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ABSTRACT

Corporate Growth Convergence in Europe*

It is widely believed that the implementation of the Single Market Programme in 1992 has had an impact on national markets in Europe, and some people have argued that it has induced a convergence in industrial structures across countries. Using a newly available database, however, covering nearly every firm above 100 employees in 14 European countries over the time period 1994 to 1998, we do not find strong evidence for 'convergence' in manufacturing in Europe. 'Full' convergence in corporate sizes within industries is unambiguously rejected by the data, although there may be some industries where some form of conditional convergence is observed. A Gibrat process best describes the growth of very large and mature firms; but smaller and younger firms depart from this prediction. While we can identify significant correlates of growth such as firm size, age or the internal organization of the firm, most of the variation in corporate growth remains unpredictable.

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NON-TECHNICAL SUMMARY

The 1992 Single Market Programme was designed to reduce the internal barriers to trade within the European Community. In doing so, it was expected to increase efficiency – by allowing firms whose operations had been restricted by national boundaries to expand and take advantage of economies of scale – and to increase competition – by allowing firms in different nation states to penetrate more easily into each others' markets. These changes were widely expected to lead to a reshaping of Europe's industrial structure, but predictions vary as to what the final shape of Europe's industrial structure will look like.

One model – sometimes referred to as the convergence model – asserts that the industrial structures in the different national markets will converge to the same size distribution of firms. The logic here is that the same economic forces ought to apply to firms operating anywhere in Europe, and, therefore, that what we observe in particular national markets ought to mirror what we observe at the European level. Another model – sometimes called the 'specialization' model – asserts that the forces of competition unleashed by the 1992 programme will lead to an industrial structure in Europe in which a few very large firms located in some of the larger economies will dominate markets across Europe, and that these firms will face competition in different regions or national markets from specialized, niche players who cannot compete with them head to head. If this turns out to be the case, then some countries will be populated by niche or specialized players while others will host broader, mass market players, and the industrial structure we see in different countries will differ.

What underlies these two different models are different hypotheses about how the economic forces unleashed by the 1992 programme will affect the growth of different firms. In the convergence model, firms will all tend towards a similar size (or converge to a similar distribution of sizes), and they will do so at similar speeds over time. In the specialization model, different firms in the same country or in the same industry across countries will not display any tendency to converge to a common size or distribution, and at a common speed. Instead, we are likely to observe that each firm grows at a different rate, tending towards a different long-run steady state.

Using data covering more than 65,000 firms larger than 100 employees in 113 industries, across 14 European countries during the time period 1994–8, we examine patterns of corporate growth in Europe. Convergence within industries or within national economies is unambiguously rejected by the data – firms do not appear to be tending towards a common size or size distribution. In fact, the data strongly suggests that corporate growth rates are more or less random, meaning that there is no evidence in the data to suggest that there is a stable underlying size distribution of firms within or between nations or industries in Europe. National and even industrial differences between firms seem to be dwarfed by the heterogeneities that we observe between firms in the same industry and in the same country. Corporate growth rates are far too idiosyncratic to support any notion that firms are converging towards a stable European industrial structure.

I. INTRODUCTION

It is widely believed that protectionist policies and the fragmented nature of Europe's national markets have historically confined many European firms to small domestic markets. If this is so, then the implementation of the Single Market Programme (SMP) in 1992 ought to have had major consequences on the structure of the various national markets in Europe. The SMP required Member States to abolish all remaining trade barriers to the free circulation of goods, services, persons and capital by the end of 1992[1]. For many people, this meant that firms formerly prevented from reaching optimum size would now be to expand and realize all of the economies that are latent in the technologies which they use. This, in turn, ought to lead to a decline in national concentration and a heightening of competitive pressures in formerly closed national markets.

What is rather less clear is whether these changes mean that the national economies in different European countries and industries are likely to become more or less similar to each other over time; i.e. whether they are converging. The question of convergence is an important one for at least two reasons. First, there are well grounded fears that some firms in some national markets will be able to take more advantage of the opportunities presented by 1992 than others, leading to a set of market structures in which market leaders are domiciled in some European countries and more peripheral, fringe firms are domiciled elsewhere. Second, as Europe moves towards a common currency, it is important that it becomes an optimal currency area. This, in turn, means that shocks must hit the various regions within Europe symmetrically (or, if there are asymmetric shocks, that there are mechanisms for dealing with them, such as relatively unrestricted labour or capital flows), and the potential for mutual beneficial trade must exist.

The first issue is largely about whether the size distribution of firms within and across countries and industries is becoming more or less similar over time (the second is more concerned with the sectoral distribution of economic activity in different regions), and it is the issue that we are going to focus on here. Part of the problem with answering the question "*are market structures converging in Europe post-1992?*" is that there are at least two different ways in which "convergence" might manifest itself: market structures might have the same steady state size distribution of firms across industries and/or countries; and some or all of them might share a common speed of convergence towards possibly different steady state sizes. This, in turn, means that a full exploration of the convergence issue requires one to develop a series of tests, and to build an econometric model general enough to nest both types of convergence.

In this paper, we ask whether there is any tendency for size distributions to converge within or across industries and countries in Europe. Using an extremely large data set covering more than 65,000 firms larger than 100 employees in 113 industries across 14 European countries over the time period 1994 to 1998, we test for convergence in the two senses identified above. Our results are relatively clear: while we can identify significant correlates of growth such as firm size, age or the internal organization of the firm, most of the variation in corporate growth rates within and between industries and/or countries in Europe is unpredictable. This means that convergence in corporate sizes within industries or within countries is unambiguously rejected by the data in the senses discussed above.

The paper is organized as follows. The next section outlines our framework for convergence, Section III describes the database, Section IV presents the main results on convergence in European manufacturing, and Section V contains a number of concluding observations. The appendix presents our convergence estimates by country.

II. A FRAMEWORK FOR TESTING CONVERGENCE

There is now a very large empirical literature about firm growth which has explored the following simple model of the evolution of firm size,

$$\Delta S_i(t) = S_i^*(t) + \beta S_i(t-1) + \mu_i(t), \tag{1}$$

where S_i is the actual size of firm *i* at time *t*, S_i^* is the long run steady state size of firm *i*, β is the speed with which firm *i* converges toward S^* when $S_i \neq S_i^*$ and $\mu_i(t)$ is a normally distributed *iid* white noise process.[2]

There are (at least) two ways of thinking about this model. The first is that it is just the usual ad hoc partial adjustment model grafted on to a theory of the determinants of S^*.[3] The other justification of (1) derives from Geroski, Machin and Walters, 1997, who solve an intertemporal optimization problem for a firm anticipating the future and subject to adjustment costs. This produces (1) as the first order condition for output choice, where S^* bears the interpretation of the change in current expectation about the present discounted value of future profits. In this model, β is a measure of the size of adjustment costs, and the authors argue that if adjustment costs are zero and expectations are formed rationally, then $\Delta S_i(t)$ is essentially random; i.e. that Gibrats Law holds. The main virtue of this argument is that it provides a relatively simple and compelling account of the null hypothesis that firm sizes follow a random walk; i.e. that $\Delta S_i(t) = \mu_i(t)$.

One way or the other, one has to specify S^* before (1) can be used for empirical work. There are at least three different ways that one might approach this problem, depending on how much information one has about the exogenous determinants of S^*. The most common approach is to write:

$$S_i^*(t) = c + \alpha X_i(t) + \eta_i(t). \tag{2}$$

where $\eta_i(t)$ is a white noise error and $X_i(t)$ is a set of observable exogenous drivers of $S^*(t)$. Using (2), (1) becomes

$$\Delta S_i(t) = c + \alpha X_i(t) + \beta S_i(t-1) + \upsilon_i(t), \tag{3}$$

where $\upsilon_i(t) \equiv \mu_i(t) + \eta_i(t)$.

