsilon_{it} \quad t = 3, \ldots, T \tag{7}$$

where $\epsilon = v_{it} - (1-\alpha)(s_{i0} - \eta_i)$. Again, the OLS estimator is consistent when $\alpha = 1$ and upward biased under the alternative. Breitung and Meyer however showed that the bias is $\alpha + \frac{1-\alpha}{2}$. That means that the power of the test, contrary to the previous case, is not affected by the individual-specific term, that is by the term $\frac{Var(\eta_i)}{Var(v_{it})}$.

For long T panels, none of these could be applied, since the asymptotic distribution tends to a DF: so we should combine N DF/ADF tests as in Im et al. (2003).

3.2 OLS with fixed effects

Harris and Tzavalis (1999) propose a test of the unit root hypothesis based on a bias correction of the within group estimator under the null. Under the assumption that v_{it} is a series of independently and identically normally distributed random variables having $E(v_{it}) = 0$ and $Var(v_{it} = \sigma_v^2) < \infty$, Harris and Tzavalis (1999) shows

$$\sqrt{n}(\hat{\rho}_{WG} - 1 - B) \rightarrow N(0, C) \tag{8}$$

where $\hat{\rho}_{WG}$ is the within group estimator and B and C are given

$$B = -15\left\{2(T+2)\right\}^{-1} \tag{9}$$

and

$$C = \left\{15(193T^2 - 728T + 1147)\right\}\left\{112(T+2)^3(T-2)\right\}^{-1} \tag{10}$$

As this bias correction and variance are valid only homoschedasticity, it is likely that the test perform poorly under heteroschedasticity (Bond et al. (2005)). Kruiniger and Tzavalis (2002) propose unit root tests in short panels where error terms are serially correlated and heteroscedastic.

3.3 A test for Cross Section Dependence

Pesaran (2004), Baltagi et al. (2007) show that there can be considerable size distortions in panel when the hypothesis of cross section independence is violated and the specification exhibits, for example, spatial error correlation.

When N is small and the time dimension T is sufficiently large, the cross section correlation can be modeled using seemingly unrelated regression (SURE), and traditional times series techniques - such the Lagrange Multiplier (LM) of Breusch and Pagan - can be applied[5]. However in cases where N is large, standard techniques are not applicable. Another approach, used in the literature of spatial statistics, measures the extent of cross dependence by means of a spatial matrix.

[5]For example, Chu et al. (2007) used the panel SURADF tests to investigate Gibrat's law of proportionate effects for 48 electronic firms in Taiwan. Panel SURADF tests handle cross-sectional dependence across firms and, at the same time, investigate a separate unit-root null hypothesis for each and every individual panel member, identifying how many and which series in the panel are stationary process

Pesaran (2004) proposes instead a simple diagnostic test that neither it requires any *a priori* specification of a connection matrix nor it suffers of panel data model limitations. It is therefore applicable in a variety of contexts, including stationarity dynamic and unit-root heterogeneous panels with short T and large N. The test, in all its various formulation, is based on simple averages of pair-wise correlation coefficients of OLS residuals from individual regressions.

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \tag{11}$$

where

$$\hat{\rho_{ij}} = \frac{\sum_{t=1}^{T} \hat{v_{it}} \hat{v_{jt}}}{\left(\sum_{t=1}^{T} \hat{v_{it}}^2\right)^{1/2} \left(\sum_{t=1}^{T} \hat{v_{jt}}^2\right)^{1/2}} \tag{12}$$

Unlike the LM statistic, the CD statistic has exactly mean at zero for fixed value of T and N, under a wider range of panel data model, and it is shown to have a standard normal distribution, assuming that the errors are symmetrically distributed, v_{it} are $i.i.d.(0,1)$. In addition, it can be applied to unbalanced panels. In this last case, equation (13) can be modified by

$$CD = \sqrt{\frac{2}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \sqrt{T_{ij}} \hat{\rho}_{ij} \right) \tag{13}$$

where $T_{ij} = \sum \mathbf{1}_{T_i \cap T_j}$ (the number of common time series observations between units i and j) and

$$\hat{\rho_{ij}} = \frac{\sum_{t \in T_{ij}} (\hat{v_{it}} - \bar{\hat{v_{it}}})(\hat{v_{jt}} - \bar{\hat{v_{jt}}})}{\left(\sum_{t=1}^{T} (\hat{v_{it}} - \bar{\hat{v_{it}}})^2\right)^{1/2} \left(\sum_{t=1}^{T} (\hat{v_{jt}} - \bar{\hat{v_{jt}}}))^2\right)^{1/2}} \tag{14}$$

with $\bar{\hat{v_{it}}} = \sum_{t \in T_{ij}} \hat{u_{ij}} / T_{ij}$. Finally, in cases where the cross section units can be ordered *a priori*, as with spatial observations, the CD test can be generalized capturing the spatial pattern too (Pesaran (2004)).

