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How Deregulation Shapes Market Structure and Industry Efficiency: The Case of the Italian Motor Insurance Industry

by Giuseppe Turchetti and Cinzia Daraio*

1. The evolution of re- and de-regulation in the Italian insurance industry

Motor insurance is the most important insurance line in Italy, accounting for about 60.4 per cent of direct non-life insurance business and for 22.3 per cent of total insurance premiums in 2002. Its nature as compulsory insurance, its influence on the inflation rate, together with the growing role played by biological damage reimbursements and by fraud, have opened a deep and sometimes harsh debate, both in the political and technical arenas, on the measures to be adopted in order to get tariff levels under control, to increase efficiency and to promote competition.

A fundamental year for the Italian insurance sector was 1912 when the Istituto Nazionale delle Assicurazioni was created and the affirmation of the principles of "authorization of admission" and of "control on tariffs" were ratified. With the transfer of control of the insurance sector to the Ministry of Industry in 1923, began a long period in which insurance companies experienced a kind of a subjection to public administration. Only from the 1970s onwards did we observe a deep process of legislation, mainly driven by the European Community directives (first, second and third generation).

The legislator's intervention introduced incentives for a shift from a strong protectionist context to a wider and free market context for insurance. In particular, 1 July 1994 was a milestone for the insurance sector. With the coming into force of the third life and non-life directives, public authorities could no longer control tariffs and insurance policy conditions. The Italian motor insurance business, traditionally strongly regulated by the government, was deeply affected. Companies started to be free to fix prices according to customers' risk attitudes, and the new tariffs system based on the *bonus/malus* mechanism was introduced. Seven direct selling companies were set up and services began to be improved with the opening of call centres working 24 hours a day.

Two main events occurred in 2000: the government, due to the impact of motor insurance prices on inflation, froze tariffs (Law 26/05/2000, no. 137), a decision which was censured because of its incompatibility with European laws; and the Italian Antitrust Authority sanctioned (in measure no. 8546 – I377 Bulletin no. 30, 14 August 2000) quite a

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large number of companies for violation of the competition discipline (amounting to fines of € 361.5 million).

The main question addressed by our paper is if and how, over the period 1982–2000, deregulation measures influenced the structure of the supply side of the market and the efficiency and productivity of the companies operating in the Italian motor business.

In particular, we focus our attention on three main aspects:

- the effects of deregulation on the dynamics of insurers (at an aggregate level, i.e. the total number of insurers in the motor insurance market from 1982 to 2000 and the entry-exit process);
- the effects of deregulation on the rate of growth of insurance activity (as measured by premiums by line of business, in particular the motor insurance business compared with non-life and life business);
- the effects of deregulation on the efficiency and productivity of a sample of Italian motor insurers.

Techniques used include Loess, to show the existence of trends in time series, and efficiency analysis methods, in particular Data Envelopment Analysis (DEA) and Malmquist analysis. DEA has been widely used in recent years to estimate efficiency in a variety of industries and national markets.[1]

To the best of our knowledge, this paper is the second work that applies efficiency methods to data on Italian insurers. It follows the previous work by Cummins *et al.* (1996) in the definition of inputs and outputs, and it gives an enriched analysis based on new data.

The paper is organized as follows. The next section describes the evolution of the number of companies, the entry-exit dynamics, the concentration ratios, the trend of premiums in the Italian insurance industry, with particular attention to the motor liability line, over the period 1982–2000. Section 3 introduces efficiency analysis by describing the sample, defining the inputs and outputs considered in the analysis, and briefly introducing the main concepts of efficiency methodology. In section 4 main results of the efficiency analysis are reported, while section 5 concludes the paper indicating future developments of research in these areas.

2. The dynamics of the Italian insurance market structure

Motor insurance is the most important line of business in the Italian insurance market. The fact that it is compulsory is certainly the main reason explaining both this phenomenon and the number of companies operating in the motor line. Over the period 1982–2000, always more than six out of ten insurers working in the non-life business were present in the motor line.[2] The peak was reached in 1991, with 77.40 per cent of non-life companies working in the motor business (Table 1).

The period 1982–2000 can be divided in two sub-periods, 1982–1991 and 1991–2000. While in the first period the absolute number of insurance companies operating in the motor business grew from 97 to 113 (from 69.78 per cent to 77.40 per cent, in respect of total non-

[1] For a survey of 130 studies that apply frontier efficiency analysis to financial institutions in 21 countries, see Berger and Humphrey (1997).

[2] Almost all companies present in the motor insurance business operate also in other non-life lines, so they are not motor specialists.

Table 1:
Changes in the number of Italian insurers (direct business) by line of business (1982–2000)[3]

Year	RCAT	RCA_NL	RCA_TOT	TOTNL	TOTL	TOTLNL	TOTG
1982	97	69.78	62.18	139	44	27	156
1983	95	69.34	60.51	137	47	27	157
1984	97	71.32	61.78	136	48	27	157
1985	95	71.43	61.29	133	49	27	155
1986	97	73.48	62.58	132	51	28	155
1987	98	73.68	60.49	133	57	28	162
1988	103	72.54	57.54	142	65	28	179
1989	109	75.69	58.60	144	70	28	186
1990	111	76.03	57.51	146	74	27	193
1991	113	77.40	55.94	146	83	27	202
1992	108	74.48	51.43	145	91	26	210
1993	106	71.14	49.07	149	92	25	216
1994	105	71.92	48.61	146	94	24	216
1995	99	68.75	46.05	144	93	22	215
1996	98	68.06	44.95	144	96	22	218
1997	94	71.21	44.98	132	98	21	209
1998	92	75.41	46.23	122	98	21	199
1999	87	66.41	44.39	131	96	31	196
2000	80	63.49	41.67	126	97	31	192

Source: Based on ANIA data.

life companies), in the second period a strong reduction both of the absolute number, from 113 to 80, and of their weight in respect to total non-life companies, from 77.40 per cent to 63.49 per cent, was registered. In particular, the greater decrease is observable in the period after 1994, when the number declined from 105 to 80. Also the percentage of companies operating in the motor line over the total number of insurers present in the insurance sector declined significantly, from 62.18 per cent to 41.67 per cent, but this is explained more by the strong growth of the number of life companies (entrance of financial consultants and banks in the insurance business) than by the decline of the number of motor companies (Table 1).

The analysis of the dynamics of entries and exits from the motor business in the period 1982–2000 presents interesting results. Entries experienced an upward trend in the second half of the 1980s, but along the whole 1990s the curve was characterized by a downward slope, moderately slowed down in the years around 1994 because of the entrance of some

[3] Key: RCAT (motor business); RCA_NL (no. of motor insurers over total number of insurers operating in non-life business, in percentage value); RCA_TOT (no. of motor insurers over total number of insurers, in percentage value); TOTNL (total number of insurers operating in non-life business); TOTL (total number of insurers operating in life business); TOTLNL (total number of insurers operating in life and non-life business); TOTG (total number of insurers). Note: TOTG is computed as follows: TOTNL+TOTL-TOTLNL.