If $\alpha = 0$, (2) says that S^* is constant over time and the same for all firms (up to a stochastic term). If $\alpha \neq 0$, S^* also depends on a set of exogenous variables $X_i(t)$. These observable exogenous variables might include age, innovative activity, diversification, the internal organization of the firm, market size, and so on. The major problem with using (2), curiously enough, is omitted variables. Most studies cannot correct accurately for all of the possible determinants of *S** and, as a consequence, it is often difficult to avoid the suspicion that α is estimated with bias. When panel data sets are available, a commonly preferred alternative to (2) and (3) is to allow for fixed effects (basically, to allow the constant, *c*, to be *i* specific).

Fixed effects, however, only control for exogenous factors which are constant over time, and this is not always an appealing assumption to make. One alternative is to write (2) as

$$S_i^*(t) = c + \delta S_i^*(t-1) + \eta_i(t), \tag{4}$$

which allows *S** to drift over time (note that if $\delta = 1$, then *S** follows a random walk) without restricting it to follow the movement of particular observables. Needless to say, if *S** follows a random walk, then it is likely that *S(t)* will do so as well. One way or the other, using (4) in (1) yields

$$\Delta S_i(t) = c + (\delta + \beta)S_i(t-1) + \delta(1 - \beta)S_i(t-2) + \varpi_i(t) \tag{5}$$

where $\varpi_i(t) \equiv (\delta + 1)\mu_i(t) + \eta_i(t)$. Specification (4) is actually a parsimonious specification to use when one cannot fully observe the drivers of *S**, but it induces a moving average error. Clearly, one could generalize (4) to include observable exogenous variables $X_i(t)$ and allow *c* to take firm specific values; one could also generalize the basic moving average in $S^*(t)$, which would effectively add more lagged terms in $S_i(t)$ to (5).

What light do these econometric models cast on convergence? This, of course, depends on precisely how one defines the term. There are two senses in which one might talk about convergence in performance between two firms in the same industry or country:

(a) they get to the same steady state, *S** ("*full convergence*");
(b) they get to where ever they are going at the same rate (often referred to as "*β-convergence*"); i.e. firms have a common value of β, but they differ in their long run size.

The sense of convergence in (a) is long run and complete: everyone gets to the same place. However, this is a very unlikely feature of the data, not least because we know that firm size distributions are skewed within industries and across industries in the same country. The sense of convergence in (b) is much weaker. It says that the disequilibrium response to a state in which $S \neq S^*$ is the same for all firms: i.e. that they converge to whatever (different) steady state they are headed towards at basically the same speed. In this case, it may be that firms converge to a set of common size differences in the long run (i.e. to a stable place on a stable distribution of firm sizes). Roughly speaking, *β-convergence* suggests that firms will have very similar growth rates (unless their values of S* trend at very different speeds). (b) can be weakened further by allowing for the existence of "*convergence clubs*"; i.e. groups of firms who share a common value of β[4]. A natural way to model this is to try to identify the common determinants of club convergence speed, augmenting (1) with

$$\beta_j = \beta_0 + \beta_1 Y_j(t) \tag{6}$$

where $Y_j(t)$ is an observable driver of adjustment speeds for all firms *i* in club *j*. In this case, (b) becomes

(b') firms with common values of $Y_j(t)$ approach their own S* at the same rate.

Using (6), (3) becomes

$$\Delta S_i(t) = c + \alpha X_i(t) + (\beta_0 + \beta_1 Y_j(t))*S_i(t-1) + \upsilon_i(t). \quad (7)$$

It is, of course, possible to generalize (5) in exactly the same way.

Our strategy, then, is to use (3) and (7) as our basic models of corporate growth, using (6) and other extensions as a way of checking the robustness of our results. The interesting parameters to be estimated are those that determine *S** and β, for each casts light on a somewhat different sense in which one might say that "*market structures converge*". In what follows, we will examine convergence within and between industries and countries in Europe, allowing (as appropriate) these parameters to be common across the whole sample (convergence across all European industries) , country specific (convergence within countries), industry specific (convergence within industries across countries) or both (country specific convergence within industries). In all cases, the null hypothesis is that corporate growth rates are random. As is well known, if firm sizes follow a random walk, then there is no sense in which one can discuss an optimum firm size *S**, much less a speed of convergence to it. In this case, firm sizes may converge to a stable distribution, but individual firms will never display a tendency to move toward - or remain stationary at - any point on that distribution. This is obviously a situation in which firms do not display convergence in any of the senses discussed above.

III. THE DATA

The database we use is the December 1999 version of AMADEUS. AMADEUS is a Pan-European financial database, containing balance sheet information on over 220,000 major public and private companies in all sectors in 26 European countries. To be included in AMADEUS companies must comply with at least one of the following criteria: (i) their turnover must be greater than 10 million EURO; (ii) the number of their employees must be greater than 150; and (iii) their total assets must be greater than 10 million EURO.

We restrict our attention to the manufacturing sector plus agriculture (a total of $I = 113$ industries) and $C = 14$ European countries[5], generating $IC = 1582$ industry/country combinations. This reduces the number of firms in our sample to around 65,000. Up to five years of historical data are provided for each company in AMADEUS, and we choose the time period 1994 to 1998, since this is a period where one might legitimately expect to detect early responses to the 1992 programme (it also provides us with the maximum number of observations).[6] We use only those industry/country panels where at least 30 firm level observations are available. This, the elimination of some extreme outliers, and the requirement that all data be available for the whole five years (i.e. we will be concentrating on a balanced panel) reduces the number of industry/country combinations to $IC = 640$ and the number of firms to around 25,000[7].

We measure firm size by the average annual number of employees in each firm. The main advantages of using employment as measure of size is that we need not worry about price deflators, and differences in accounting conventions between countries. It is, therefore, readily comparable *across* countries, which is the main focus of this paper. Employment practices do differ across Europe, but this ought not cause too much concern since we will be working with first differences in employment. Employment data has one more property worth noting: labour is relatively more adjustable than capital, but if firms try to hoard their labour or experience difficulties in hiring, then employment will be somewhat less variable than output.[8]

The average (median) firm in our sample is around 25 (18) years old, although 25 percent of the firms are younger than 8 years. The average (median) firm has 495 (140) employees over the sample period, with a range from 10 to 328,000. The average size of firms younger than 8 years old is 285, while that of firms who are 25 or more years old is 868. The average number of subsidiaries per firm is 0.47, although 80% of the firms do not have subsidiaries (the average number of subsidiaries amongst firms who do have subsidiaries is 6.3). The average number of *4*-digit industries a typical firm in our sample operates is 2.6, although more than 30 percent of firms operate in only *one* 4-digit industry (the average number of industries that firms who operate in more than one industry have is 3.9). This suggests that the typical European firm is quite focused[9].

The average annual growth rate of employment is 2.65% for the unbalanced sample of firms (real GDP growth in the EU-15 area that we are examining is about 2.3% during the period 1994-1998). Table 1 provides some summary statistics for the balanced panel of firms[10]. Annual corporate growth rates (defined as the first difference in the log of employment) averaged 2.78% percent in the 14 countries in our sample, ranging from a maximum of 6.8% in Italy to a sample low 0.2% in Spain. All of the countries in the sample displayed positive employment growth on average during the sample period. High employment growth industries include NACE 353 (Motor Vehicle Parts), 330 (Computers and Office Machinery) and 313 (Metal Treatment), while basic metals industries such as NACE 120 (Coke Ovens) and 112 (Extraction of Black Lignite) display unusually low growth on average across the 14 countries in our sample.

