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Journal of Banking & Finance 28 (2004) 1363–1383
Journal of BANKING & FINANCE
www.elsevier.com/locate/econbase

Cross-country comparisons of efficiency: Evidence from the UK and Italian investment firms

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Received 13 May 2002; accepted 26 March 2003

Abstract

This paper compares and reconciles two new methods for cross-country comparisons of the cost efficiency of UK and Italian investment firms over the period 1995–1998. It employs four different specifications of the stochastic frontier methodology, using a translog cost function in order to measure X-efficiency. The traditional common frontier reveals that Italian investment firms are nearly as efficient as UK firms. To overcome traditional limitations, two methods are used in this paper. They provide consistent results. The first method shows differences between the efficiency of the two countries by incorporating environmental variables into the cross-country common frontier. The second method shows differences in the efficiency of the domestic versus foreign investment firms in the two countries, by testing the ability to monitor and control on a cross-border basis. Finally, to identify investment firms that are both cost and profit efficient, we undertake a profitability test.

JEL classification: D5; G24; G28
Keywords: Investment firms; Cross-country comparison; Cost efficiency; Profitability

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0378-4266/$ - see front matter
doi:10.1016/S0378-4266(03)00123-7

1. Introduction

The efficiency of European investment firms [1] is an important issue currently, given their increasing importance in the financial industry and their links with the efficiency of stock markets. Heterogeneity across countries predominates, despite a common regulatory definition. This suggests that consideration should be given to the appropriate methodological framework for efficiency comparisons. Traditionally, the assumption is that cross-country efficiency differences are determined by structural characteristics (see, for a comprehensive survey, Berger and Humphrey, 1997). Although these studies are informative, they do not allow an evaluation of efficiency across countries.

The main aim of this study is to use two new frameworks for addressing this issue. First, it is suggested that the environments faced by investment firms differ across countries in important ways such as type of regulation, supervision, technology and competition. To examine the extent to which country-specific factors may explain efficiency differences (see for instance Dietsch and Lozano-Vivas, 2000), we integrate an institutional perspective into the microeconomic efficiency model. An expanded model is proposed which incorporates structural, institutional and interpretational factors within the definition of a common stochastic frontier (Battese and Coelli, 1995). Second, even if all of the environmental differences do not exist or are well controlled for, the efficiency of institutions within their own country can differ from their efficiency as foreign entities in other countries. To test the ability of investment firms to control and monitor on a cross-border basis (Berger et al., 2000), we analyse separately foreign and domestic firms in different countries. These two methods – on the base of different perspectives – overcome the limits of the traditional methodology, in so far as they allow more appropriate cross-country estimates.

This paper makes two main contributions to the literature. First, it aims to extend the established banking literature by investigating the X-efficiency of a new industry. The dataset refers to UK and Italian investment firms over the period 1995–1998. Second, the cross-country comparison of X-efficiency proposed here is a new attempt to compare and reconcile these two methods, which control respectively for the embeddedness of the industry within the institutional environment, and for the ability of firms to operate and monitor across borders.

The empirical results demonstrate the consistency of the two methods used in this paper, and how they overcome traditional limitations. The traditional common cost frontier for both the UK and Italy, comparing efficiency levels for the two countries, reveals that Italian investment firms are nearly as efficient as UK firms. Nevertheless, the common cost frontier that incorporates environmental variables in addition to structural factors suggests that the UK industry is significantly more efficient than

[1] In this study, investment firms are defined as EU non-bank firms (constituted as companies) performing dealing, brokerage and portfolio management. Given the existence of several heterogeneous institutions offering investment services, the industry is defined in accordance with the Directive 93/22/EU.

its Italian counterpart (reflecting the same structural differences tested using separate cost frontiers). Accordingly, the average efficiency of UK domestic firms is significantly greater than the average efficiency for all foreign firms operating in the UK, and UK firms are more efficient than Italian firms where ever they compete with them (both at home in the UK and abroad in Italy).

The paper is organised as follows. Section 2 reviews the existing literature, emphasising the particular characteristics of investment firms and the comparative perspective of this study. Section 3 considers the methodological issues concerning the measurement of cross-country X-efficiency and its determinants. Section 4 presents the empirical results and Section 5 concludes.

2. Literature and motivations

The efficiency of investment firms is of interest for two reasons. First, as widely acknowledged, the share of assets held by banks is declining, and the proportion of financial assets held by non-bank intermediaries (pension funds, trust and investment firms) has grown (Allen and Santomero, 2001). Second, investment firms are the main non-bank institutions affecting the efficiency of stock markets. The ability of investment firms to minimise costs implies that they have the ability to operate and prosper by applying zero or low commissions to their clients. By benefiting from the efficiency of investment firms, investors increase their traded volumes in the stock markets. The increased efficiency of investment firms is generally associated with an increase in the efficiency of stock markets.

There is surprisingly little empirical evidence with regard to the efficiency of investment firms (Goldberg et al., 1991; Bianchi et al., 1996; Anolli and Resti, 1996). The literature review conducted by Berger and Humphrey (1997) cites no studies on investment firms. This is due in part to the difficulties of modelling successfully the peculiar nature of their production process (mainly in terms of the identification of variables that accurately represent the activities of firms), and in part to the lack of good quality data for researchers.

Furthermore, the handful of studies that have examined the efficiency of investment firms focuses solely on the issue of scale and scope economies in the industry (the only exception is Anolli and Resti (1996), who consider X-efficiency). Overall, the main findings suggest positive scale economies (generally higher for small sized firms) and no significant scope economies. In accordance with the recent banking literature (Goddard et al., 2001; Berger et al., 1993), this paper argues that the efficiency of investment firms may be better characterised considering X-efficiency, or deviations from the efficient frontier (Leibenstein, 1966, 1980). X-efficiency appears a much more relevant source of differentiation. The novelty of this paper is to redress the lack of investigation into the X-efficiency of investment firms, and to develop the preliminary approach suggested by Anolli and Resti (1996). Employing a quadratic function (simpler than the translog form used in our study), and referring only to Italian firms in 1993, their results reveal higher X-inefficiency for smaller firms, and no influence on X-efficiency arising from the nature of the investment firm (bank or non-bank).