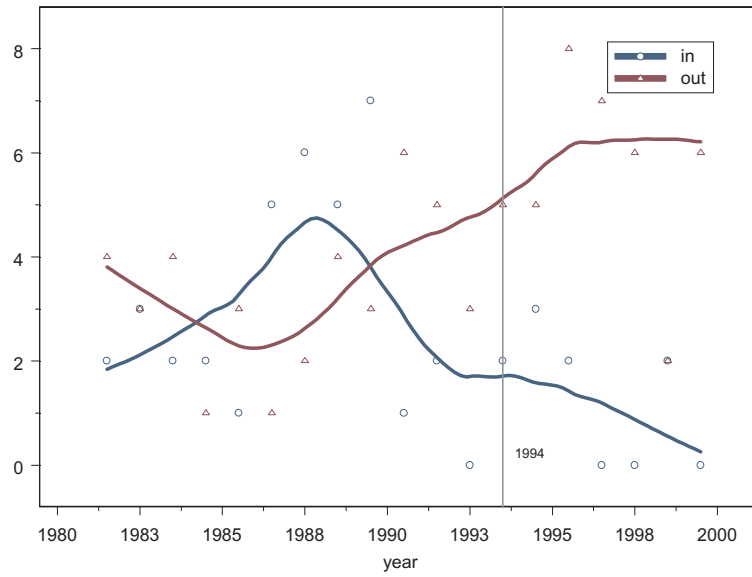

Figure 1: Trend of entries (in)-exits (out) from the motor insurance market (1982–2000)[4]

companies using the telephone as the distribution channel. Exits experienced the opposite: at the beginning of the period we observe a downward slope of the curve, but from the late 1980s the trend started to rise and it increased for the whole 1990s. Certainly the number of exits began to grow much earlier than 1994, but around that year the slope of the curve was particularly significant.

Table 2 presents concentration ratios of Italian motor insurance business, of total non-life business and of life business in the period 1982–2000. Data of motor and of non-life markets do not show significant variation of concentration of the first four, eight and 20 companies during the last 20 years, especially after 1994. Also the Herfindahl Index does not evidence variations of the concentration of the two mentioned markets during the period analysed. The life market instead presents a relevant reduction of the concentration, due to the important role conquered by new entrants using financial consultants and bank branches.

Regarding the real rates of growth of gross premiums (direct business) in the period 1992–2001, it is interesting to note that the motor business has experienced a series of ups and downs until the first half of 1990s, with a downward convergence in the 1992–1994 period, and that after the deregulation period, the premiums rate of growth started to increase again (halting in 2000 and 2001, when the government imposed a price freeze on motor third-party liability) (Figure 2). This is particularly significant because the real rate of growth of premiums of other non-life lines continued to decline also after 1994. On the other

[4] Figures 1 and 2 were designed using a locally weighted least-squares (Loess) technique (see Cleveland, 1993, 1994).

Table 2:
Concentration ratios for the Italian motor insurance industry and for total non-life business (1982–2000)
C4, C8, C20 are in percentage values

	Non-life premiums				Motor premiums				Life premiums			
Year	**C4**	**C8**	**C20**	**Herf**	**C4**	**C8**	**C20**	**Herf**	**C4**	**C8**	**C20**	**Herf**
1982	30.438	43.193	63.626	0.033	27.256	41.724	67.124	0.033	71.032	83.609	93.952	0.146
1983	29.770	42.814	63.257	0.033	26.877	41.511	66.612	0.032	70.951	83.026	93.829	0.146
1984	29.586	42.757	63.308	0.033	26.820	41.855	66.302	0.032	69.722	81.815	93.260	0.145
1985	28.989	42.416	62.868	0.032	26.225	41.180	64.884	0.031	66.821	78.731	92.483	0.137
1986	29.028	42.523	62.643	0.032	25.967	40.872	63.900	0.031	64.720	77.320	91.687	0.133
1987	29.261	42.834	62.873	0.032	25.774	40.941	63.478	0.030	60.456	73.682	89.583	0.117
1988	29.569	43.073	63.020	0.032	25.596	40.871	62.825	0.030	58.324	71.889	88.249	0.111
1989	30.183	44.325	68.596	0.035	26.020	42.835	69.082	0.033	56.193	70.383	87.836	0.101
1990	30.118	44.360	67.384	0.035	25.976	42.557	67.596	0.032	54.651	68.728	86.503	0.095
1991	29.755	45.593	67.926	0.035	26.107	43.350	68.343	0.033	52.486	66.879	85.759	0.088
1992	29.595	45.492	67.712	0.035	25.816	43.592	68.565	0.033	49.299	63.516	83.028	0.077
1993	29.792	45.776	67.676	0.035	26.064	43.859	69.152	0.034	45.391	59.399	78.856	0.066
1994	29.669	49.304	73.617	0.039	28.557	48.767	75.873	0.039	41.590	55.848	75.664	0.058
1995	29.888	49.286	73.510	0.040	27.877	48.833	75.829	0.039	40.054	53.577	74.958	0.054
1996	29.486	48.567	73.017	0.039	27.580	48.087	75.349	0.039	38.135	50.715	72.266	0.050
1997	29.358	47.711	72.599	0.038	26.249	46.655	74.280	0.037	32.136	46.830	69.737	0.039
1998	30.958	48.862	78.022	0.042	27.758	47.248	80.118	0.040	28.024	44.331	71.279	0.036
1999	30.752	47.543	77.175	0.040	27.900	46.149	78.851	0.039	24.823	39.705	66.089	0.030
2000	30.254	47.181	76.870	0.040	27.690	46.187	78.875	0.039	23.368	38.234	66.319	0.029

Source: Based on ANIA data.

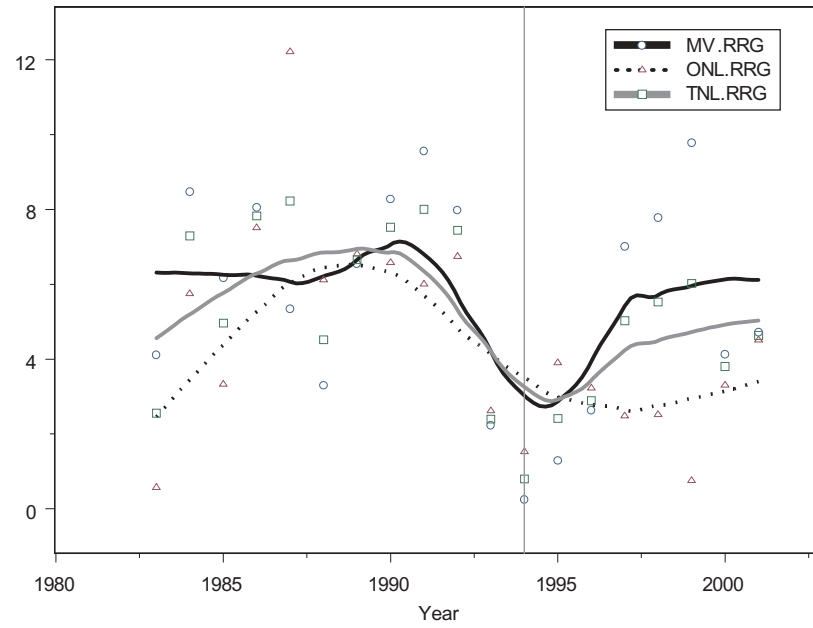

Figure 2: Real rate of growth – gross premiums (direct business) non-life business (1982–2001)[8]

side, the real rate of growth of premiums of life business increased for the whole 1982–2001 period in a very sustained way.