There are several features of the data on corporate growth rates that are worth remarking upon. First and most noticeable, corporate growth rates are very variable: for the sample as a whole, the coefficient of variation is 7.21. The last six rows of Table 1 provide an analysis of variance of the variables which are of our principal interest. 60% of the total variation in firm growth rates is within firms over time, while 40 % of the total variability in firm size is between firm variation. This suggests that the determinants of growth rates are highly firm specific and very variable over time. Further, breaking down the total variation in growth rates into within and between industry and country components shows that more of the variation is between industries than across countries. This suggests that each industry may have a different size distribution of firms but that this distribution might be fairly common across countries taken industry by industry.

The second observation worth making is that the distribution of corporate growth rates over all years together is not quite normal (see Figure 1). Deviations from the superimposed normal density curve are due to the fact that growth rates in employment cluster "*excessively*" around zero, and that there are some extraordinarily high and low growth rates (i.e. the tails have slightly more mass than implied by the normal distribution).

These first two observations lead naturally to a third, namely that while simple first order auto-regressions in firm size were fairly well determined with an R^2 of 0.97, the fit on auto-regressions in growth was very poor, with a coefficient of below 0.1 and an R^2 of only one percent. That is, firm size appears to follow a random walk, and this means that size differences between firms are, as a consequence, very stable and persistent over time. All of this is, on the face of it, difficult to reconcile with the hypothesis of convergence in any form.

IV. TESTS OF CONVERGENCE IN EUROPEAN INDUSTRY

We start by applying the models discussed in Section II to the full pooled sample of 640 industry/country combinations containing 25,346 firms. We then examine convergence within industries and countries by estimating the models for each of the 640 industry/country combinations separately. We conclude by examining whether convergence occurs within industries across countries, and whether there are convergence clubs within industries.

(i) Some baseline estimates

Our basic strategy is to use equations (3) and (7) to build four specific models of corporate growth:

$$\Delta S_i(t) = \alpha_0 + \beta_0 S_i(t-1) + \mu_i(t) \qquad \text{(Model 1)}$$
$$\Delta S_i(t) = \alpha_0 + \alpha_1 X_i(t) + \beta_0 S_i(t-1) + \mu_i(t) \qquad \text{(Model 2)}$$
$$\Delta S_i(t) = \alpha_0 + \beta_0 S_i(t-1) + \beta_1 Y_j(t-1)*S_i(t-1) + \mu_i(t) \qquad \text{(Model 3)}$$
$$\Delta S_i(t) = \alpha_0 + \alpha_1 X_i(t) + \beta_0 S_i(t-1) + \beta_1 Y_j(t-1)*S_i(t-1) + \mu_i(t) \qquad \text{(Model 4)}$$

where S is defined as the natural logarithm of the annual number of employees. The vector X contains the following variables: age of the firm, number of subsidiaries, number of 4-digit SIC industries the firm operates in, and rival's growth defined as the growth rate in the number of employees of all firms in the same 3-digit industry excluding firm *i*. Y is equal to X with the exception of rivals growth.[11]

Model 1 is the most restrictive: S^* and β are set equal to a constant which is the same for all firms. This corresponds to "*full convergence*" in the sense of (a) in Section II and is (3) with $\alpha = 0$. Model 2 allows S^* to depend on X, but β is a constant common to all firms (i.e. it is (3) without the restriction that $\alpha = 0$). If the data were consistent with model 2 but not model 1, then one would conclude that "*β convergence*" exists in the sense of (b) in Section II. All firms that have the same value of X will get to the same S^* in the long run, and all firms will approach their steady state value of S^* at the same speed regardless of their S^*. In Model 3, β depends on Y, but S^* is taken to be a constant which is the same for all firms (this is (7) with the restriction that $\alpha = 0$).. This again is "*full convergence*", and firms that have the same Y belong in the same convergence club, and there is "*β convergence*" within each such club. Finally, in Model 4, S^* depends on X and β depends on Y (i.e. this is (7) without he restriction that $\alpha = 0$). Obviously, there is no convergence in this case, although there may be groups of firms with common values of X and/or Y for whom there is "*full convergence*" or "β *convergence*". The most natural conjecture is that these groups of firms will all belong to the same industry or operate in the same country. Our null hypothesis is that all of the estimated co-efficients are zero, in which case $\Delta S_i(t) = \mu_i(t)$; i.e. firm size follows a random walk.

Table 2 presents the estimation results of applying Models 1 – 4 to the full sample of 25,346 firms for the full time period.[12] The first estimates shown below each model ("Pooled") are the estimation results without industry and country fixed effects; the next estimates show regressions containing industry and country fixed effects ("Fixed effects"). The estimated β co-efficients range from -0.031 (Model 1) to -0.061 (Model 4, including industry and country fixed effects). While all β co-efficients are significant with t-values of between 40 and 60, estimated half-lives of adjustment range from 22 to 11 years. The implied values of S* (evaluating X_i and Y_j at mean values) ranges from 351 employees (Model 4) to 578 employees from Model 2. F-tests indicate that industry and country fixed effects are always significant at the 1% level.

Models 2 and 4 suggest that age and diversification negatively influence corporate growth, while the more subsidiaries the firm has the higher is its growth rate.[13] Rival growth has a positive co-efficient in the regressions where unobserved industry and country heterogeneity is ignored (i.e. the "Pooled" regressions), but rivals growth has an (expected) negative sign in those regressions where industry and country dummies are included (i.e. the "Fixed" regressions). Model 4 suggests that the older and the more diversified the firm is, the lower is it's speed of adjustment to S*. All F-tests reject the null hypothesis that all of the estimated co-efficients are jointly equal to zero with F-values of between 500 and more than 3,000. Given the huge number of observations this is not surprising. However, despite these enormous t-values, the percentage of explained variance in these regressions is very low, with R^2's between 0.033 and 0.056.

Two tests of robustness are woth mentioning. First, when we estimate equation (5) to test for the restrictions embodied in (3) the results are as follows: S(t-1) still takes on a negative co-efficient of -0.029 (t=-42.25) and the co-efficient on S(t-2) is positive (0.011) and only marginally significant (t=1.94). Our estimates of implied S* do not change much. Simple as it is, this suggests that (2) might be an adequate model of S*. Second, the null hypothesis in all of this is that firm size follows a random walk , and this hypothesis is rejected with significance levels similar to using equation (3) as the starting point.

(ii) Convergence within industries and countries

There are 640 industry/country groups in the data, with an average of about 40 firms per industry/country group. The next question that we wish to address is whether convergence occurs within industries and/or within countries: i.e. do firms in the same industry and/or the same country have the same S^* and β? To do this test, we compare a model which forces S^* and β to be the same for all firms for all countries and/or industries with one which allows either S^* or β or both to vary across countries and/or industries.

We applied likelihood ratio tests to the choice between these four models (see Panel A in Table 3). On average, 60% of the industry-country panels cannot be simplified from

Model 4 to Model 3, while in 55% percent of the panels Model 4 can be simplified to Model 2. This means that it is somewhat more likely that one will reject the hypothesis that firms in a particular industry/country panel will have the same value of S* than that they will display the same speed of adjustment, β. There is, however, a lot of variation across countries. In Austria, for example, the growth process is nearly equally well described by Models 2, 3 or 4; by contrast, in Spain, Model 4 does much better than either Models 3 or 2. The last column shows that in 80% of the 640 industry/country panels it is impossible to accept the restrictions identified as Model 1.