A further motivation for this study stems from the recent interest in comparisons of banking efficiency (Berger and Humphrey, 1997). This further highlights the lack of any prior research in a comparative perspective on investment firms. From a European perspective, this increasing interest in investment firms can be attributed in part to attempts to deregulate the financial sector (Molyneux et al., 1996), and also to the harmonisation process which is contributing to the creation of a more integrated and harmonised financial market (Berg et al., 1993; Fetcher and Pestieau, 1993; Bergendahl, 1995; Ruthenberg and Elias, 1996; Pastor et al., 1997).

Our selection of two polarised systems at the European level – UK and Italy – is designed to allow an investigation of the impact of structural and environmental differences on efficiency. First, in terms of structural characteristics, these two national industries typify the different models existing in Europe: the Anglo-Saxon model (with larger and diversified investment firms), and the continental European one (dominated by smaller and more specialised institutions). Second, the historical evolution of the two national industries is markedly different. As a consequence of Directive 93/22/EU harmonizing the securities industry, in the early 1990s the Italian industry has experienced a deep regulatory and structural transformation, which has included modified legal framework, increased merger activities and greater competition. This contrasts with the more stable regulatory, structural and institutional environment faced by UK firms. Understanding the reasons for persistent structural and environmental differences among these national industries (in relation to X-efficiency levels) is crucial for evaluating their changing operating environment and the public polices applied to the sector (Berger and Humphrey, 1997). The comparative analysis not only provides information about the relative efficiency and competitiveness of institutions operating in different environments, but also aids our understanding of the reasons for the persistence of different structural characteristics despite regulatory harmonisation.

Our primary objective is to identify a framework for comparing the efficiency of national industries. Two recent methods are adopted. The first accounts for differences arising from country-specific aspects of technology, environment and regulatory conditions. This approach takes into account the influence of environmental factors on the industry, enabling the researcher to capture the impact of the environment in the cross-country X-efficiency comparison (Dietsch and Lozano-Vivas, 2000) by including indicators of these (environmental) factors in a more comprehensive definition of a common frontier (Battese and Coelli, 1995). The motivation for identifying environmental variables is to allow us to incorporate institutional arguments into the econometric model. The second method (Berger et al., 2000) analyses cross-border X-efficiency by conducting completely separate analyses of foreign and domestic institutions located in different countries. This avoids the problem of controlling for all environmental variables, since all the institutions face essentially the same environmental conditions. Moreover, it provides evidence of the extent to which institutions are able to monitor and control operations on a cross-border basis, since the efficiency of institutions within their own border may not be representative of how well they may perform as foreign entities in another nation.

Furthermore, according to recent studies of environmental differences, we have taken the specification of environmental variables in the efficiency measurement further by evaluating the effects of environmental factors on measured efficiency. To address the limitation of a partial control for environmental differences, we employ the institutional perspective to allow us to categorise the exogenous environmental determinants of X-efficiency. In particular, structural, institutional and interpretation categories are coded (by adapting Fligstein, 1991). Structural variables refer to the characteristics of the investment firms' industry in terms of activities performed and size, which are captured by the industry's profitability. Institutionalisation refers to forces that may impose (or at least influence) the structure of the industry, such as the amount of supervisory and regulatory intervention, the intensity of competition among firms, the economic conditions, and the capital market development. Interpretation refers to the way in which structural and institutional factors are influenced by nationally specific cultural perceptions, as represented by variations in the quality of regulation and supervision. Although interpretation is a crucial variable influencing and biasing the structural and institutional aspects, to date it has not been included (and modelled) in efficiency studies.

Finally, in so far as cost minimisation is the critical issue for the management of investment firms in our paper, a possible limitation that follows is that the neglect of revenues may be misleading. A seemingly cost inefficient firm might be offsetting higher expenses with higher revenues. However, it is difficult to specify profit functions for financial institutions because good data for output prices are not generally available. To test whether we are losing important efficiency information by analysing costs instead of profits, we compare our cost efficiency results to accounting ROA (return on assets) in a procedure similar to that used by Spong et al. (1995).

This paper contributes to the efficiency literature by investigating the X-efficiency of a new industry – investment firms – in a comparative perspective. This is the first cross-country comparison of investment firms' efficiency by using two alternative methods. First, we control for environmental differences across countries by integrating environmental variables into the definition of the common frontier. Second, we compare the X-efficiency of foreign versus domestic institutions operating within the borders of different home countries. This constitutes also the first profitability test of the industry.

3. Methodology

Our study uses a variety of ways to specify the stochastic frontier approach to model cost efficiency. An investment firm is identified as inefficient if its costs are higher than those predicted for an efficient firm producing the same input/output combination, and if the difference cannot be explained by statistical noise. In particular, we estimate separate cost frontiers for the UK and Italy, and then compare these results with those derived from a sample combining the two industries. This has traditionally been used for comparisons of cost efficiencies between national institutions and for comparisons across countries (see Berg et al., 1993; Cebenoyan et al., 1993;

Fetcher and Pestieau, 1993; Mester, 1993; Bergendahl, 1995; Ruthenberg and Elias, 1996; Pastor et al., 1997; Altunbas et al., 2001). Moreover, in order to cope with differences arising from country-specific aspects (Dietsch and Lozano-Vivas, 2000), we propose an extended model including environmental variables in a more comprehensive definition of a common frontier. Finally, to avoid the econometric problems of controlling for all the environmental differences, we examine the efficiency of foreign and domestic investment firms in the two home countries to test their ability to operate across borders (Berger et al., 2000).