While the high relevant growth of life business can be explained by a series of economic, financial, social and industrial factors, it is interesting to note the difference in the evolution of the growth of motor business in comparison with the growth of other non-life lines. In fact, as most of them are mature lines, we should have expected them to experience similar movement.

Actually, as claimed by some researchers and insurance operators, the increase in motor premiums after 1994 can be explained by a series of factors. Firstly, the total number of vehicles increased in the period 1994–2001 from 39,755,000 to 46,480,000.[5] Secondly, the average premium might have grown (increasing by 53.5 per cent in the period 1994–2001[6]) because the vehicles insured changed to high-powered cars and to turbo and diesel vehicles, as well as clients' tendency to ask for higher sums insured.

Among the causes that could explain the rise in tariffs in the motor business in the 1990s that are particularly mentioned in the debate are:[7] (a) the increase in the average cost of compensations for damage, which almost doubled from € 1,923 to € 3,830 between 1994

[5] Source: Automobile Club Italia.
[6] Source: Assicurazioni Generali (2003).
[7] Data reported are from Assicurazioni Generali (2003).
[8] Key: MV.RRG: motor vehicles premiums' real rate of growth; ONL.RRG: other non-life premiums' real rate of growth; TNL.RRG: total non-life premiums' real rate of growth.

and 2001; (b) the rapid rise in the cost of repairs; (c) the outstanding frequency of cervical spine lesions, that are typical of the Italian system (in Italy 66 per cent of reported claims relate to such lesions as against 40 per cent in Germany, 15 per cent in Spain, and 6 per cent in France); (d) the frequency of fraud.

3. The dynamics of productivity and efficiency in the Italian motor insurance industry (1982–2000)

3.1 Sample description

Our database consists of financial statements for almost all insurers operating in Italy over the period 1982–2000 and it is based on official data from the Italian Association of Insurance Companies.

In our empirical analysis we selected insurers operating in Italy, active and working in the motor liability sector during the whole period 1982–2000. The number of retained companies was 53 from which we excluded several companies for some negative values in outputs, obtaining a final sample useful for the analysis of 45 insurers. The 66.7 per cent of our sample (30 insurers) are made of generalist insurers, the remaining 33.3 per cent (15 firms) are active only in the non-life business.

Premiums collected by the companies in our sample over total premiums (direct business) in the motor business for the whole period under consideration (1982–2000) range from a minimum of 59.45 per cent in 1986 to a maximum of 77.89 per cent in 1999. On average (1982–2000), our sample represents 64.52 per cent of the Italian motor insurance market.

As already mentioned, in 2000 the Italian Antitrust Authority sanctioned quite a large number of companies for information exchange. Twenty-seven companies out of the 45 that make up our sample have been hit by this antitrust measure. Among these, 12 are active only in non-life business (specialists) and 15 are active both in life and non-life business (generalists).

Using this dataset, we analysed the dynamics of productivity and efficiency of the most representative Italian insurers active in the motor business over the period 1982–2000.

3.2 Definition of outputs and inputs

As they produce services, insurers are analogous to other financial firms. Consistent with most of the recent literature on financial institutions, for the measurement of output we adopt a modified version of the value-added approach, which counts as important outputs those that have significant value added, as judged using operating cost allocations (Berger and Humphrey, 1992; Cummins *et al.*, 1996; Cummins and Rubio-Misas, 2001). Insurers provide three principal services:

1. *Risk-pooling and risk-bearing.* Insurance provides a mechanism through which consumers and businesses exposed to losses can engage in risk reduction through pooling. The actuarial, underwriting, and related expenses incurred in risk pooling are important components of value added in the industry. Insurers also add value by holding equity capital to bear the residual risk of the pool.
2. *"Real" financial services relating to insured losses.* Insurers provide a variety of real services for policyholders including financial planning, risk management, and the supply of legal defence in liability disputes. By contracting with insurers to provide

these services, policyholders take advantage of insurers' specialized expertise to reduce the costs associated with managing risks.

3. *Intermediation.* For life insurers, financial intermediation is a principal function, accomplished through the sale of asset accumulation products such as annuities. For non-life insurers, intermediation is an important but incidental function, resulting from the collection of premiums in advance of claim payments. Insurers' value added from intermediation is reflected in the net interest margin between the rate of return earned on invested assets and the rate credited to policyholders.

Transactions flow data, such as the number of applications processed, policies issued, and claims settled, are not readily available. However, a satisfactory proxy for the amount of risk-pooling and real insurance services provided is the value of real losses incurred (Skogh, 1982; Cummins *et al.*, 1996; Berger *et al.*, 1997; Cummins and Weiss, Zi, 1999). Losses incurred are defined as the losses that are expected to be paid as the result of providing insurance coverage during a particular period of time. Because the objective of risk-pooling is to collect funds from the policyholder pool and redistribute them to those who incur losses, proxying output by the amount of losses incurred seems quite appropriate. Losses are also a good proxy for the amount of real services provided, since the amount of claims settlement and risk management services are also highly correlated with loss aggregates. Because types of services provided differ among the principal lines of insurance, and following a previous study on the Italian insurance efficiency (Cummins *et al.*, 1996), we use as separate output measures the value of several non-life insurance losses incurred,

Table 3:
Inputs and outputs

Inputs	**Price**[9]
1. Acquisition production and organization costs	Value added of credit and insurance at 1995 market price
2. Overheads and administrative expenses	Value added of credit and insurance at 1995 market price
3. Fixed capital	Government bond yield (long-term)
4. Financial equity capital	Italian equity return (1995 base)
5. Policyholder debt capital	Government bond yield (long-term)
Outputs	
1. Motor property incurred losses	
2. Motor liability incurred losses	
3. Other liabilities incurred losses	
4. Other properties incurred losses	
5. Invested assets	

[9] According to previous studies and the international literature, prices are considered equal for all insurers.

distinguishing between motor property, motor liability, other liabilities, and other properties.

Losses incurred and all other monetary values used in our analysis are expressed in 1982 monetary units by deflating the Italian Consumer Price Index (source: Bank of Italy). Losses incurred are a satisfactory measure of output for coverage provided during any given year. However, insurers also perform services in connection with claims occurring in previous years that have not yet been settled or claims resulting from contingent events. As a proxy for these services, in the definition of each output we consider, for each year, the sum of the paid claims (for the line of business considered) and the claims reserves of the year, minus the claims reserves of the previous year. By doing so, in the definition of the outputs, we consider as proxy of financial services the sum of paid claims and changes in reserves. Our final output variable, which represents a proxy for the intermediation function, is the real value of invested assets.

In defining inputs of insurance activity, we follow Cummins *et al.* (1996) and the recent insurance efficiency literature. We identify five inputs:

— agents labour and distribution expense (acquisition, production and organization costs);
— overheads and administrative expenses;
— fixed capital (physical capital and other business expenses);
— financial equity capital;
— policyholder debt capital (reserves, all kinds).

3.3 Methodology

To measure efficiency in the Italian motor insurance industry, we utilize modern frontier efficiency analysis, in particular DEA and Malmquist analysis.[10] DEA is a non-parametric technique that does not require the specification of a production or cost function but rather computes efficient "best practice" production and cost frontiers based on linear combinations of firms in the industry. DEA involves the measurement of the performance of each firm in the industry compared to "best practice" efficient frontiers. The comparison is based on relevant inputs and outputs of the financial service provided by the companies.