4 The Italian case

As previously stated, the Italian banking industry is of interest since it experienced a deregulation process during the nineties that lead, among other things, to liberalized entry and easier procedures to open new branches. Therefore, it is reasonable to expect a movement towards higher level of competition, both at National and macro-regional level.

Let's start with the simple t-tests based on OLS regressions.

Table 3: OLS:Dependent variable: Firm shares

Variable	**NATIONAL**	**NORTH**	**CENTRE**	**SOUTH**
t*	2.91	3.17	0.65	1.06
p-value	0.004	0.002	0.517	0.290
With time dummies				
t*	4.8	6.93	6.2	4.8
p-value	0.000	0.000	0.000	0.000
N	5758	2086	1695	1977

*Note: the t-statistic for H_0: $\beta = 1$ against $H_1 : \beta < 1$

Results relying on constrained estimations - imposing restrictions on the constant being equal or greater than zero - are substantially identical.

Table 4: Breitung and Meyer 1994:Dependent variable: Firm shares

Variable	**NATIONAL**	**NORTH**	**CENTRE**	**SOUTH**
t*	3.19	2.5	0.31	2.9
p-value	0.001	0.012	0.750	0.004
N	5758	2086	1695	1977

*Note: the t-statistic for H_0: $\beta = 1$ against H_1: $\beta < 1$.

As table (3) and (4) show, the null hypothesis $H_0 : \alpha = 1$ cannot always be rejected and the series seem to present unit roots, especially in the market-share related to the provinces in the Centre/South of Italy. These results disappear when it is controlled for common shocks (captured by year dummies). If the hypothesis of unit root cannot be rejected, it means that the positions of the main banks in the market could be displaced permanently by other actors, and there is evidence for a shift towards higher degree of competition.

Finally, table (5) presents results for OLS regressions including fixed effects where the values of the t-statistic have been computed correcting the bias as suggested by Harris and Tzavalis (1999). These regressions clearly indicated the presence of unit root at each level of aggregation.

Table 5: Harris and Tzavalis 1999:Dependent variable: Firm shares

Variable	**NATIONAL**	**NORTH**	**CENTRE**	**SOUTH**
t*	-0.09	0.16	0.05	-0.32
p-value	0.103	0.106	0.101	0.125
N	5758	2086	1695	1977

*Note: the t-statistic for H_0: $\beta = 1$ against H_1: $\beta < 1$.

4.1 Cross Section Dependence in Dynamics Panels

In the previous section, as it is typically assumed in panel data models, disturbances are treated as cross sectionally independent. To check if the panel at hand is characterized by cross-section dependence, the CD test is applied[6]. Two specification are used: one with residuals of homogeneous regression and one with residuals from N individual regressions from model (1). In both cases, the tests draw also on the residuals of the specification with/without the intercept and the observations are grouped again according to macro-regional classification (North, Center and South)[7].

The correlation are computed over the common set of observations for i and j. As it is already noted, the OLS estimates of the constant, $(1 - \alpha_i)\eta_i$, and slope α_i for the individual series are biased when T is small. And that bias could be substantial for value of α near unity.

However, the CD TEST advanced by Pesaran (2004) is valid for all values of α in model 1, including unity. The main reason lies in the fact that despite the sample bias of the parameters estimates, the OLS have exactly mean zero even for a fixed T, so long as the errors are symmetrically distributed.

The main limitation of Pesaran's test relies in its pair wise construction since it could be possible that pair wise correlation compensate each others, summing to zero.

While allowing for different value of α_i and cross-section correlation, we still assume that in model (1) v_{it} are serially uncorrelated with zero mean. Due to computational reasons, I restrict the analysis to the balanced panel made of 20%

[6]For this test I built a STATA command csdar.ado relying on xtcsd.ado as developed by De Hoyos and Sarafidis (2006).

[7]Results in table (6) refer to estimation without intercept. Those with intercept are analogous and are not reported.

of the observations. Table (6) reports results for the cross section dependence test developed by Pesaran. In both cases, allowing or not for heterogeneity, there is evidence for cross section dependence in all the macro-region considered.

Table 6: Pesaran's Test of Cross Section Independence

	NATIONAL	**NORTH**	**CENTRE**	**SOUTH**
Residuals from a regression*				
CD Statistic	6.875	50.370	44.920	52.694
P-value	0.000	0.000	0.000	0.000
Residuals from N regression*				
CD Statistic	5.106	50.228	44.334	52.864
P-value	0.000	0.000	0.000	0.000

* without intercept

5 Panel Unit Root Tests for Cross Sectionally Dependent Panels

Overall, the outcome of the preceding tests clearly indicates the presence of cross section dependence amongst units.

Pesaran builds on the assumption that the error terms v_{it} of equation (1) follow a single common factor structure

$$v_{it} = \lambda_i f_t + \epsilon_{it} \tag{15}$$

The common factor is assumed to be stationary and to impact the cross-section with a fraction determined by the individual specific factor loading λ_i. Because of the common factor, cross section dependence arises and can be approximated by the cross-section mean $\bar{s}_t = \frac{1}{N}\sum_{i=1}^{N} s_{it}$.