We first specify separate stochastic cost functions for each country, to verify whether or not structural variables are the same in the two national industries. Following Aigner et al. (1977), the single-equation stochastic cost function model can be expressed as

$$\mathrm{TC}_i = x_i\beta + u_i + v_i, \tag{1}$$

where TC_i is the logarithm of the total cost; x_i is a vector of input prices and output; β is a vector of unknown parameters, which can be estimated using the maximum likelihood method (Olson et al., 1980). v_i is a two-sided error term representing statistical noise, and u_i is a one-sided error term representing inefficiency. The v_i are assumed to be independently and identically distributed, and the u_i are assumed to be distributed independently of the v_i. Here, it is assumed that the v_i are normally distributed with zero mean and variance σ^2, and the u_i are either half normally or truncated normally distributed. [2]

Firm-specific estimates of technical inefficiency, u_i, can be calculated by using the distribution of the inefficiency term conditional on the estimate of the composed error term, ε_i (Jondrow et al., 1982). The mean of this conditional distribution for the half normal model is shown as

$$E(u_i/\varepsilon_i) = \frac{\sigma\lambda}{1+\lambda^2}\left[\frac{f(\varepsilon_i\lambda/\sigma)}{1-F(\varepsilon_i\lambda/\sigma)} + \left(\frac{\varepsilon_i\lambda}{\sigma}\right)\right], \tag{2}$$

where $F(\cdot)$ and $f(\cdot)$ are respectively the standard normal distribution and the standard normal density function. $E(u/\varepsilon)$ is an unbiased but inconsistent estimator of u_i (see Greene, 1993, pp. 80–82). The ratio of variability (standard deviation, σ) for u and v can be used to measure the relative inefficiency of a firm, where $\lambda = \sigma_u/\sigma_v$ is a measure of the amount of variation stemming from inefficiency relative to noise for the sample (Jondrow et al., 1982).

Here the functional form for the cost frontier is a full translog, [3] which can be written as

[2] To check the robustness of the efficiency results to the half normal distribution for u_i, we investigate an alternative, that is the truncated normal (Stevenson, 1980). It is obtained by the truncation at zero of the normal distribution with mean, μ, and variance σ^2.

[3] Although there is evidence that the translog can provide a poor fit for observations that are far from the means of the data (see Mitchell and Onvural, 1996), we could not specify a Fourier flexible form for Italian investment firms because of the small size of the industry, which implies too few observations. Nevertheless, Berger and Mester (1997) found that the translog and the Fourier flexible form yield a small difference in average efficiencies, and very little difference in efficiency dispersion or rank of the individual banks.

$$\ln TC = \alpha_0 + \sum_{i=1}^{m} \alpha_i \ln Q_i + \sum_{i=1}^{n} \beta_j \ln P_j + \frac{1}{2}\left[\sum_{i=1}^{m}\sum_{j=1}^{m} \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} \ln P_i \ln P_j + \tau \ln K \ln K\right] + \sum_{i=1}^{n}\sum_{j=1}^{m} \rho_{ij} \ln P_j \ln Q_i + \sum_{i=1}^{m} \alpha_{ik} \ln Q_i \ln K + \sum_{j=1}^{m} \beta_{jk} \ln P_j \ln K + \varepsilon_i, \quad (3)$$

where TC is the cost of production (excluding financial costs), P_j $(j = 1, 2)$ are input prices, K is the financial capital and Q_i are output quantities. α, β, γ, δ and ρ are the coefficients to be estimated. Standard symmetry and input price homogeneity constraints are imposed on the total cost function (3).

The single cost frontiers are estimated here by using the random effects panel data approach (see Baltagi and Griffin (1998) and Cornwell et al. (1990) for the advantages of the panel data approach). In particular, we use a time-varying model for the technical inefficiency effects in the stochastic frontier function for panel data (Battese and Coelli, 1992).

We also subject our cost efficiency measures to a profitability test (Spong et al., 1995). The idea is to split investment firms into two categories: "most efficient" firms (firms that rank in the upper quartile of cost efficiency and in the upper half of ROA) and "least efficient" firms (bottom quartile of cost efficiency and bottom half of ROA). It follows that only firms which do well on both cost efficiency and profitability typify the efficient firms.

We then specify a common stochastic frontier, including only endogenous structural variables, to compare the efficiency scores of investment firms from the two countries. This model has two limitations. First, it is based on the assumption that cross-country efficiency differences are mainly attributable to managerial decisions within investment firms. However, the environments faced by investment firms differ systematically across nations in important ways, and this can explain the differences in efficiency. Second, the test of the efficiency determinants follows the two-stage procedure as suggested by Mester (1993, 1996). Firm efficiency – predicted using this traditional model – is then simply regressed on, or tested for correlation with, a set of variables describing the aspects under investigation. Although this has long been considered a useful exercise, this approach is also subject to various methodological limitations (see Berger and Mester, 1997).

In order to deal with these limitations, we adopt a common frontier for the two industries that also includes exogenous environmental variables. This model offers several interesting methodological challenges. First, it controls for environmental differences across countries and investigates the effects of these variables on measured efficiency. Second, it alleviates several of the anomalies present in the aforementioned two-stage approach. This methodology essentially allows for a firm-specific and time-varying intercept shift in the distribution of the inefficiency term, and this intercept shift is itself a function of the exogenous environmental variables that vary across countries. The model can be expressed as (Battese and Coelli, 1995)

$$TC_i = \exp(x_i\beta + v_i + U_i), \tag{4}$$

where TC_i, x_i, β and v_i are defined as in Eq. (1); while U_i is obtained by truncation (at zero) of the normal distribution $N(m_i, \sigma_i^2)$, or rather with mean, $Z_i\delta$, and variance σ^2; Z_i is a vector of firm-specific variables that are allowed to vary over time; δ is a vector of unknown coefficients of the firm-specific inefficiency variables.