Efficiency scores vary between zero and one (in the input-oriented framework applied in this study), with fully efficient firms having efficiencies equal to one and inefficient firms having efficiencies between zero and one. This section provides a brief overview of the basic concept of frontier efficiency methodology.

We estimate efficient production and cost frontiers providing measures of cost, technical, allocative and scale efficiency for each firm in our sample.

Cost efficiency for a given firm is defined as the ratio of the costs of a fully efficient firm (a firm operating on the efficient cost frontier) with the same output quantities and input prices to the given firm's actual costs. One minus the firm efficiency ratio provides a measure of the proportion by which costs could be reduced if the firm operated on the cost frontier. Firms achieve cost efficiency by adopting the best practice technology (becoming

[10] Starting from the first empirical application by Farrell (1957), a huge amount of literature on efficiency analysis has been developed. For more technical details on DEA see the "classical" works by Lovell (1993); Charnes *et al.* (1994). For an updated survey on DEA models see Cooper *et al.* (1999). For an introduction to Malmquist Analysis see Grosskopf (1993).

technically efficient) and choosing the optimal mix of inputs (becoming allocatively efficient), conditional on outputs and input prices.

Technical efficiency for a given firm is defined as the ratio of the inputs use of a fully efficient firm producing the same outputs vector to the inputs use of the firm under consideration. Technical efficiency can be decomposed into pure technical efficiency and scale efficiency. Pure technical efficiency is measured relative to variable returns to scale (VRS) production frontier, i.e. a frontier characterized by increasing, constant, and/or decreasing returns to scale. Firms operating on the VRS frontier are considered fully efficient in the pure technical sense. If the firm is operating with increasing or decreasing returns to scale, it can improve its efficiency by moving to a constant returns to scale frontier, i.e. by becoming scale efficient. Technical efficiency is equal to the product of pure technical and scale efficiency.

Allocative efficiency measures firm success in choosing the cost-minimizing combination of inputs. Cost efficiency can be shown to equal the product of technical and allocative efficiency. Therefore, to be fully cost efficient, a firm must be both technically and allocatively efficient.

The Malmquist approach measures both improvements in technology and changes in efficiency relative to the frontiers for different time periods. Malmquist analysis allows us to separate shifts in the frontier (technical change) from improvements in efficiency relative to the frontier (technical efficiency change). The product of technical change and technical efficiency change, the total factor productivity change (TFP), is measured by the Malmquist Index (Grosskopf, 1993).

If a Malmquist Index computed over two years is over 1, it indicates an increase in total factor productivity from year t to year $(t + 1)$; if it is under 1 then it indicates a decrease in total factor productivity. The same interpretation applies for technical change (technical efficiency change): if the value of the index is higher than 1, there has been an improvement in technology (technical efficiency) from year t to year $(t + 1)$; on the other hand, if its value is lower than 1, that means that a deterioration in technology is in place from year t to year $(t + 1)$.

4. Results of efficiency and productivity analysis

Efficiency results presented in Table 4 show average efficiencies for the entire sample as well as distinguishing between companies hit by the antitrust measure (FINED=1) and companies not hit by the Antitrust measure (FINED=0). Averages are shown for cost efficiency and its components (allocative efficiency and pure technical efficiency, computed under the hypothesis of VRS).

Cost efficiency of the 45 companies active for the whole period experienced a fall in 1994 (and we had also the highest value of standard deviation), but after that year it increased again, reaching almost the same level of cost efficiency observed in 1990. On the one hand, the confusion and the reorganization processes that occurred around 1994 produced a considerable loss of cost efficiency. In 1995, for example, costs could have been reduced on average by 21 per cent if companies had operated on the cost frontier. On the other hand, we observe a level of technical efficiency (under VRS) that was extremely high on average over the whole period 1982–2000.

Another interesting observation is that fined firms present higher levels of cost efficiency, allocative efficiency, pure technical and scale efficiency in respect to non-fined companies during almost the whole period. Moreover, among the companies fined (27

Table 4:
Cost efficiency, allocative efficiency, technical efficiency (VRS) and scale efficiency. All sample (45 obs), FINED=1 (27 obs), FINED=0 (18 obs)

	All sample (45 obs)					Only FINED=1 companies (27 obs)				
year	statistics	Cost eff	Alloc eff	tech eff VRS	Scale eff	statistics	cost eff	alloc eff	tech eff VRS	Scale eff
1982	Mean(82)	0.68	0.7	0.96	0.94	mean	0.71	0.73	0.96	0.94
	stdev	0.26	0.25	0.07	0.09	stdev	0.27	0.25	0.08	0.08
	min	0.25	0.25	0.67	0.63	min	0.32	0.36	0.67	0.72
	max	1	1	1	1.00	max	1	1	1	1.00
1983	Mean(83)	0.71	0.73	0.97	0.97	mean	0.74	0.76	0.98	0.96
	stdev	0.25	0.24	0.06	0.04	stdev	0.25	0.24	0.06	0.05
	min	0.33	0.33	0.75	0.78	min	0.33	0.33	0.75	0.78
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1984	Mean(84)	0.75	0.76	0.98	0.98	mean	0.79	0.81	0.98	0.98
	stdev	0.24	0.23	0.04	0.05	stdev	0.23	0.21	0.05	0.05
	min	0.33	0.35	0.81	0.78	min	0.41	0.41	0.81	0.78
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1985	Mean(85)	0.76	0.78	0.96	0.98	mean	0.82	0.83	0.98	0.98
	stdev	0.22	0.21	0.08	0.05	stdev	0.19	0.18	0.04	0.04
	min	0.24	0.37	0.65	0.76	min	0.43	0.45	0.87	0.82
	max	1	1	1	1.00	max	1	1	1	1.00
1986	Mean(86)	0.78	0.80	0.97	0.98	mean	0.83	0.84	0.98	0.99
	stdev	0.21	0.20	0.06	0.05	stdev	0.19	0.18	0.03	0.03
	min	0.42	0.43	0.77	0.73	min	0.43	0.43	0.89	0.84
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1987	Mean(87)	0.77	0.79	0.97	0.98	mean	0.83	0.84	0.99	0.98
	stdev	0.21	0.20	0.06	0.04	stdev	0.17	0.17	0.03	0.03
	min	0.34	0.34	0.73	0.83	min	0.46	0.46	0.89	0.84
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1988	Mean(88)	0.78	0.82	0.96	0.97	mean	0.84	0.86	0.97	0.99
	stdev	0.19	0.18	0.08	0.07	stdev	0.18	0.17	0.05	0.03
	min	0.44	0.44	0.69	0.60	min	0.44	0.44	0.83	0.86
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1989	Mean(89)	0.82	0.84	0.98	0.98	mean	0.86	0.87	0.98	0.99
	stdev	0.16	0.15	0.05	0.04	stdev	0.15	0.14	0.04	0.03
	min	0.50	0.50	0.71	0.85	min	0.52	0.52	0.85	0.85
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1990	Mean(90)	0.81	0.83	0.98	0.99	mean	0.82	0.83	0.98	0.99
	stdev	0.19	0.17	0.06	0.02	stdev	0.18	0.17	0.04	0.02
	min	0.47	0.47	0.73	0.88	min	0.47	0.47	0.84	0.88
	max	1	1	1	1.00	max	1	1	1	1.00
1991	Mean(91)	0.85	0.85	0.99	1.00	mean	0.87	0.87	1.00	1.00
	stdev	0.16	0.16	0.02	0.01	stdev	0.15	0.15	0.02	0.00
	min	0.51	0.52	0.89	0.94	min	0.55	0.56	0.94	0.99
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1992	Mean(92)	0.87	0.87	0.99	0.99	mean	0.88	0.89	1.00	1.00
	stdev	0.14	0.14	0.03	0.02	stdev	0.13	0.13	0.02	0.01
	min	0.56	0.56	0.86	0.88	min	0.64	0.64	0.91	0.97
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1993	Mean(93)	0.82	0.84	0.98	0.99	mean	0.86	0.86	0.99	0.99
	stdev	0.17	0.16	0.07	0.02	stdev	0.16	0.15	0.02	0.03
	min	0.51	0.52	0.63	0.87	min	0.52	0.52	0.88	0.87
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1994	Mean(94)	0.52	0.53	0.97	0.98	mean	0.56	0.56	0.98	0.98
	stdev	0.3	0.3	0.07	0.04	stdev	0.32	0.32	0.04	0.05
	min	0.19	0.19	0.65	0.84	min	0.19	0.19	0.82	0.84
	max	1	1	1	1.00	max	1	1	1	1.00
1995	Mean(95)	0.79	0.82	0.97	0.98	mean	0.80	0.84	0.96	0.98
	stdev	0.18	0.17	0.07	0.05	stdev	0.17	0.16	0.07	0.05
	min	0.43	0.45	0.73	0.82	min	0.43	0.45	0.73	0.82
	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
1996	Mean(96)	0.84	0.86	0.98	0.97	mean	0.84	0.86	0.97	0.97
	stdev	0.17	0.16	0.05	0.07	stdev	0.17	0.15	0.06	0.06
	min	0.40	0.48	0.78	0.64	min	0.40	0.48	0.78	0.71
	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
1997	Mean(97)	0.82	0.84	0.98	0.96	mean	0.84	0.85	0.98	0.95
	stdev	0.19	0.18	0.05	0.08	stdev	0.19	0.18	0.06	0.10
	min	0.21	0.21	0.74	0.57	min	0.21	0.21	0.74	0.57
	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
1998	Mean(98)	0.75	0.76	0.98	0.99	mean	0.80	0.81	0.99	0.99
	stdev	0.21	0.20	0.05	0.03	stdev	0.17	0.17	0.03	0.02
	min	0.20	0.20	0.78	0.84	min	0.43	0.43	0.89	0.90
	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
1999	Mean(99)	0.82	0.83	0.99	0.99	mean	0.84	0.84	0.99	0.99
	stdev	0.18	0.17	0.03	0.03	stdev	0.16	0.16	0.02	0.03
	min	0.41	0.49	0.85	0.86	min	0.51	0.51	0.91	0.86
	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
2000	Mean(00)	0.84	0.84	0.99	0.98	mean	0.87	0.88	0.99	0.97
	stdev	0.18	0.17	0.03	0.06	stdev	0.15	0.14	0.04	0.05
	min	0.48	0.48	0.84	0.72	min	0.48	0.48	0.84	0.76
	min	1	1	1	1.00	min	1	1	1	1.00