In general, the results of the 640 versions of Models 1 – 4 that we estimated seem fairly plausible. For example, Model 4 generates negative estimates of β in more than 70% of the 640 industry/country panels; in 178 of the panels (27.8%), β is significantly negative. Larger (in absolute value) than average β coefficients are estimated for Spain, Greece, Portugal, and Sweden, while both Switzerland and the Netherlands display very small (in absolute value) estimates. However, the range of estimates of β is not all that large by any standard, and these estimates are not obviously inconsistent with "*β-convergence*", at least on a rough and ready basis. Estimated values of the R^2's rise from an average 6% in Model 1 to 22% in Model 4, although not all that many of the observable exogenous variables in X(t) or Y(t) are individually significant. While 9 – 15% of the variation in growth rates across firms in each industry/country panel can be explained by these simple regressions in Spain, Portugal, Greece, and Finland, for Switzerland and the Netherlands R^2's are nearly zero. The effect of age on firm growth is, on average, negative (it has a negative impact on growth in 421 panels (65.8%) and in 123 industry/country combinations (19.2%) it is significantly negative). By contrast, the more subsidiaries the firm has, the higher its growth rate on average: in 459 panels (71.7%), the estimated effect is positive, and in 147 panels (23%) the t-values are larger than two. Diversification and rival's growth play a much smaller role in the regressions. All of these conclusions on the estimates of β and on the effects of particular observables X(t) on S* are drawn from the results obtained by using Model 4, but they appear to apply as well to those generated by using Model 2.

The most remarkable feature of these regressions is the enormous heterogeneity in the estimated parameters which appears in the data. The estimates of α show an enormous range, from 0.06 (in Switzerland) to 0.67 (in Spain), with an average of 0.23. Taken together, these estimates generate predicted values of S* ranging from 20 to 480,327 from Model 2, with a mean value of 589 (see Panel B of Table 3). Interestingly, most of the variation in β's is between countries (42.76%), while most of the variation in implied S*'s is between industries (33.76%). Two conclusions seem to suggest themselves. First, all of this variation means that it is hard to reject the Gibrat hypothesis that firms sizes follow a random walk (the average p-value for this test is 0.16). Second, these results suggest that we are much more likely to observe "β-*convergence*" than "*full convergence*" in the data, and that we are unlikely to find much convergence of either type across industries within particular countries. However, there may be some convergence of one or the other type within industries across countries.

(iii) Convergence within industries across countries

Our next task, then, is look at within industry convergence *across* countries, and asking whether there is convergence of either type within each industry across countries. For each industry *I*, we select the *C* panels from the total of *IC* panels which belong to it. This gives a grand panel which contains all the firms for each industry in all the countries in the sample. Comparing this one with the *C* individual country panels for that industry asks the question whether there are parameters in the model which are common in all countries in Europe (or, if there are convergence clubs, for some of them).

In total, there are 113 3-digit manufacturing industries in the database. Using Model 1 generates estimates whose average value of β is -0.031 (with an average t-value of -4.94). While this points to a statistically significant convergence in corporate size, the economic significance of this estimate of β is rather limited, since the implied half-life of adjustment is nearly 22 years, and the average R^2 for these regressions is only 4%. The average R^2 increases from 0.04 (Model 1) to 0.09 (Model 4), which is a much smaller increase in explanatory power than for our within industry-within country regressions. This suggests that country and country-industry interaction effects play at least a role in the determination of corporate growth rates. As before, in most of the industries older firms grow slower (in 81 out of the 113 industries from Model 2), while having more subsidiaries implies a greater growth rate (in 97 industries). The direct effects of diversification and rival growth are negative, on average. The average p-values from the F-tests testing for the Gibrat hypothesis are: 0.08 (Model 1), 0.06 (Model 2), 0.07 (Model 3) and 0.05 (Model 4). As before, we conclude that it is difficult to reject the null that corporate growth rates are random.

The positive effect of the number of subsidiaries on firm growth deserves further interpretation. Production activity and corporate governance in Europe are very often organized in "corporate groups" or "corporate pyramids".[14] Our findings of a positive influence of the number of subsidiaries on corporate growth indicates that organizational capabilities may be important determinants of firm growth. Organizing production in several legal entities appears to facilitate adjustment to economic shocks. We know that it can take years to mould a successful management team. Management teams that are already assembled in these legal entities may react quicker to growth opportunities. Monitoring by corporate headquarters may be easier in such circumstances.[15]

(iv) Convergence clubs

The conclusions which these results seem to be driving us towards is that there is no convergence (particularly) between or (less clearly) within industries (across countries). However, the definitions of “industry” that we have been working with are rather broad, and it is more than possible that a finer disaggregation will reveal the existence of one or more “convergence clubs” whose members might display fewer heterogeneities than appear when we look across broadly defined industries (much less across countries). There are many number of ways to define possible convergence clubs, and we have experimented with several.

We first discriminate across types of industries using the Davies and Lyons, 1996, industry classification scheme. Following the spirit of Sutton, 1991, and Schmalensee, 1992, they distinguish between homogenous good industries (Type 1) and differentiated good industries (Type 2), further distinguishing amongst the latter between R&D intensive industries (Type 2R), advertising intensive industries (Type 2A), and R&D and advertising intensive industries Type 2AR).[16] From the 113 3-digit industries in our sample, we could confidentally allocate 91 to these categories: of which, 50 are homogenous good industries and 41 differentiated good industries, 21 being Type 2R, 12 Type 2A, and 8 Type 2AR.

Panel A of Table 4 presents our results for Model 2. The β-parameter is not dramatically different between these broad categories of industries. Homogenous good industries display a larger value of β in absolute value than differentiated good industries. Advertising intensive industries show the smallest value of β, around 30% lower than the β of homogenous good industries. The age of the firm retards growth most in R&D intensive industries, while age is least negative in advertising intensive industries. To grow via subsidiaries is most important in homogenous good industries. Diversification strategies positively affect growth particularly in advertising intensive industries. Rivalrous interaction is important in differentiated good industries, and among them particularly important in advertising intensive industries. Implied vales of S* vary substantially across industry types and are lowest in advertising intensive industries and largest in R&D and advertising intensive industries. A comparison of the mean number of employees in 1994 and the implied values of S* reveals that the implementation of the SMP is likely to increase the average size of firms operating in homogenous good industries, while firms operating in differentiated good industries were very near their S* already in 1994. There is, however, a large amount of variation within differentiated good industries.

Panel B of Table 4 further explores the possibility of convergence clubs by estimating Model 2 for different sub-samples of firms. We discriminate between “small” and “large” firms and then between “very small” and “very large” firms. The “small” (“large”) firm sub-sample includes firms that have less (more) employees than the median firm in 1994. The “very small” (“very large”) sub-sample includes those firms that are smaller (larger) than the 5% (95%) percentile cutoff point of the distribution of employees in 1994. The estimates of implied S* are again taken from Model 2.

“Small” firms exhibit a β, which is more than three times as large as the β for “large” firms in absolute value. Life cycle effects as measured by the influence of the age variable are much more important for “small” than for “large” firms. This picture is reinforced by looking at the 5% percentiles of the size distribution. The β of “very small” firms is more than five times as large in absolute value than the β of “very large” firms. The age of the firm is particularly relevant for growth for “very small” firms, while age is irrelevant for growth for “very large” firms. Diversification positively affects growth for the largest firms, and rivalrous interaction plays a large role in the growth process of these firms. While the Gibrat hypothesis is rejected by F-tests, our estimates of the implied values of S* for “very large” firms is not well defined.