The inefficiency effects – U_i – in Eq. (4) can be specified as

$$U_i = Z_i\delta + W_i, \tag{5}$$

where W_i are assumed to be not identically distributed and independent truncations of the normal distribution with zero mean and variance, σ^2, such that the point of truncation is $-Z_i\delta$. On the basis of Eq. (4), cost efficiency is defined as

$$TE_i = \exp(-U_i) = \exp(-Z_i\delta - W_i). \tag{6}$$

Although the Battese and Coelli (1995) method has the potential to make better efficiency comparisons across countries, it still has some limitations. First, it is based on the assumption that the basic cost function parameters are identical for both countries. Note that the single-country frontiers do not suffer from this weakness. Second, it is difficult to control for all the environmental differences across countries.

To overcome these limitations, we test here an alternative method (Berger et al., 2000). This compares the X-efficiency of foreign versus domestic institutions operating in different home countries (rather than one), by distinguishing the nations of origin of foreign institutions. The aim is to test the home field advantage and the global advantage hypothesis. [4] The separate analysis of institutions located in different countries, achieved by using separate frontiers (Battese and Coelli, 1992), avoids the above econometric problems.

4. Data and variables

To define input and output, the data are derived from financial statements collected by the Italian Associazione Intermediari Mobiliari, and from the UK database FAME (Financial Analysis Made Easy). The sample consists of 190 observations for Italy and 928 observations for the UK over the period 1995–1998. It constitutes more than 80% of the industry in terms of market share.

The identification of the most appropriate inputs and outputs for investment firms – that differ from those in commercial banking – requires the appropriate extension of the model to a new industry. We assume that the institutions use labour and physical capital inputs to produce earning assets. Owing to the lack of data for the UK, we use just one output, represented by total earning assets from ordinary financial statement (debtors plus bank deposits, which on average represents around

[4] Under the home field advantage, domestic institutions are more efficient than foreign institutions. Under the global advantage hypothesis, some efficiently managed foreign institutions operate more efficiently than the domestic institutions. Berger et al. (2000) consider two forms of global advantage: the general and the limited form.

65% of the total assets). This output accounts for all of an investment firm's earning assets. In addition, the test for Italy of the consistency conditions among single- and multiple-output sets is positive. [5] The inputs (whose prices are used to estimate the cost frontier) include labour and physical capital. Finally, to account for risk, the quality of outputs is proxied by the volume of equity capital (as suggested by Mester (1996); and confirmed by Altunbas et al. (2000)). Table 1 provides the descriptive statistics for the input, output and control variables for 1998.

The exogenous environmental determinants of X-efficiency are proxied here by structural, institutional and interpretation categories. Table 2 sets out their definitions and statistics separately for the UK and Italy. The first category is measured as the profitability ratio (return on equity) of the industry of investment firms per country. This could be either positively or negatively related to cost efficiency.

The second category, institutionalisation, includes stock market performance, number of domestic companies, ownership, legal reserves, accounting standards, inward and outward. Stock market performance mainly influences the profitability ratios of investment firms, due to increase in commissions (higher investors' demand in the bullish market) and improvement in profits arising from direct investments in the financial markets by investment firms. The number of domestic companies is not just a pure scale measure, but represents the opportunity for diversification offered by the market to the clients of investment firms. It is expected to positively affect cost efficiency. A large ownership concentration, on the one hand, is associated with few investor rights (and implies unattractiveness to small shareholders). On the other hand, a large ownership concentration is a desirable structural firm characteristic, since large shareholders might monitor managers and increase the value of the firm (Shleifer and Vishny, 1986). It is expected that this would have a negative impact on cost efficiency. The legal reserve of all the national industries (not only the financial one) measures, on the one hand, the protection accorded to creditors in a firm's *status* in which they have few other powers; and, on the other, the burden for investment firms (in which case, it is expected to have a positive relation with cost inefficiency). Accounting standards play a critical role in corporate governance (in so far as choices/burdens of firms are driven by accounting concerns) and investment decisions. Accounting standards could be either positively or negatively related to cost efficiency. 'Inward' and 'outward' represent the degrees of internationalisation of a national financial industry, and refer to direct investment from abroad (and

[5] As there is no agreement on the definition of outputs within the few studies conducted to date on investment firms, we test several consistency conditions – in efficiency levels, ranking and identification of the best/worst firms as proposed by Bauer et al. (1998) – among single- and multiple-output sets for Italy. These sets include: volumes of activities performed (dealing, brokerage and portfolio management); revenues from activities performed; and total earning assets from financial statements. The test of the consistency conditions is positive. Results are reasonably close to one another in terms of panel level, and do not vary much over time even when data for separate years are used. The peculiar nature of the production process of investment firms can be captured well by earning assets. The easier availability of this data can increase the interest of further researchers towards this industry.

Table 1
Descriptive statistics of outputs, inputs and control variables, 1998

Variable		Mean	Median	Std Dev	Min	Max
Single frontier sample, Italy[a]						
TC	Total costs	16,880,051	15,217,939	13,503,816	1,381,469	72,361,041
P_1	Price of labour[b]	197,493	153,523	138,263	54,750	686,447
P_2	Price of physical capital[c]	5.6613	4.6552	4.0840	0.5133	19.1598
Q_1	Debtors + deposit	252,378,487	37,457,082	536,977,141	106,703	2,734,641,899
K	Capital	26,232,622	17,991,118	21,191,010	2,232,090	96,171,920
Single frontier sample, UK[d]						
TC	Total costs	932394.38	232414.00	1760799.42	158.00	12204792.00
P_1	Price of labour[b]	46419.67	26989.93	64896.48	16.29	467432.33
P_2	Price of physical capital[c]	15.51	0.62	66.97	0.01	836.39
Q_1	Debtors + deposit	873576.30	200051.00	1620589.76	1.00	9567098.00
K	Capital	465718.87	157396.00	649373.32	229.00	2672329.00
Common frontier sample[e]						
TC	Total costs	2,071,635.05	294,483.92	4,851,374.23	94.98	43,772,936.30
P_1	Price of labour[b]	42,242.19	28,053.30	58,891.86	9.79	415,248.66
P_2	Price of physical capital[c]	7.86	0.27	37.11	0.00	502.79
Q_1	Debtors + deposit	444,554.82	49,480.01	913,938.90	0.00	5,751,186.05
K	Capital	24,141,720.87	170,210.40	138,859,804.81	137.66	1,654,250,740.43