Only FINED=0 companies (18 obs)					Only FINED=1 Generalist (15 obs)					Only FINED=1 Specialist (12 obs.)				
statistics	cost eff	alloc eff	tech eff (VRS)	Scale eff		cost eff	alloc eff	tech eff (VRS)	Scale eff		cost eff	alloc eff	Tech eff (VRS)	Scale eff
mean	0.63	0.65	0.96	0.94	mean	0.86	0.88	0.97	0.92	mean	0.53	0.55	0.96	0.96
stdev	0.25	0.24	0.05	0.10	stdev	0.22	0.20	0.07	0.09	stdev	0.23	0.22	0.06	0.05
min	0.25	0.25	0.85	0.63	min	0.36	0.36	0.75	0.72	min	0.32	0.36	0.8	0.86
max	1	1	1	1.00	max	1.00	1.00	1.00	1.00	max	1	1	1	1.00
mean	0.67	0.69	0.96	0.99	mean	0.89	0.90	0.99	0.95	mean	0.60	0.61	0.98	0.98
stdev	0.23	0.23	0.06	0.02	stdev	0.19	0.18	0.04	0.06	stdev	0.21	0.20	0.04	0.03
min	0.33	0.34	0.82	0.95	min	0.41	0.41	0.84	0.78	min	0.33	0.33	0.85	0.92
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.68	0.70	0.98	0.98	mean	0.89	0.90	0.99	0.97	mean	0.67	0.69	0.97	1.00
stdev	0.23	0.23	0.03	0.05	stdev	0.19	0.18	0.04	0.06	stdev	0.21	0.20	0.06	0.01
min	0.33	0.35	0.91	0.78	min	0.41	0.41	0.84	0.78	min	0.42	0.44	0.81	0.97
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.66	0.7	0.93	0.97	Mean	0.9	0.91	0.99	0.96	mean	0.72	0.74	0.97	0.99
stdev	0.23	0.21	0.1	0.06	stdev	0.16	0.15	0.03	0.05	stdev	0.19	0.18	0.04	0.01
min	0.24	0.37	0.65	0.76	Min	0.5	0.5	0.87	0.82	min	0.43	0.45	0.88	0.96
max	1	1	1	1.00	Max	1	1	1	1.00	max	1	1	1	1.00
mean	0.70	0.73	0.95	0.97	mean	0.89	0.90	0.99	0.98	mean	0.76	0.77	0.98	1.00
stdev	0.22	0.20	0.08	0.06	stdev	0.18	0.17	0.03	0.04	stdev	0.18	0.17	0.04	0.01
min	0.42	0.45	0.77	0.73	min	0.47	0.48	0.91	0.84	min	0.43	0.43	0.89	0.98
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.68	0.72	0.94	0.97	mean	0.87	0.88	0.99	0.97	mean	0.78	0.79	0.99	1.00
stdev	0.23	0.21	0.08	0.05	stdev	0.17	0.17	0.03	0.04	stdev	0.16	0.16	0.03	0.00
min	0.34	0.34	0.73	0.83	min	0.53	0.53	0.90	0.84	min	0.46	0.46	0.89	0.99
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.70	0.75	0.93	0.95	mean	0.90	0.92	0.97	0.98	mean	0.76	0.78	0.98	1.00
stdev	0.18	0.18	0.10	0.10	stdev	0.15	0.13	0.05	0.04	stdev	0.18	0.17	0.05	0.00
min	0.47	0.47	0.69	0.60	min	0.60	0.60	0.83	0.86	min	0.44	0.44	0.84	1.00
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.77	0.79	0.97	0.97	mean	0.88	0.90	0.98	0.98	mean	0.83	0.84	0.98	0.99
stdev	0.17	0.16	0.07	0.04	stdev	0.15	0.13	0.04	0.04	stdev	0.14	0.14	0.04	0.01
min	0.50	0.50	0.71	0.86	min	0.61	0.63	0.85	0.85	min	0.52	0.52	0.85	0.96
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.8	0.83	0.96	0.99	Mean	0.88	0.9	0.97	0.99	mean	0.75	0.75	1	1.00
stdev	0.19	0.17	0.07	0.02	stdev	0.17	0.15	0.05	0.03	stdev	0.17	0.17	0	0.01
min	0.52	0.53	0.73	0.92	Min	0.54	0.54	0.84	0.88	min	0.47	0.47	1	0.98
max	1	1	1	1.00	Max	1	1	1	1.00	max	1	1	1	1.00
mean	0.81	0.82	0.99	0.99	mean	0.92	0.93	0.99	1.00	mean	0.81	0.81	1.00	1.00
stdev	0.17	0.17	0.03	0.02	stdev	0.13	0.12	0.02	0.00	stdev	0.15	0.15	0.00	0.00
min	0.51	0.52	0.89	0.94	min	0.55	0.56	0.94	0.99	min	0.57	0.57	1.00	1.00
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.84	0.86	0.98	0.99	mean	0.93	0.94	0.99	1.00	mean	0.82	0.82	1.00	1.00
stdev	0.14	0.14	0.04	0.03	stdev	0.11	0.10	0.02	0.01	stdev	0.14	0.14	0.00	0.00
min	0.56	0.56	0.86	0.88	min	0.71	0.71	0.91	0.97	min	0.64	0.64	1.00	0.99
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.77	0.81	0.95	0.99	mean	0.93	0.94	0.99	0.99	mean	0.77	0.77	1.00	0.99
stdev	0.19	0.16	0.11	0.02	stdev	0.13	0.12	0.03	0.02	stdev	0.14	0.14	0.01	0.04
min	0.51	0.52	0.63	0.92	min	0.60	0.60	0.88	0.94	min	0.52	0.52	0.97	0.87
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.47	0.49	0.96	0.99	Mean	0.68	0.69	0.98	0.96	mean	0.41	0.41	0.99	1.00
stdev	0.26	0.25	0.09	0.03	stdev	0.31	0.3	0.04	0.06	stdev	0.27	0.27	0.05	0.00
min	0.23	0.25	0.65	0.87	Min	0.21	0.21	0.88	0.84	min	0.19	0.19	0.82	0.99
max	1	1	1	1.00	Max	1	1	1	1.00	max	1	1	1	1.00
mean	0.78	0.80	0.97	0.98	mean	0.82	0.83	0.98	0.98	mean	0.78	0.84	0.94	0.98
stdev	0.20	0.18	0.07	0.04	stdev	0.19	0.19	0.03	0.06	stdev	0.14	0.11	0.10	0.02
min	0.46	0.46	0.74	0.87	min	0.43	0.45	0.89	0.82	min	0.56	0.66	0.73	0.92
max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00	max	1.00	1.00	1.00	1.00
mean	0.84	0.85	0.99	0.97	mean	0.87	0.88	0.98	0.97	mean	0.81	0.84	0.96	0.98
stdev	0.16	0.16	0.04	0.09	stdev	0.18	0.16	0.04	0.07	stdev	0.16	0.14	0.07	0.03
min	0.53	0.53	0.83	0.64	min	0.40	0.48	0.83	0.71	min	0.52	0.59	0.78	0.92
min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
mean	0.80	0.81	0.98	0.97	mean	0.82	0.83	0.99	0.95	mean	0.85	0.89	0.96	0.95
stdev	0.18	0.17	0.04	0.04	stdev	0.22	0.22	0.02	0.11	stdev	0.15	0.13	0.08	0.08
min	0.55	0.56	0.86	0.88	min	0.21	0.21	0.92	0.57	min	0.61	0.66	0.74	0.73
min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
mean	0.67	0.69	0.97	0.98	mean	0.86	0.87	0.98	0.99	mean	0.72	0.73	0.99	0.99
stdev	0.23	0.22	0.06	0.04	stdev	0.14	0.14	0.04	0.03	stdev	0.17	0.16	0.02	0.02
min	0.20	0.20	0.78	0.84	min	0.60	0.60	0.89	0.90	min	0.43	0.43	0.95	0.95
min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
mean	0.80	0.80	0.99	0.99	mean	0.89	0.89	0.99	0.99	mean	0.78	0.78	1.00	0.99
stdev	0.19	0.18	0.04	0.02	stdev	0.15	0.14	0.03	0.04	stdev	0.16	0.16	0.01	0.03
min	0.41	0.49	0.85	0.94	min	0.56	0.56	0.91	0.86	min	0.51	0.51	0.97	0.88
min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00	min	1.00	1.00	1.00	1.00
mean	0.78	0.78	1	0.98	mean	0.91	0.92	0.98	0.97	mean	0.83	0.83	1.00	0.97
stdev	0.2	0.2	0.01	0.06	stdev	0.13	0.11	0.05	0.03	stdev	0.15	0.15	0.00	0.07
min	0.48	0.48	0.95	0.72	min	0.59	0.7	0.84	0.88	min	0.48	0.48	1.00	0.76
min	1	1	1	1.00	min	1	1	1	1.00	min	1	1	1.00	1.00