Panel C of Table 4 splits the sample into “small&young” and “large&old” firms, firms “with subsidiaries” and “without subsidiaries”, and “diversified” and “undiversified” firms. The “small&young” (“large&old”) sub-sample includes firms that have less (more) employees than the 10% (90%) cutoff point of the distribution of employees in 1994 and are younger (older) than the 10% (90%) cutoff of the age distribution. Firms “with(out) subsidiaries” have (do not have) any subsidiaries. The sub-sample (“un)diversified” firms includes those firms that operate in (only one) more than one 4-digit SIC industry. The most striking results that emerges from all the regressions that we ran on these various sub-samples is the difference in the estimated β-co-efficient between “small&young” and "large&old" firms. For "large&old" firms, the estimated value of β is positive and it is impossible to estimate S* with any precision; unsurprisingly, for this group, the Gibrat hypothesis cannot be rejected. Further, life cycle effects significantly drive the growth process of "small&young" firms. Finally, it is worth noting that firms "without subsidiaries" and "undiversified" firms exhibit larger β-co-efficients in absolute value than firms "with subsidiaries" and "diversified" firms.

V. CONCLUSIONS

In this paper, we have asked whether there is evidence that a common industrial structure is emerging between some or all countries of the European Union for any (or all) industries. Using a newly assembled data set to analyze the corporate growth process in 113 industries in 14 European countries over the period 1994-1998, we have found very limited evidence that the post-1992 integration of formerly fragmented economies in Europe has induced any strong tendency for industrial structures in Europe to converge. In particular, what we have called *"full convergence"* is clearly rejected by the data. In the case of what we have called *"β-convergence"*, the decision is slightly less clear cut: there is far less variation in how fast different firms adjust towards their steady state sizes than there is in the steady state sizes of firms themselves, which is why *β-convergence* seems to be more consistent with the data than *full convergence*. Our results on *"convergence clubs"* are most suggestive in the case of small and young firms where common drivers of growth are the size and the age of the firm. The growth process of large and mature firms, by contrast, is best described by Gibrat's Law. Further, what evidence there is in support of the hypothesis of convergence indicates that it is more likely to occur within industries across countries than within countries across industries.

Three observations are worth making about these results. First, the fact that individual firms do not appear to be converging towards a common size distribution within industries across countries presumably means that specialization is occurring; that market structures in particular industries in different European countries are retaining distinct – and possibly complementary – identities. If this is truely the case, then the only meaning that one might be able to give to the phrase "*European industrial structure*" is that it is a patchwork of national (or possibly sub-national) industrial structures which retain their separate identity even as they gradually change over time.

Second, it seems to be the case that national, and for that matter, industrial differences between the growth of different firms are relatively modest compared to the heterogeneities that are evident even for firms in the same industry and the same country. The sources of corporate growth are, it appears, both idiosyncratic and firm specific.

This second observation leads naturally to a third. The reason that there is little evidence of convergence is that we have found it very difficult to detect major departures from the null hypothesis that corporate growth rates are pretty much random. The variables which might drive convergence or the effects that they have on growth rates are just not important enough to power effective convergence. This, in turn, means that most of the drivers of growth rates are firm specific and hard to predict. Firm specific factors such as the size, age and the internal organization of the firm seem to play a role in the growth process, but none of them display the kinds of idiosyncratic, firm specific variation that corporate growth rates do. In fact, most of them vary much more between firms than they do within firms over time, and that means that for the most part they are statistically incongruent with corporate growth rates. If we truely wish to explain corporate growth rates in terms of observables, we need to find variables which have statistical congruent properties with growth; i./e. that vary much more over time for particular firms than they vary across firms at any given time.

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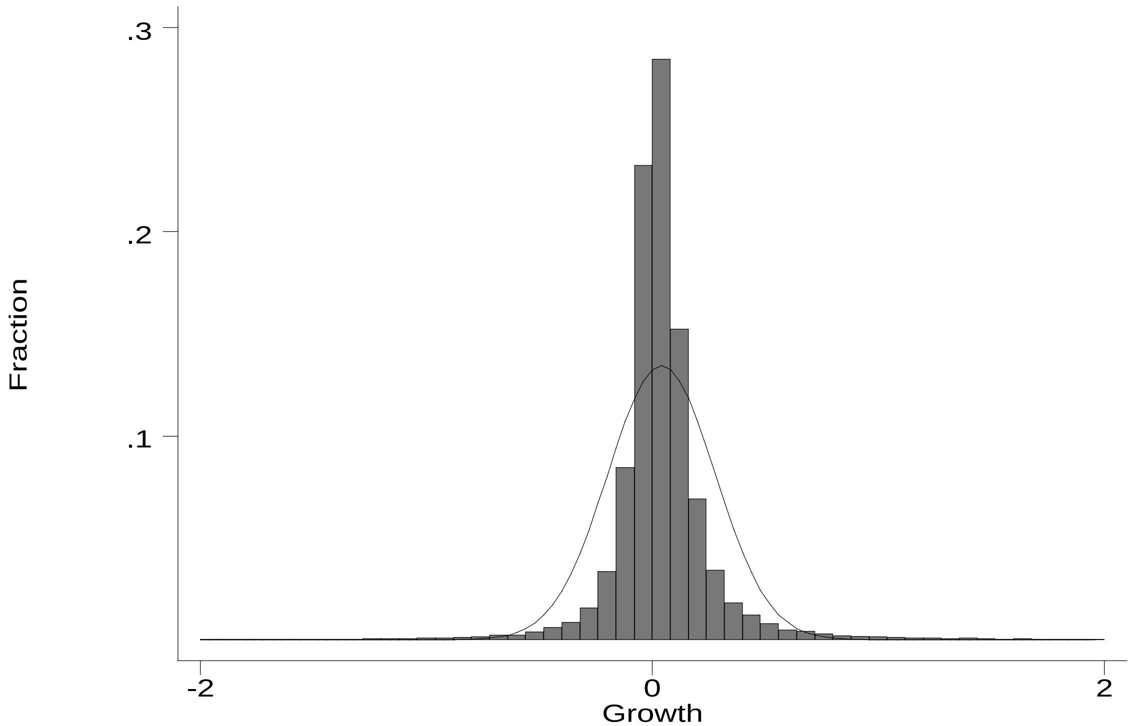
Figure 1: Distribution of annual growth rates in European manufacturing



Note: Logarithmic first differences below minus two and in excess of two are omitted.