[a] Values in thousands of Italian lira.
[b] P_1 = Total labour costs/number of employees.
[c] P_2 = Operating expenses less labour and interest expenses/total fixed assets. Total number of firms for 1998: Italy = 44, UK = 237, common sample = 281. Total observations over 1995–1998: Italy = 190, UK = 928, common sample = 1118. Total number firms over 1995–1998: Italy = 62, UK = 308, common sample = 370.
[d] Values in thousands of pounds.
[e] Values in thousands of US dollars.

direct investment abroad) in financial activities. These are expected to have – respectively – a positive and negative relationship with cost inefficiency.

The third category, interpretation, refers to the historical background of the financial system. By definition, this is difficult to measure as it does not simply represent the amount of legal requirements but also their implementation (thus their quality). However, the inclusion of this category opens a new agenda in the measurement of an industry's embeddedness. Our choice has been to refer to shareholder rights and law enforcement (as quantified by LaPorta et al., 1998). They are both expected to be positively related to cost efficiency. The more the financial system is oriented to attribute

Table 2
Exogenous environmental variables employed as determinants of efficiency

	1998		1997		1996		1995	
	UK	Italy	UK	Italy	UK	Italy	UK	Italy
Structure								
ROE national industry	0.2436	0.3814	0.1598	0.1543	0.1706	0.0434	0.0741	0.0420
Institutionalisation								
Market performance[a]	0.158	0.512	0.199	0.360	0.233	0.108	−0.047	−0.069
Number of domestic listed companies (ln)[a]	7.7828	5.7683	7.6236	5.4596	7.7969	5.4972	7.6392	5.5215
Legal reserve[b]	0	0.2	0	0.2	0	0.2	0	0.2
Ownership[b]	0.220	0.580	0.220	0.580	0.220	0.580	0.220	0.580
Accounting standards[b]	78	62	78	62	78	62	78	62
Inward (ln ml $)[c]	10.3018	10.5905	10.1065	10.3887	9.9436	10.2966	9.7936	10.1547
Outward (ln ml $)[c]	10.4064	11.049	10.2096	10.8467	9.91246	10.6860	9.9350	10.5934
Interpretation								
Shareholder' rights[b]	4	0	4	0	4	0	4	0
Law enforcement[b]	47.010	39.730	47.010	39.730	47.010	39.730	47.010	39.730

ROE national industry is defined as income after tax as a percentage of equity (referred to the national industry). Stock market performance is based on local stock exchange index results, converted into US dollar. Number of domestic listed companies refers to the number of domestic companies, excluding investment companies. Inward expresses direct investment from abroad in financial activities, while outward represents direct investment abroad. Legal reserve represents the minimum percentage of total share capital required by corporate law. Ownership refers to the percentage of common shares owned by the three largest shareholders in the ten largest (by market capitalisation) non-financial domestic public traded companies. Accounting standards represents an index created by rating companies' 1990 annual reports on their inclusion or omission of 90 items. Shareholder's rights is measured by voting procedures, considering the number of votes for share, and anti-director rights. Law enforcement is measured by efficiency of the juridical system, rule of law, corruption, risk of expropriation by government and likelihood of contract repudiation by the government.

[a] From IFC (1999), Emerging Stock Markets Factbook.

[b] From LaPorta et al. (1998).

[c] From OECD (1999), International Direct Investment Statistics Yearbook.

rights to shareholders and to enforce the law, the higher is the willingness of the public to invest and the lower are the financial and operating costs that investment firms have to sustain in order to attract customers (and provide their services).

5. Empirical results

5.1. Separate cost frontiers

The national X-efficiency results based on separate cost frontiers estimated as a panel indicate the existence of structural differences between the two polarised industries at the European level. The evolution over time of the X-efficiency scores (Table 3) shows a low and decreasing trend for Italy (from 0.46 to 0.44 assuming

Table 3
X-efficiency estimates for the UK and Italy, 1995–1998

Year	Firms	Half normal					Truncated				
		Mean	Median	Std Dev	Min	Max	Mean	Median	Std Dev	Min	Max
UK											
Panel	928	0.7104	0.7101	0.1476	0.3488	0.9798	0.5943	0.5800	0.1305	0.3082	0.9682
1998	237	0.7076	0.7080	0.1498	0.3395	0.9797	0.6029	0.5936	0.1324	0.3058	0.9710
1997	254	0.7078	0.7090	0.1477	0.3458	0.9800	0.6034	0.5960	0.1309	0.3107	0.9714
1996	230	0.7119	0.7103	0.1467	0.3521	0.9751	0.6078	0.5976	0.1311	0.3155	0.9638
1995	207	0.7086	0.7088	0.1386	0.3584	0.9756	0.6054	0.5954	0.1245	0.3203	0.9643
Italy											
Panel	190	0.5843	0.5703	0.1817	0.2237	0.9457	0.4430	0.4166	0.1688	0.1632	0.9105
1998	44	0.5776	0.5604	0.1957	0.1856	0.9444	0.4441	0.4124	0.1749	0.1501	0.9066
1997	48	0.5855	0.5652	0.1904	0.2076	0.9480	0.4458	0.4154	0.1751	0.1582	0.9091
1996	49	0.6020	0.5823	0.1904	0.2304	0.9514	0.4581	0.4295	0.1792	0.1664	0.9115
1995	49	0.6121	0.5845	0.1872	0.2540	0.9546	0.4632	0.4241	0.1797	0.1748	0.9139

Separate cost frontiers. Half normal distribution and truncated distribution.