Table 5:
Total factor productivity (TFP), efficiency change (EC), technological change (TC) For all sample (45 obs), only FINED =1 companies (27 obs), FINED =1 specialist (12 obs), FINED =1 generalist (15 obs) and Not FINED (18 obs)

		All sample (45 obs)				Fined (27 obs)		
		TFP	EC	TC		TFP	EC	TC
1982\1983	mean	1.00	1.04	0.95	mean	0.99	1.05	0.95
	stdev	0.21	0.08	0.17	stdev	0.14	0.06	0.12
	min	0.11	0.81	0.11	min	0.60	0.95	0.60
	min	1.69	1.26	1.24	min	1.30	1.15	1.18
1983\1984	mean	1.02	1.02	1.00	mean	1.02	1.02	1.00
	stdev	0.15	0.07	0.12	stdev	0.12	0.06	0.10
	min	0.61	0.88	0.61	min	0.73	0.88	0.73
	min	1.33	1.24	1.28	min	1.28	1.18	1.28
1984\1985	mean	0.99	0.98	1.01	mean	1.02	1.00	1.02
	stdev	0.14	0.09	0.09	stdev	0.06	0.05	0.03
	min	0.57	0.65	0.76	min	0.88	0.87	0.92
	min	1.44	1.13	1.34	min	1.18	1.13	1.07
1985\1986	mean	1.02	1.02	1.00	mean	1.00	1.01	0.99
	stdev	0.25	0.08	0.16	stdev	0.08	0.04	0.07
	min	0.58	0.90	0.61	min	0.78	0.94	0.78
	min	2.42	1.37	1.83	min	1.19	1.13	1.08
1986\1987	mean	0.99	1.00	0.99	mean	0.98	1.00	0.98
	stdev	0.14	0.06	0.13	stdev	0.12	0.04	0.09
	min	0.62	0.82	0.62	min	0.72	0.88	0.72
	min	1.42	1.21	1.42	min	1.37	1.13	1.20
1987\1988	mean	1.01	0.98	1.03	mean	1.00	0.99	1.01
	stdev	0.15	0.11	0.10	stdev	0.08	0.04	0.07
	min	0.54	0.50	0.82	min	0.87	0.84	0.88
	min	1.42	1.21	1.35	min	1.15	1.04	1.15
1988\1989	mean	1.07	1.04	1.02	mean	1.04	1.01	1.02
	stdev	0.19	0.14	0.10	stdev	0.08	0.04	0.07
	min	0.80	0.86	0.82	min	0.88	0.95	0.92
	min	1.88	1.73	1.34	min	1.20	1.15	1.20
1989\1990	mean	1.04	1.01	1.02	mean	1.03	1.01	1.02
	stdev	0.14	0.06	0.09	stdev	0.09	0.05	0.07
	min	0.75	0.88	0.77	min	0.84	0.88	0.84
	min	1.54	1.19	1.21	min	1.24	1.19	1.15
1991\1990	mean	1.04	0.98	1.06	mean	1.01	0.98	1.03
	stdev	0.11	0.05	0.09	stdev	0.08	0.04	0.08
	min	0.82	0.82	0.90	min	0.88	0.88	0.90
	min	1.33	1.03	1.33	min	1.19	1.00	1.19
1991\1992	mean	0.97	1.00	0.97	mean	0.95	1.00	0.95
	stdev	0.13	0.04	0.12	stdev	0.08	0.01	0.08
	min	0.67	0.85	0.76	min	0.81	0.97	0.81
	min	1.47	1.10	1.47	min	1.13	1.03	1.13
1992\1993	mean	1.09	0.98	1.11	mean	1.13	0.99	1.14
	stdev	0.16	0.07	0.13	stdev	0.13	0.03	0.12
	min	0.65	0.69	0.87	min	0.84	0.86	0.90
	min	1.40	1.05	1.40	min	1.40	1.03	1.40
1993\1994	mean	1.09	0.99	1.11	mean	1.14	0.98	1.16
	stdev	0.27	0.07	0.26	stdev	0.32	0.05	0.31
	min	0.81	0.81	0.81	min	0.82	0.81	0.82
	min	2.16	1.19	2.16	min	2.16	1.06	2.16
1994\1995	mean	1.20	1.00	1.20	mean	1.23	0.98	1.24
	stdev	0.41	0.13	0.33	stdev	0.44	0.12	0.36
	min	0.40	0.77	0.44	min	0.40	0.77	0.44
	min	2.24	1.54	2.02	min	2.05	1.23	2.02
1995\1996	mean	1.03	1.01	1.02	mean	1.05	1.01	1.04
	stdev	0.17	0.12	0.14	stdev	0.15	0.11	0.13
	min	0.58	0.64	0.75	min	0.75	0.71	0.75
	min	1.44	1.43	1.38	min	1.37	1.43	1.37
1996\1997	mean	1.21	0.99	1.23	mean	1.16	0.98	1.18
	stdev	0.36	0.09	0.33	stdev	0.33	0.09	0.29
	min	0.52	0.73	0.52	min	0.52	0.73	0.52
	min	2.32	1.26	2.32	min	2.32	1.26	2.32
1997\1998	mean	1.20	1.20	1.15	mean	1.17	1.20	1.09
	stdev	0.69	0.55	0.70	stdev	0.65	0.50	0.64
	min	0.38	0.78	0.38	min	0.38	0.90	0.38
	min	3.92	3.50	3.92	min	3.92	3.50	3.92
1998\1999	mean	1.05	1.00	1.05	mean	0.97	0.99	0.97
	stdev	0.28	0.05	0.28	stdev	0.11	0.03	0.10
	min	0.72	0.86	0.72	min	0.72	0.88	0.72
	min	2.28	1.18	2.28	min	1.24	1.05	1.17
1999\2000	mean	1.02	0.99	1.03	mean	0.96	0.98	0.97
	stdev	0.17	0.08	0.15	stdev	0.10	0.07	0.07
	min	0.74	0.72	0.81	min	0.74	0.76	0.81
	min	1.73	1.16	1.73	min	1.09	1.09	1.07