Table 1: Descriptive statistics on variables used in regression analysis

Country	Size	Growth	Age	No. of Subsidiaries	Diversification	No. of industries	No. of firms
Austria	229	0.012	16.3	0.20	2.78	19	261
Belgium	244	0.012	24.7	0.76	2.03	67	1,508
Switzerland	4,964	0.008	42.9	2.91	3.51	13	156
Germany	399	0.010	20.2	0.35	2.55	108	9,008
Denmark	293	0.040	23.4	0.38	2.88	24	384
Spain	271	0.002	22.9	0.59	2.21	46	759
Finland	275	0.040	18.7	0.81	2.30	12	132
France	352	0.022	29.6	0.81	2.32	73	1,953
United Kingdom	1,005	0.032	32.0	0.66	3.36	92	4,554
Greece	230	0.040	19.2	0.31	1.91	19	261
Italy	195	0.068	21.5	0.10	2.44	88	4,752
Netherlands	2,017	0.015	38.0	1.64	3.72	29	392
Portugal	239	0.030	13.2	0.00	3.46	1	13
Sweden	293	0.035	34.1	0.47	2.36	49	1,213
All	495	0.028	24.7	0.47	2.63	640	25,346
A breakdown of variance:							
Standard deviation	4,220	0.202	23.0	2.83	1.93		
Between 25,440 firms	3,728	0.081	n.a.	n.a.	n.a.		
Within firms	492	0.121	n.a.	n.a.	n.a.		
Between 113 3-digit industries	590	0.021	4.8	0.51	0.52		
Within industries	3,630	0.181	18.2	2.32	1.41		
Between 14 countries	998	0.017	6.4	0.60	0.46		
Within countries	3,222	0.185	16.6	2.23	1.47		

Note: Size is the average annual number of employees,
Growth is the average annual growth rate in employees,
Age is defined as the number of years since incorporation,
Number of Subsidiaries is the number of subsidiaries of the firm as reported in AMADEUS,
Diversification is the number of 4-digit SIC industries the firm operates.

Table 2: The pooled sample
Convergence across industries and across countries

	Model 1				Model 2				Model 3				Model 4			
	Pooled		Fixed effects		Pooled		Fixed effects		Pooled		Fixed effects		Pooled		Fixed effects	
	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
S(t-1)	-0.031	-58.56	-0.033	-58.08	-0.032	-56.30	-0.034	-56.06	-0.031	-43.08	-0.032	-41.97	-0.059	-39.48	-0.061	-40.65
Age					-0.008	-13.00	-0.010	-16.05					-0.047	-18.57	-0.052	-20.31
Sub					0.003	11.90	0.003	14.12					0.002	1.71	0.003	3.72
Div					0.000	0.90	-0.001	-1.59					-0.010	-7.72	-0.009	-6.85
Rival growth					0.045	3.50	-0.031	-1.92					0.046	3.62	-0.031	-1.90
Age*S(t-1)									-0.001	-8.77	-0.001	-11.30	0.008	15.99	0.008	17.02
Sub*S(t-1)									0.000	12.26	0.000	14.33	0.000	0.26	0.000	-1.13
Div*S(t-1)									0.000	3.60	0.000	1.02	0.002	8.10	0.001	6.56
α_0	0.185	67.13	0.198	52.27	0.209	66.90	0.232	56.06	0.194	65.55	0.208	52.84	0.348	44.55	0.372	45.00
No. Obs.	101,384		101,384		101,384		101,384		101,384		101,384		101,384		101,384	
No. Firms	25,346		25,346		25,346		25,346		25,346		25,346		25,346		25,346	
R^2	0.033		0.047		0.036		0.052		0.035		0.051		0.039		0.056	
Implied S*	374		403		490		578		447		509		351		414	
F-test (Gibrat)	3,429.7		3,373.6		749.4		765.6		916.5		923.4		518.8		528.3	
p-values (Gibrat)	0.0000		0.0000				0.0000				0.0000				0.0000	
F-test (Country)			76.8				88.1				81.8				86.1	
F-test (Industry)			6.0				5.7				6.0				5.9	

Note: The dependent variable is $\Delta S_i(t)$, where S_i is the natural logarithm of firm employees.
Model 1: $\Delta S_i(t) = \alpha_0 + \beta_0 S_i(t-1) + \mu_i(t)$
Model 2: $\Delta S_i(t) = \alpha_0 + \alpha_1 X_i(t) + \beta_0 S_i(t-1) + \mu_i(t)$
Model 3: $\Delta S_i(t) = \alpha_0 + \beta_0 S_i(t-1) + \beta_1 Y_j(t-1)*S_i(t-1) + \mu_i(t)$
Model 4: $\Delta S_i(t) = \alpha_0 + \alpha_1 X_i(t) + \beta_0 S_i(t-1) + \beta_1 Y_j(t-1)*S_i(t-1) + \mu_i(t)$
Age is defined as the natural logarithm of the number of years since incorporation.
Sub is number of subsidiaries.
Div is number of 4-digit SIC industries the firm operates.
Rival growth is the growth of rivals in the same 3-digit industry.
Implied $S^*=\exp(-(\alpha_0 + \alpha_1 X_i)/(\beta_0 + \beta_1 Y_j))$, with X_i and Y_j evaluated at respective mean values.
F-test (Gibrat) is an F-test that all estimated coefficients are jointly zero.
p-values (Gibrat) are the probability levels attached to F-test (Gibrat).
F-test (Country) is an F-test that the 14 country fixed effects are jointly zero.
F-test (Industry) is an F-test that the 113 industry fixed effects are jointly zero.

Table 3: Growth rate regressions within industries and within countries
Panel A: Model selection

	Model 4 vs 3 Percent rejected	Model 4 vs 2 Percent rejected	Model 4 vs 1 Percent rejected
Austria	21.1	10.5	68.4
Belgium	59.7	44.8	74.6
Switzerland	61.5	53.8	76.9
Germany	50.9	40.7	64.8
Denmark	54.2	41.7	70.8
Spain	82.6	71.7	91.3
Finland	50.0	16.7	66.7
France	63.0	53.4	80.8
United Kingdom	55.4	38.0	85.9
Greece	63.2	52.6	89.5
Italy	64.8	42.0	83.0
Netherlands	65.5	48.3	89.7
Portugal	0.0	0.0	100.0
Sweden	59.2	53.1	83.7
Total	59.1	45.2	79.1

Note: Percent rejected means the percentage of industries in the depicted country where it would be an unduly simplification (at the 5% level) to reduce the model from the first mentioned to the second mentioned. The test used is the likelihood ratio test: twice the difference between the log likelihood of the restricted panel and the log likelihood from the unrestricted panel is distributed as chi-squared with degrees of freedom equal to the number of restrictions imposed.

Panel B: An analysis of variance of β and implied S* (Model 2) for 640 industry/country panels

	β	t-value	Implied S*
Mean	-0.050	-2.05	589
Median	-0.035	-1.83	364
Minimum	-0.559	-9.90	20
Maximum	0.176	3.53	480,327
Standard deviation	0.070	1.81	56,730
% between 113 industries	32.57%	36.94%	33.76%
% between 14 countries	42.76%	33.50%	18.90%

Note: Implied S* is from Model 2.

Table 4: Convergence clubs
Panel A: Industry types

Sample:	Homogenous good industries		Differentiated good industries		R&D intensive industries		Advertising intensive industries		R&D and advertising intensive industries	
	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
S(t-1)	-0.039	-46.55	-0.031	-37.21	-0.035	-31.64	-0.029	-12.16	-0.031	-13.88
Age	-0.007	-8.49	-0.007	-7.81	-0.009	-7.54	-0.004	-1.77	-0.007	-2.75
Sub	0.005	12.54	0.002	7.37	0.003	6.51	0.004	2.73	0.001	2.27
Div	0.001	1.79	0.000	-0.05	0.000	-0.66	0.006	3.26	0.000	-0.28
Rival growth	-0.006	-0.28	-0.060	-2.45	-0.009	-0.25	-0.172	-2.57	0.081	0.86
α_0	0.237	53.31	0.203	43.81	0.234	38.11	0.149	12.11	0.209	16.46
No. Obs.	55,656		45,728		28,304		6,488		4,992	
No. Firms	13,914		11,432		7,076		1,622		1,248	
No. Industries	50		41		21		12		8	
R^2	0.045		0.041		0.044		0.034		0.048	
Mean employees in 1994	333		687		654		553		1,045	
Implied S*:	429		684		855		181		873	
F-test (Gibrat)	484.5		328.5		240.6		34.0		46.1	
p-values (Gibrat)	0.0000		0.0000		0.0000		0.0000		0.0000	

Note: All regressions include industry fixed effects at the 3-digit level.
Davies and Lyons (1996) define an industry as R&D (advertising) intensive if the R&D (advertising) to Sales ratio is larger than 1%, and an industry as R&D and advertising intensive if both ratios are larger than 1%. Homogenous good industries are the rest. The total number of 3-digit industries where the Davies/Lyons (1996) classification is available is 91.
Implied $S^*=\exp(-(\alpha_0 + \alpha_1 X_i)/\beta_0)$, with X_i evaluated at respective mean values.
F-test (Gibrat) is an F-test that all estimated coefficients are jointly zero.
p-values (Gibrat) are the probability levels attached to F-test (Gibrat).