Table 4
Profitability test for the UK and Italian investment firms' industry

Year	Least efficient			Most efficient		
	Number	Cost efficiency	ROA	Number	Cost efficiency	ROA
UK						
Mean	52	0.5092	−0.0609	42	0.8002	0.4226
1998	41	0.5013	−0.0784	33	0.9017	0.3797
1997	44	0.5045	−0.0688	37	0.8962	0.3343
1996	40	0.5134	−0.0722	32	0.9039	0.3057
1995	31	0.5246	−0.0858	22	0.9004	0.2874
Italy						
Mean	5	0.3634	0.0004	6	0.8223	0.0511
1998	2	0.3164	0.0193	5	0.8397	0.0893
1997	3	0.3620	−0.0066	3	0.8041	0.0607
1996	5	0.3741	−0.0556	4	0.8656	0.0276
1995	7	0.3992	0.0008	6	0.8615	0.0742

the truncated distribution) and a medium/high and nearly steady trend over time for the UK (around 0.60 assuming the truncated distribution). [6] A possible explanation is related to the differentiation of the effects of the Directive 93/22/EU on national industries: the Directive, mainly reflecting the structure of the Anglo-Saxon model, has had little impact on UK firms, and a greater influence on countries characterised by a different financial system and regulatory framework.

To evaluate the ability of firms to use their resources and skills effectively to generate income, we perform a profitability test. The traditional performance evaluation reveals trend for ROA to increase over time for UK and Italian firms (Table 4). The profitability test suggests a divergence in cost efficiency and profitability for the Italian industry. The dominant explanatory hypotheses are, on the one hand, the growth rate of financial markets (and the associated profits), which help to explain the increase in profitability for Italian firms; and, on the other hand, the peculiar revenue composition (absolute dominance of the brokerage activity), which does not enable Italian firms to benefit from the advantages associated with diversification, acting primarily on the cost side. The Italian case can be fully understood only if the revenue side is not neglected. Referring to the UK industry, the increase in profitability ratios (associated with a constant cost efficiency over the four years) suggests that considering only the cost side would not distort the interpretation of the industry efficiency; the most profitable firms are the least cost inefficient (and the least profitable, the most cost inefficient as well). We conclude from these tests that cost efficiency is an adequate measure of the overall efficiency of these firms.

[6] As expected, lower efficiency levels are obtained using the truncated distribution, notwithstanding similar national pictures emerge considering the two distributions. Nevertheless, the Mann–Whitney test for difference of the medians shows that the truncated normal distribution is more appropriate.

5.2. Common cost frontier without exogenous environmental variables

We now propose a common frontier, built by pooling data for the UK and Italian firms, containing only structural firm variables. Our aim here is to compare, in the traditional way, cross-country efficiency. The efficiency levels for each country are summarised in Table 5.

The UK firms average an efficiency score very close to that of the Italian industry: a mean over the four years of 0.65 against a 0.63. This result is remarkably different from the one obtained by referring to separate frontiers: the previous evidence of strong structural differences between the two industries contrasts sharply with this similarity in the efficiency levels. The divergence in these findings emphasises that traditional comparative efficiency studies using a common frontier – without environmental variables – provide only a partial explanation, as the impact of the exogenous variables is not taken into account.

5.3. Common cost frontier with exogenous environmental variables

In order to properly compare national efficiency levels by considering the embeddedness of the structural firm characteristics in the environment in which organisations operate, our attempt is to jointly consider structural, institutional and interpretational variables in the common frontier. Country-specific correlates to X-efficiency are taken into account in the frontier specification. The aim is to verify whether the absence of efficiency differentiation between the two countries – measured by a common frontier without environmental variables – is due to a misspecification of the frontier. The estimated common frontier including environmental variables provides several relevant results (Table 6).

First, UK investment firms are more efficient than Italian firms. The UK industry averages an efficiency score of 91%, the Italian one of 79%. [7]

The other relevant finding here is that the efficiency level of investment firms improves in each country when environmental variables are taken into account in the common frontier definition (as shown by the comparison of Tables 5 and 6). The change determined by the inclusion of environmental variables is not just related to the level, but also to the magnitude of the difference in the X-efficiency of the two industries. Considering just endogenous structural variables, X-efficiency shows a substantial equality in Italy and the UK; however, a remarkable differentiation appears if one takes into account the environment in which investment firms are embedded. These results confirm the relevance of environmental variables in explaining differences in efficiency across countries.

[7] We found large, positive, and significant rank order correlation between the single frontier and the common frontier for both the UK and Italy. This suggests that the efficiency ordering generated by the single frontier is consistent with the efficiency ordering generated by the common frontier. In addition, we found non-significant rank order correlation between common frontiers with and without environmental variables. This implies that the new methodology is returning a different result than the standard method.