Fined – generalist (15 obs)				Fined – specialist (12 obs)				Not fined (18 obs)			
	TFP	EC	TC		TFP	EC	TC		TFP	EC	TC
mean	0.98	1.04	0.93	mean	1.00	1.04	0.96	mean	1.02	1.03	0.95
stdev	0.12	0.06	0.10	stdev	0.15	0.05	0.13	stdev	0.29	0.10	0.23
min	0.60	0.95	0.60	min	0.60	0.97	0.60	min	0.11	0.81	0.11
min	1.13	1.15	1.02	min	1.30	1.13	1.18	min	1.69	1.26	1.24
mean	1.04	1.04	1.00	mean	1.01	1.00	1.01	mean	1.00	1.02	1.00
stdev	0.11	0.07	0.10	stdev	0.13	0.05	0.11	stdev	0.18	0.08	0.14
min	0.73	0.88	0.73	min	0.74	0.89	0.84	min	0.61	0.91	0.61
min	1.22	1.18	1.11	min	1.28	1.09	1.28	min	1.33	1.24	1.23
mean	1.02	1.00	1.02	mean	1.03	1.01	1.02	mean	0.95	0.94	0.99
stdev	0.04	0.03	0.03	stdev	0.08	0.06	0.04	stdev	0.21	0.12	0.14
min	0.97	0.96	0.97	min	0.88	0.87	0.92	min	0.57	0.65	0.76
min	1.13	1.05	1.07	min	1.18	1.13	1.06	min	1.44	1.07	1.34
mean	1.02	1.01	1.01	mean	1.00	1.02	0.98	mean	1.05	1.04	1.00
stdev	0.08	0.03	0.05	stdev	0.05	0.04	0.06	stdev	0.37	0.12	0.24
min	0.87	0.94	0.88	min	0.93	0.94	0.88	min	0.58	0.90	0.61
min	1.19	1.10	1.08	min	1.10	1.13	1.08	min	2.42	1.37	1.83
mean	0.97	1.00	0.97	mean	0.96	1.00	0.95	mean	1.02	1.00	1.02
stdev	0.08	0.04	0.07	stdev	0.15	0.04	0.12	stdev	0.18	0.09	0.16
min	0.72	0.88	0.72	min	0.72	0.93	0.72	min	0.62	0.82	0.62
min	1.05	1.08	1.06	min	1.37	1.13	1.20	min	1.42	1.21	1.42
mean	1.01	0.99	1.02	mean	0.99	0.99	1.00	mean	1.04	0.98	1.06
stdev	0.08	0.04	0.07	stdev	0.06	0.03	0.05	stdev	0.22	0.17	0.12
min	0.87	0.84	0.88	min	0.88	0.89	0.88	min	0.54	0.50	0.82
min	1.15	1.04	1.15	min	1.09	1.04	1.09	min	1.42	1.21	1.35
mean	1.04	1.02	1.02	mean	1.04	1.01	1.03	mean	1.12	1.09	1.01
stdev	0.07	0.04	0.05	stdev	0.08	0.01	0.08	stdev	0.28	0.22	0.14
min	0.92	0.95	0.92	min	0.93	1.00	0.93	min	0.80	0.86	0.82
min	1.18	1.15	1.11	min	1.20	1.04	1.20	min	1.88	1.73	1.34
mean	1.04	0.99	1.04	mean	1.01	1.02	1.00	mean	1.06	1.01	1.02
stdev	0.07	0.04	0.06	stdev	0.10	0.06	0.08	stdev	0.19	0.07	0.12
min	0.94	0.88	0.94	min	0.84	0.95	0.84	min	0.75	0.88	0.77
min	1.15	1.06	1.15	min	1.24	1.19	1.14	min	1.54	1.15	1.21
mean	1.01	0.97	1.04	mean	1.04	0.99	1.05	mean	1.07	0.97	1.09
stdev	0.08	0.04	0.07	stdev	0.08	0.02	0.09	stdev	0.13	0.06	0.10
min	0.88	0.88	0.90	min	0.94	0.92	0.94	min	0.82	0.82	0.97
min	1.18	1.00	1.18	min	1.19	1.00	1.19	min	1.33	1.03	1.33
mean	0.92	1.00	0.92	mean	0.97	1.00	0.97	mean	0.99	0.99	1.00
stdev	0.06	0.01	0.06	stdev	0.07	0.01	0.07	stdev	0.19	0.06	0.17
min	0.81	0.97	0.81	min	0.87	0.97	0.87	min	0.67	0.85	0.76
min	1.04	1.03	1.04	min	1.11	1.01	1.11	min	1.47	1.10	1.47
mean	1.18	1.00	1.19	mean	1.08	0.99	1.09	mean	1.01	0.97	1.05
stdev	0.12	0.02	0.11	stdev	0.12	0.04	0.10	stdev	0.18	0.10	0.12
min	1.05	0.94	1.05	min	0.84	0.86	0.90	min	0.65	0.69	0.87
min	1.40	1.03	1.40	min	1.27	1.03	1.27	min	1.27	1.05	1.27
mean	1.17	0.96	1.21	mean	1.13	0.99	1.14	mean	1.03	1.01	1.03
stdev	0.31	0.06	0.28	stdev	0.35	0.04	0.34	stdev	0.14	0.08	0.13
min	0.92	0.81	0.99	min	0.82	0.90	0.82	min	0.81	0.87	0.81
min	1.83	1.03	1.83	min	2.16	1.06	2.16	min	1.36	1.19	1.36
mean	1.47	1.02	1.43	mean	0.98	0.93	1.06	mean	1.15	1.02	1.13
stdev	0.43	0.13	0.35	stdev	0.23	0.10	0.23	stdev	0.36	0.15	0.24
min	0.64	0.78	0.64	min	0.40	0.77	0.44	min	0.73	0.84	0.73
min	2.05	1.23	2.02	min	1.46	1.11	1.34	min	2.24	1.54	1.74
mean	1.09	0.99	1.10	mean	1.03	1.04	0.99	mean	1.00	1.01	1.00
stdev	0.14	0.09	0.11	stdev	0.13	0.12	0.10	stdev	0.20	0.14	0.14
min	0.80	0.71	0.98	min	0.77	0.91	0.77	min	0.58	0.64	0.75
min	1.37	1.15	1.37	min	1.35	1.43	1.22	min	1.44	1.39	1.38
mean	1.21	0.99	1.21	mean	1.15	0.99	1.16	mean	1.28	1.00	1.32
stdev	0.43	0.09	0.37	stdev	0.27	0.11	0.15	stdev	0.38	0.08	0.36
min	0.52	0.81	0.52	min	0.92	0.73	0.98	min	0.89	0.85	0.89
min	2.32	1.26	2.32	min	2.03	1.26	1.62	min	2.32	1.26	2.32
mean	0.99	1.06	0.92	mean	1.37	1.34	1.28	mean	1.26	1.18	1.26
stdev	0.40	0.19	0.32	stdev	0.79	0.66	0.81	stdev	0.75	0.63	0.78
min	0.38	0.90	0.38	min	0.84	1.00	0.84	min	0.41	0.78	0.52
min	1.90	1.75	1.73	min	3.92	3.50	3.92	min	3.92	3.50	3.92
mean	0.98	0.99	0.99	mean	0.96	0.99	0.96	mean	1.18	1.02	1.18
stdev	0.08	0.02	0.09	stdev	0.12	0.05	0.08	stdev	0.38	0.07	0.40
min	0.82	0.95	0.82	min	0.79	0.88	0.87	min	0.86	0.86	0.86
min	1.12	1.03	1.12	min	1.24	1.05	1.17	min	2.28	1.18	2.28
mean	0.96	0.98	0.98	mean	0.96	0.99	0.98	mean	1.13	1.00	1.12
stdev	0.10	0.06	0.06	stdev	0.10	0.08	0.09	stdev	0.21	0.09	0.20
min	0.74	0.81	0.85	min	0.80	0.76	0.81	min	0.81	0.72	0.90
min	1.09	1.06	1.06	min	1.06	1.09	1.07	min	1.73	1.16	1.73