Panel B: Initial firm size

Sample:	Small firms		Large firms		Very Small firms		Very Large firms	
	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
S(t-1)	-0.053	-35.23	-0.017	-16.37	-0.078	-8.50	-0.014	-2.61
Age	-0.014	-15.52	-0.001	-1.36	-0.036	-7.71	0.002	0.56
Sub	0.004	4.00	0.001	5.35	0.015	2.18	0.001	2.75
Div	-0.001	-1.72	0.001	2.61	-0.002	-0.76	0.004	2.58
Rival growth	-0.022	-0.94	-0.037	-1.63	-0.009	-0.09	-0.248	-2.49
α_0	0.321	47.94	0.092	15.02	0.462	14.68	0.040	0.97
No. Obs.	50,808		51,536		5,096		5,060	
No. Firms	12,702		12,884		1,274		1,265	
No. Industries	113		113		107		97	
R^2	0.040		0.012		0.062		0.031	
Mean employees in 1994	70		923		25		6,157	
Implied S*:	409		249		384		18	
F-test (Gibrat)	317.1		55.8		25.7		4.5	
p-values (Gibrat)	0.0000		0.0000		0.0000		0.0004	

Note: The Small (Large) firm subsample includes firms that have less (more) employees than the median firm in 1994. The Very Small (Large) subsample includes those firms that are smaller (larger) than the 5% (95%) percentile cutoff point of the distribution of employees in 1994.
Implied $S^*=\exp(-(\alpha_0 + \alpha_1 X_i)/\beta_0)$, with X_i evaluated at respective mean values.
F-test (Gibrat) is an F-test that all estimated coefficients are jointly zero.
p-values (Gibrat) are the probability levels attached to F-test (Gibrat).

Panel C: Size, age, subsidiaries and diversification

Sample:	Small and young firms		Large and old firms		Firms without subsidiaries		Firms with subsidiaries		Undiversified firms		Diversified firms	
	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
S(t-1)	-0.128	-8.84	0.003	0.47	-0.041	-59.34	-0.021	-9.22	-0.045	-39.34	-0.031	-43.36
Age	-0.030	-2.02	0.003	0.13	-0.007	-11.37	-0.009	-3.28	-0.009	-8.38	-0.006	-8.28
Sub	-0.006	-0.35	-0.001	-1.51	---	---	0.001	1.53	0.004	6.80	0.003	10.53
Div	-0.006	-1.23	0.003	1.93	-0.001	-1.42	0.005	4.04	---	---	0.001	2.18
Rival growth	-0.018	-0.08	-0.018	-0.15	-0.009	-0.53	-0.164	-2.29	-0.030	-0.96	-0.038	-1.93
α_0	0.632	12.26	-0.074	-0.68	0.250	68.97	0.159	9.66	0.273	45.92	0.192	47.72
No. Obs.	1,800		2,776		86,252		6,152		32,964		66,724	
No. Firms	450		694		21,563		1,538		8,241		16,681	
No. Industries	87		92		113		103		111		113	
R^2	0.119		0.045		0.062		0.050		0.058		0.036	
Mean employees in 1994	30		576		227		2,016		275		602	
Implied S*:	141		---		455		1,821		1,821		527	
F-test (Gibrat)	17.0		1.19		988.7		23.1		428.5		428.3	
p-values (Gibrat)	0.0000		0.3129		0.0000		0.0000		0.0000		0.0000	

Note: The Small and young (Large and old) subsample includes firms that have less (more) employees than the 10% (90%) cutoff point of the distribution of employees in 1994 and are younger (older) than the 10% (90%) cutoff of the age distribution. The subsample Firms with(out) subsidiaries includes those firms that have (no) subsidiaries. The subsample (Un)diversified firms includes those firms that operate in (one) more than one 4-digit SIC industry.
Implied $S^*=\exp(-(\alpha_0 + \alpha_1 X_i)/\beta_0)$, with X_i evaluated at respective mean values.
F-test (Gibrat) is an F-test that all estimated coefficients are jointly zero.
p-values (Gibrat) are the probability levels attached to F-test (Gibrat).

Appendix: Table A1: Convergence regressions within countries across industries for Model 2

	Austria		Belgium		Switzerland		Germany		Denmark	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
S(t-1)	-0.038	-5.9	-0.023	-10.6	-0.012	-2.2	-0.036	-34.8	-0.042	-6.8
Age	0.001	0.2	-0.016	-7.2	-0.015	-3.4	-0.006	-6.7	-0.014	-3.1
Sub	0.008	1.0	0.000	0.5	0.001	1.7	0.002	4.3	0.009	2.3
Div	-0.003	-1.0	-0.002	-1.1	0.006	2.4	-0.001	-1.7	0.001	0.3
Rival growth	-0.168	-1.1	-0.049	-1.1	0.184	0.6	-0.022	-0.8	-0.066	-0.3
α_0	0.204	6.7	0.162	15.0	0.105	2.8	0.209	36.6	0.287	8.8
No. Obs.	1,044		6,032		624		36,032		1,536	
No. Firms	261		1,508		156		9,008		384	
R^2	0.068		0.061		0.086		0.043		0.051	
Implied S*:	195		435		1,719		259		666	
F-test (Gibrat)	8.45		44.16		4.4		271.4		12.44	
p-values (Gibrat)	0.0000		0.0000		0.0006		0.0000		0.0000	

	Spain		Finland		France		United Kingdom		Greece	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t	Coeff	t
S(t-1)	-0.146	-21.4	-0.042	-4.1	-0.026	-13.2	-0.032	-21.6	-0.054	-7.6
Age	0.004	0.5	-0.001	-0.1	-0.010	-4.7	-0.009	-6.3	-0.015	-2.4
Sub	0.010	3.2	0.008	3.5	0.001	1.5	0.008	12.0	0.017	2.9
Div	-0.002	-0.5	-0.007	-1.0	0.000	0.1	-0.002	-2.9	0.014	2.7
Rival growth	0.102	0.5	0.198	0.4	-0.024	-0.6	-0.094	-2.5	0.159	0.8
α_0	0.700	20.0	0.260	4.8	0.184	16.5	0.237	28.3	0.312	9.1
No. Obs.	3,036		528		7,812		18,216		1,044	
No. Firms	759		132		1,953		4,554		261	
R^2	0.160		0.097		0.046		0.047		0.117	
Implied S*:	126		372		635		1,115		421	
F-test (Gibrat)	99.31		5.35		47.07		126.51		19.1	
p-values (Gibrat)	0.0000		0.0001		0.0000		0.0000		0.0000	

	Italy		Netherlands		Portugal		Sweden	
	Coeff	t	Coeff	t	Coeff	t	Coeff	t
S(t-1)	-0.038	-26.4	-0.019	-3.7	-0.030	-1.4	-0.034	-11.9
Age	-0.016	-9.8	-0.005	-1.3	-0.018	-2.7	-0.013	-4.5
Sub	0.013	7.2	0.007	4.0	n.a.	n.a.	0.000	-0.3
Div	0.000	-0.2	-0.001	-0.3	-0.009	-0.9	0.000	-0.2
Rival growth	0.032	0.9	-0.012	-0.1	-0.065	-1.2	-0.083	-0.8
α_0	0.284	36.9	0.133	4.5	0.224	3.7	0.242	15.5
No. Obs.	19,008		1,568		52		4,852	
No. Firms	4,752		392		13		1,213	
R^2	0.051		0.045		0.253		0.082	
Implied S*:	1,027		1,258		299		631	
F-test (Gibrat)	173.05		4.26		3.99		39.42	
p-values (Gibrat)	0.0000		0.0008		0.0073		0.0000	

Implied $S^*=\exp(-(\alpha_0 + \alpha_1 X_i)/\beta_0)$, with X_i evaluated at respective mean values.