As usual, the ϵ_{it} are assumed to be $i.i.d$ across i and t with zero mean and variance σ_i^2, and $E(\epsilon_{it})^4 < \infty$. Furthermore, ϵ_{it}, f_t and λ_i are mutually independently distributed for all i.

Pesaran proposes the following augmented Dickey-Fuller regression:

$$\Delta s_{it} = c_i + \rho_i s_{i,t-1} + \beta_i \bar{s}_{t-1} + \sum_{j=1}^{p} \gamma_{ij} \Delta s_{i,t-j} + \sum_{j=0}^{p} \gamma_{ij} \Delta \bar{s}_{i,t-j} + \epsilon_{it} \tag{16}$$

where, as usual in the univariate case, lagged first-differences on both s_i and $\bar{s_i}$ are added in order to take into account also for possible correlation in the error term. Either individually or in a combined fashion, the t-value of ρ_i can be used to test the presence of unit roots. In the first case, the statistic is called cross-sectionally augmented Dickey-Fuller ($CADF_i$) while in the second case the statistic is constructed as

$$CIPS = \frac{1}{N}\sum_{i}^{N} CADF_i \tag{17}$$

It is called CIPS since it resembles the IPS statistic (Im et al. (2003)). In the case were T is fixed, to ensure the $CADF$ statistics do not depend on the nuisance parameters, Pesaran (2003) suggests to apply the test to the deviations of the variable from initial cross-section mean.

Table 7: Pesaran's Test for Unit Root

	NATIONAL	**NORTH**	**CENTRE**	**SOUTH**
CADF regression 0 lag				
t	-1.563	-2.020	-2.067	-2.086
z[t-bar]	1.178	-1.309	-2.067	-2.086
P-value	0.881	0.095	0.023	0.084
CADF regression 1 lag				
t	-1.333	-2.708	-1.590	-1.262
z[t-bar]	3.024	-1.560	0.744	1.644
P-value	0.999	0.059	0.772	0.950

Table (7) shows the Pesaran's test for unit root computed for the Italian Banking dataset. Due to the presence of the lagged level of the cross sectional average, the limiting distribution of the CADF statistics and the CIPS statistic does not follow a standard Dickey-Fuller distribution. However, Peseran provides critical values based on simulations for the CADF and CIPS-distributions for three cases (no intercept and no trend, intercept only, intercept and trend). As results from this test suggests, cross-section dependence does matter. When controlling for it, the series exhibit the presence of unit roots. That means that there is a dynamic in the positions of the main competitors in the market, and there exist the possibility for the main actors to be displaced by competitors.

The question to be addressed now is what are the factors which drive the results. It seems likely that more than one factor play a role. Merger and acquisition activity, the presence of scale economies, and the role of regulation each appear to have had a role. As suggested by Kim et al. (2003), movements in market shares can also be used to infer (and measure) switching costs. By making costly for consumers to change bank - and consequently more difficult for a new bank to acquire new clients, switching costs tend to limit entry as well as shuffle in market shares. To this end, other investigation are required. However, from this simple analysis is possible to infer that the Italian Banking industry experienced movement towards higher levels of competition. In particular, these results match those on the local level competition of Guiso et al. (2006). By looking at the long-term effect of the regulatory restriction, they found that, after the deregulation process, there was a catching up of the areas (especially the provinces in the South) where the banking market was less competitive during the regulation period. So, the presence of unit root in the market share data of this macro-region is consistent with their analysis.

6 Conclusions

The paper proposed the use of unit root tests in the setting of micro panel data sets to assess market share instability in order to get an understanding of the competitive condition in an industry. Using Italian Banking micro-panel, this study empirically tests the presence of unit roots in the series of market shares of the first five banks in each province. The presence of unit roots in the market share data could be interpreted, in fact, as signal of an industry that experienced the displacement of the leading bank by its competitors. On the other hand, if share turn out to be mean reverting, it is reasonable to conclude that the industry is rather stable and competitors reached positions difficult to overcome.

T-tests based on least squares estimators, which are consistent only under the unit root null, have been proposed. Those tests are shown to have good size properties and at least as high power as tests based on GMM and ML estimators. According to those tests, the hypothesis of unit root tests cannot always be rejected for all the subgroups considered in the analysis.

However, these tests do not consider the possibility of cross-section correlation amongst units. To check if the panel at hand is characterized by cross-section dependence, the Pesaran's cross-section dependence test was applied. The Pesaran's statistics clearly indicated the presence of cross-section dependence. As a consequence, the ADF regression proposed by Pesaran was applied. In that case, results strongly confirmed the presence of unit root tests.

The kind of exercises performed in this article could only offer (preliminary) indications of the dynamic of market shares in an industry. To individuate which factors drive the results, of course, other analysis are required. Nevertheless, as this simple application to the Italian banking case shows, panel unit root tests are useful and versatile tools that, combined with an institutional knowledge of the industry under investigation, could offer interesting insights on the industry competitive process.

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