companies), specialist insurers (12 companies) present in several years higher pure technical efficiency, but for the whole period they show lower cost and allocative efficiencies in respect to generalist insurers (15 companies). The possibility of overcoming difficulties in the motor line and in the other non-life lines with a higher efficiency in the life line probably explains these differences.

Several interesting results emerge from the Malmquist total factor productivity analysis. First of all, we observe that the companies in the sample did not experience strong variations either in the efficiency change dimension or in the technological change dimension during the period 1982–1993. After 1993, we observe an increase in total factor productivity at significant rates 9 per cent (1993/94), 20 per cent (1994/95), 21 per cent (1996/97), and 20 per cent (1997/98). These increments are mainly due to technological changes (shift in the curve) rather than to efficiency changes. This is consistent with the deep process of reorganization of companies at the administrative and distribution levels, and the re-structuring of operative activities, also promoted by the more diffuse introduction of modern information and communication technologies. The reduction in increments observed in 1998/1999 and 1999/2000 could be connected to changes in the accountability system introduced in 1998.[11]

Secondly, the comparison between fined and non-fined companies shows that the variations in total factor productivity are quite similar up to the early 1990s. Then, in the second half of the 1990s, non-fined companies present better results, especially with regard to the technological change dimension. It could be argued that higher competitive pressures in the motor business after 1994 produced a stronger incentive to pursue the introduction of real innovations in companies not participating in the information network established among fined insurers.

Among fined companies, generalist ones present better results than specialist ones in terms of total factor productivity, especially because of a higher increase in the technological change dimension. We could hypothesize that the technological innovations introduced by companies operating also in the life business (probably because of the innovation required by the strong dynamics observed in the life business) also benefited the non-life activities.

5. Main conclusions

In this paper we have tried to provide empirical evidence on how deregulation can shape market structure and industry performance. In order to do that, we analysed the evolution of the number of motor insurers, their entry-exit dynamics, the concentration ratios, the trend of premiums, and their relation to legislative events over the period 1982–2000. From this analysis we could conclude that the deregulation process activated in the insurance business in 1994 affected the Italian motor insurance industry. After 1994 the dynamics of entry-exit were particularly active and the number of authorized insurers clearly fell (from 97 in 1982, it went up to 113 in 1991, it went down to 105 in 1994 and it reached its minimum in 2000 with 80 companies, representing a fall of 23.8 per cent in only six years).

This downward trend in the number of competitors in the motor business observed in

[11] We are investigating in more detail the possible effects of this accounting innovation.

the second half of the 1990s is particularly significant, as it comes after a period of almost 15 years of constant growth.

Moreover, from the efficiency analysis carried out on a sample of 45 Italian insurers active in the motor insurance business, it seems that cost efficiency and in particular total factor productivity increased in the period considered (1982–2000), especially in the second half of the 1990s.

However, in order to derive definitive policy implications from the analysis suggested in this paper, it is still necessary to run further elaborations and data processing and to provide extra empirical evidence. Nevertheless, we think that to measure the extent, dispersion and interaction among deregulation measures and the dynamics of efficiency and productivity of insurers over time could give the regulators very helpful information. Several directions for future research are possible. Whether and to what extent the new structure of the market and the improvement of efficiency and productivity benefited and will benefit customers, are probably the most important questions to address.

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