NOTES

[1] The potential benefits of the SMP are set out in the Cecchini Report (1988), which expected substantial improvements in supply-side conditions by increasing market access between countries. For recent ex-post evaluations, see European Economy (1996) and Botasso and Sembinelli (2001). The latter find that the SMP reduced market power and increased productivity for a panel of Italian firms. For an ex-ante analysis of the SMP effects, see Buigues et al. (1990).

[2] Much of the work in this literature has concentrated on identifying the determinants of S^*. For work on the effects of age, see Evans, 1987, Dunne and Hughes, 1994, Das, 1995, and many others. R&D expenditures (Hall, 1987; Liu, Tsou and Hammitt, 1999), mergers and acquisitions (Ijiri and Simon, 1974), and the internal organization of firms (Dunne, Roberts and Samuelson, 1989; Variyan and Kraybill, 1992) have also featured in this literature. For an alternative test of convergence, see Geroski et al, 2000, and for recent overviews of the literature, see Sutton, 1997, and Hart, 2000.

[3] This interpretation is fine if S^* does not move too much over time; however, if, for example, S^* trends, then S_i never catches up to it, meaning that adjustment is never complete. This is hardly a compelling specification, and a more reasonable approach is to suppose that firm i adjusts according to the rule : $\Delta S_i(t) = S_i^*(t) + \beta S_i(t-1) + \varphi \Delta S_i^*(t) + \mu_i(t)$; that is, to suppose that firm i not only tries to eliminate some part of the discrepancy between S and S^* in each period t, but also tries to anticipate movements in S^* and respond to them directly as they happen as well. As it happens, most of the variables that we will use to model S* do not have enough times series variations to implement this extension of (1).

[4] For work on β-convergence and the convergence club literature, see Barro and Sala-i-Martin (1995), Abramovitz (1986), Bernard and Jones (1996 a and b) and Dollar and Wolff (1988).

[5] The 14 countries in the sample are the EU-15, with the exceptions of Ireland and Luxembourg (for which there is no data) plus Switzerland.

[6] A rough indicator of the degree of implementation of the overall SMP is the share of measures actually transposed into national legal systems. Botasso and Sembenelli (2001) report that by mid-September 1996, Member States had transposed on average 92.9% of these measures, whereas at the end of 1992 the same figure was about 75%.

[7] We have thus 4 growth rate observations per firm in the balanced panel and more than 100,000 observations. Note that not all 113 industries are present for all countries. The *un*balanced panel comprises 65,000 firms and around 173,000 observations with an average of 3.1 growth rate observations per firm.

[8] Hence, if firm size measured by employment follows a random walk, it is likely to be true that this will apply as well to firm size as measured by turnover; if firm size measured by employment has (say) a moving average component, then it seems likely that this will be even more true of firm size as measured by assets.

[9] Ravenscraft and Scherer, 1987, obtain 7.54 4-digit FTC manufacturing categories for 471 large U.S. companies in the FTC's 1975 Line of Business Survey. Montgomery,1994, reports an average of 10.9 SIC codes for the Top 500 U.S. Public Companies in 1992. When we restrict our sample to the 500 largest European manufacturing companies in 1994, we obtain an average of 4.51 4-digit SIC industries. It appears, therefore, that U.S. manufacturing companies are more diversified than their European rivals.

[10] We report only the statistics about the balanced panel of firms as the properties of the whole (unbalanced) sample of 65,000 firms are very similar. For instance, the average (median) size of the companies in the whole sample is 486 (135) employees whereas it is 495 (140) in the sample of Table 1. Likewise, the average annual percentage growth rate of the number of employees for the whole sample is 2.65% whereas it is 2.78% for the balanced sample of Table 1. We have also replicated all the tests discussed in Section IV for the unbalanced sample. The differences are, however, minor and this makes us think that possible sample selection bias (the balanced panel is a sample of survivors) is unlikely to undermine the conclusions that we draw about convergence from the balanced panel.

[11] In principle, one could also assume that rival growth affects the speed of adjustment. However, we did not interact rival's growth with lagged size, since this gives rise to severe multi-collinearity problems.

[12] We present only the results for the balanced panel, since the results obtained with the unbalanced panel are virtually identical. For example, the β co-efficient for the balanced panel of Table 2 is -0.031 for Model 1 while this co-efficient is -0.033 for the unbalanced panel. Further, to preserve space we present only OLS estimates, however, we made a number of robustness checks. When estimating with 2SLS and instrumenting S(t-1) by S(t-2), the β co-efficient is -0.032 (t = - 11.7), virtually identical to the OLS estimate. When estimating with the method of Anderson and Hsiao (1982), i.e. first differencing to account for unobserved firm level heterogeneity and then instrumenting ΔS(t-1) by S(t-2), which is a valid instrument since it is correlated with ΔS(t-1) but uncorrelated with $\Delta\mu_i(t)$, we obtain a β co-efficient of -0.029 (t = - 10.7), only slightly lower than the OLS estimate. The Anderson and Hsiao (1982) estimator is consistent when $N \rightarrow \infty$ or $T \rightarrow \infty$ or both. All other results are qualitatively as well as quantitatively identical to those reported in the text.

[13] Compare this to Wernerfelt and Montgomery, 1988, who find that narrowly diversified firms do better than widely diversified firms in terms of Tobin's q. Schmalensee, 1985, argues that widely diversified firms are unable to transfer their competencies to different markets. For a discussion of possible determinants and effects of diversification, see Montgomery, 1994. For a life-cycle theory of the firm, see Mueller (1972).

[14] See Gugler, 2001, for a recent analysis of corporate governance and performance in Europe. While research on this topic is still in its infancy, results suggest that monitoring intensity is indeed higher when non-financial firms own and control other non-financial firms (i.e. organization in a pyramid or corporate group). However, there may be conflicts of interest between dispersed outside shareholders and inside large and controlling shareholders in corporate pyramids.

[15] Penrose, 1959, and Chandler, 1992, emphasize organizational capabilities as important determinants of firm performance. Nelson, 1991, has argued that "*...successful firms can be understood in terms of a hierarchy of practised organizational routines, which define lower order organizational skills and how these are co-ordinated, and higher order decision procedures for choosing what is to be done at lower levels*" (pp. 67-68).

[16] Davies and Lyons define an industry as R&D (advertising) intensive if the R&D (advertising) to sales ratio is larger than 1%, and an industry as R&D and advertising intensive if both ratios are larger than 1%. Homogenous good industries are the rest. For more details and for data and methodological problems see their Appendix 3.