Table 5
X-efficiency estimates for the UK and Italy, 1995–1998 (common cost frontiers without exogenous environmental variables)

Year	Firms	Mean	Median	Std Dev	Min	Max
UK						
1998	237	0.6501	0.6463	0.1426	0.3171	0.9638
1997	254	0.6533	0.6488	0.1398	0.3255	0.9646
1996	230	0.6595	0.6542	0.1384	0.3340	0.9574
1995	207	0.6584	0.6553	0.1314	0.3425	0.9584
Italy						
1998	44	0.6382	0.5710	0.2354	0.2053	0.9803
1997	48	0.6276	0.5739	0.2318	0.2129	0.9808
1996	49	0.6338	0.5862	0.2288	0.2205	0.9812
1995	49	0.6422	0.6073	0.2339	0.2283	0.9816

Table 6
X-efficiency estimates for the UK and Italy, 1995–1998 (common cost frontiers with exogenous environmental variables)

Year	Firms	Mean	Median	Std Dev	Min	Max
UK						
1998	237	0.9172	0.9208	0.0181	0.8521	0.9577
1997	254	0.9225	0.9262	0.0163	0.8225	0.9555
1996	230	0.9271	0.9282	0.0123	0.8808	0.9546
1995	207	0.9275	0.9289	0.0125	0.8790	0.9533
Italy						
1998	44	0.7806	0.7901	0.1300	0.4170	0.9444
1997	48	0.8186	0.8451	0.0953	0.5985	0.9562
1996	49	0.8333	0.8629	0.0865	0.5333	0.9470
1995	49	0.8101	0.8378	0.1078	0.4956	0.9454

Finally, given our findings regarding the relevance of environmental variables in defining the efficiency of a national industry, we observe that improvements in X-efficiency levels have been higher for firms operating in a field having more favourable conditions.

The previous results emphasise the importance of including environmental variables in the traditional cost frontier model using only endogenous structural variables. Institutional and interpretational variables play an important role in determining the efficiency level of each firm. Only the combination of structural characteristics and environmental ones allows us to capture the industry efficiency and explain national differences.

5.4. Home field advantage versus global advantage hypothesis

In order to undertake an efficiency comparison from a different perspective, we adopt the Berger et al. (2000) method, which uses the efficiency results estimated with the two single frontiers. We obtain several relevant outcomes.

Table 7
Cross-border cost efficiency

Home country	UK			Italy		
	Number	Mean efficiency	Std Err	Number	Mean efficiency	Std Err
All domestic firms	139	0.7153	0.1410	31	0.5671	0.1825
All foreign firms	98	0.6940#	0.1620	13	0.6491*	0.1699
UK firms	–			3	0.7114**	0.1593
Italy firms	1	0.6741		–		
US firms	18	0.6103##	0.1443	0		
Netherlands firms	9	0.6756	0.1897	3	0.6101	0.2392
Switzerland firms	8	0.6973#	0.1454	0		
Germany firms	5	0.7046	0.1147	0		
France firms	5	0.5640	0.2220	3	0.5892	0.0307
Canada firms	3	0.6876	0.1966	0		
Jersey firms	6	0.7051	0.1548	0		
Japan firms	11	0.7331	0.2155	2	0.8579	0.0010
Singapore firms	5	0.7265	0.0750	0		
South Korea firms	3	0.8553	0.0933	0		
Virgin Island firms	4	0.8456**	0.0577	0		
Bermuda firms	3	0.7845	0.0344	0		
All other countries	17	0.7219	0.1289	2	0.49521	0.1324

Superscripts ** and * (or ## and #) indicate cell mean is significantly higher (or lower) than domestic mean at 5% and 10% levels.

The data displayed in Table 7 support the home field advantage for UK firms because the average efficiency of UK domestic firms is significantly greater than the average efficiency for all foreign firms operating in the UK (0.7153 versus 0.6940). The data also offer support for the global advantage hypothesis for UK firms, because they are more efficient than Italian firms where ever they compete with them – both at home in the UK (0.7153 versus 0.6741) and abroad in Italy (0.7114 versus 0.5671). This result is consistent with our earlier findings regarding the superior efficiency of UK firms relative to Italian firms. Finally, the data also offer support for the global advantage for Japanese firms, because they are more efficient than domestic banks in both the UK (0.7331 versus 0.7153) and in Italy (0.8579 versus 0.5671). [8]

By comparing the results from Battese and Coelli (1995) and Berger et al. (2000), we conclude that the two methods produce consistent results. They both reveal differences in the X-efficiency of the two countries. The first method achieves this by integrating environmental variables in the definition of the cross-country frontier, the second by testing the ability to monitor and control on a cross-border basis. In contrast, the traditional method for efficiency comparison based on structural

[8] Similar to the results in Berger et al. (2000), the small number of foreign firms in the data prevent some of these differences from being statistically significant. Also note that it is not formally possible for both UK firms and Japanese firms to have global advantages – to determine which of these countries has the true advantage over the other, we would have to test foreign UK firms against a domestic Japanese frontier.

variables only (Battese and Coelli, 1992) produces different results. This suggests that the new methods used in this paper overcome the limitations traditionally associated with such studies, in so far as they deliver consistent X-efficiency estimates.

5.5. Exogenous environmental X-efficiency determinants

The evidence presented above concerning the influence of environmental forces on X-efficiency implies that the findings regarding efficiency determinants can be used to improve managerial strategies and address competitive issues. The influence of each environmental variable on the X-efficiency score is investigated by looking at the OLS estimation of δ values, as defined in Eq. (6). To check the robustness of δ values for the choice of environmental variables, we define three frontiers with different sets of environmental categories (Table 8). We verify that the signs of δ values are consistent among different frontiers and that the related efficiency levels do not vary. We conclude from these results that we have identified the appropriate set of country-specific environmental variables.

In general, the influence of environmental variables is consistent with our expectations. The coefficient of the industry profitability ratio has a positive and significant sign. Higher cost inefficiency is associated with higher industry profitability. As verified in our profitability test, one explanation can be the divergence in cost efficiency and profitability for the Italian industry. Moreover, we observe that the coefficient of stock market performance is negative and significant. As expected, investment firms operating in more profitable markets are more cost efficient. Stock market performance is indeed related to the profits gained by investment firms through their direct investment activity and through their clients' commissions.

Table 8
Exogenous environmental X-efficiency determinants

Determinants	Delta	Coefficient	Std Err	Coefficient	Std Err	Coefficient	Std Err
Structural							
ROE industry	δ_1	12.9295*	6.6071	14.6031**	7.6079	1.9985*	0.8696
Institutional							
Stock mkt performance	δ_2	−4.3558**	2.2710	−3.9998**	2.0870		
N. listed companies	δ_3	−5.8086**	3.0475	−7.1270	4.2996		
Inward	δ_4	5.3275**	3.0857	3.4341**	1.7897		
Outward	δ_5	−5.2923**	3.1171	−4.3906**	2.1511		
Legal reserve	δ_6	0.0088	0.9989	1.8341**	1.0448		
Accounting	δ_7	0.3215	0.4983	0.7094	0.4438		
Ownership	δ_8	0.0186	0.9953	3.7173**	1.1734		
Interpretational							
Shareholder rights	δ_9	−0.1228	0.6306			−0.7264*	0.2849
Law enforcement	δ_{10}	0.2972	0.7617			0.0449	0.0316

The symbol * indicates a significance level between 5% and 10%; ** between 1% and 5%.

The number of listed companies is positively and significantly related to cost efficiency. An extensive number of listed companies is associated with a diversification of investment services, and with the benefits from related cost complementarities. Ownership concentration is positively related to cost inefficiency. High concentration has negative implications for investment firms both on the revenue side (lower demand owing to the reduced willingness to operate in the stock market and, accordingly, to reduced requests for investment services) and on the cost side (need to sustain higher costs due to the greater concentration of the financial environment). National legal reserve also has a positive and significant sign: as the legal reserve requirement increases, the cost inefficiency of investment firms increases. Although higher requirements denote better protection for investors, investment firms incur higher costs in inducing investors to buy stocks of firms distributing less dividends (due to the higher levels of reserves).

The high positive inward coefficient (significant at 10%) implies that when investment firms are less efficient, financial institutions from outside enter the national industry. Foreign firms investing in less efficient national industries have a positive effect on the average efficiency of the destination industry. The negative outward coefficient (significant at 10%) suggests that the more efficient investment firms are able to operate abroad. Investment firms operating in countries where the industry is more cost efficient are able to export superior practices and structures and, therefore, are more likely to expand their activities in a foreign country. Foreign firms entering a country might be among the most efficient in their country of origin, and tend to come from the most developed financial systems. In terms of cross-country competition predictions, the empirical findings for outward and inward suggest that more efficient firms go abroad exporting their model; and, accordingly, less efficient industries attract foreign firms having superior practices and structures. The movement of firms across national boundaries intensely shapes the industry. [9] We conclude that these results support the findings from the Berger et al. (2000) method: the home field advantage for the UK industry, where the average efficiency for all the foreign firms is lower than the efficiency of UK firms; and the global advantage for UK firms, which are more efficient than the Italian firms both at home in the UK and abroad in Italy. By considering X-efficiency determinants in terms of inward and outward, we reconcile the results of the two methods.

The coefficient for shareholder rights is negative (and significant at 10%), implying that the cost efficiency of investment firms increases as shareholders become more protected by the financial system as a whole. When shareholder rights increase, fewer resources have to be devoted to customer relationships, as the financial system as a whole substitutes for the firm in this task.

[9] A more efficient investment firm entering a foreign market – with different environmental features – would likely generate a diffusion process of its different practices and structures, developed in a different environment. The issue is whether the destination industry benefits from a positive effect (homogenisation to best practices/structures coming from abroad) or is affected by the negative one (foreign competitors performing better efficiency replace national players).

6. Conclusions

The aim of this paper is to investigate the X-efficiency of investment firms across countries by comparing and reconciling two new methods. First, we incorporate environmental variables into an extended common cost frontier. This shows that the UK and Italian securities industries are characterised by an efficiency differentiation, which can be ascribed to heterogeneity in the environment as a whole and in the structure of firms. Second, we examine the efficiency of foreign versus domestic firms in different countries by a separate country analysis. This reveals that the UK and Italian firms perform differently as foreign-owned entities. In cross-country comparisons of efficiency, controlling for environmental factors provides results consistent with the control for the ability to operate and monitor across borders.

Referring to the UK and Italy, an unbalanced data set (comprising 1118 firm observations between 1995 and 1998) measures cost inefficiency by four different specifications of the stochastic frontier model. Using separate frontiers for each country, the X-efficiency of UK investment firms is higher than for Italian firms. Structural differences are thus shown to exist. Surprisingly, deriving a traditional common cost frontier using only structural variables, Italian investment firms are shown to be nearly as efficient as the UK institutions. However, presenting a common cost frontier integrating interpretational and institutional variables in addition to structural factors, UK investment firms are shown to be significantly more efficient than Italian firms. Environmental variables therefore appear to play an important role in efficiency comparisons. Accordingly, investigating national ability to operate across countries, UK firms are found to have higher efficiency than Italian firms where ever they compete with them – both at home in the UK and abroad in Italy (global advantage hypothesis).

Furthermore, controlling for exogenous environmental variables reveals that an important set of structural, interpretational and institutional variables has a significant influence on cost efficiency and profitability. The management of investment firms should direct investments to those countries that guarantee greater shareholder rights and achieve greater diversification and better performance of financial markets. Moreover, in terms of cross-country operations, more efficient firms go abroad, exporting a more efficient model; accordingly, less efficient companies attract foreign investment firms having higher efficiency. This result here enables us to reconcile the two new methods for efficiency comparisons.

Acknowledgements

The author wishes to acknowledge the constructive comments offered by two anonymous referees, Peter Miller, Agostino Fusconi, Philip Molyneux, Pascal Frantz, Jonathan Williams, and participants at the European Financial Management Association 2001 Meeting, the Wolpertinger 2000 and 2001 Meetings, The European Operational Research 2001 Conference, research colloquia at the London

School of Economics and Political Science, and Università Cattolica del Sacro Cuore, Milan.

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