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EFFICIENCY AND COMPETITION IN FINANCIAL SERVICES

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Summary

This paper presents new estimates of technical efficiency and multi-factor productivity growth for the OECD financial services (banking and insurance) sector, over the period 1971-86. In addition, it provides tests of two conjectures : can we talk of convergence in productivity growth across OECD members, particularly EC countries, and to what extent can prevailing competition explain variation in efficiency and productivity growth ?

1. Introduction

It seems widely accepted today that productivity growth in banking and insurance services, herein called financial services, is very low, if not negative. In a recent paper on the US insurance industry, Baumol (1991) has argued that this is by no means attributable to managerial slack or "other form of misbehavior", but to what he calls the cost disease.[1] The cost disease plagues many other service industries such as education, artistic performance and police protection; it affects activities which are inherently resistant to technical change.

The purpose of this paper is not to dispute Baumol's view but to put it in a slightly different perspective in which productivity growth consists of technical change, which indeed can be affected by cost disease, and of efficiency change which is in contrast determined by factors pertaining to management quality and competitive conditions.We present estimates of multi-factor productivity growth, technical progress and efficiency change for the OECD financial services. We then try to see to what extent efficiency change which is most often falling can be explained in part by the strength of regulation and the competitive conditions prevailing in each country. We also check whether or not there would be a competition-driven convergence in productivity growth of financial services.

The paper is organized as follows. In the next section, we sketch the methodology to be used to obtain the two components of multi-factor productivity change. This amounts to estimating a sectoral production function using panel data consisting of financial services in a number of OECD countries over the period 1971-86 with a time trend. This production function then allows for the construction of a 'best practice' frontier to be used as a yardstick of efficiency across countries. Section 3 is devoted to the presentation of the OECD data and to the concept of financial services output. Section 4

1 The "cost disease" or the "unbalanced growth" hypothesis states that "differences in the rates of productivity growth in the pertinent sectors of the economy explain nearly all of the expansion of the services as a share of both the labor force and GNP, the latter being accounted for by a rise in the relative prices of the services at issue rather than by any expansion of their real outputs", Baumol *et al.* (1989; 116).

presents the main results as to multi-factor productivity changes in financial services. We will see that both the rate of multi-factor productivity change as well as the level of efficiency vary quite a lot across countries and over time. Section 5 attempts to explain part of that variation with variables pertaining to the regulatory and competitive environment of financial services and to check whether or not one observes any convergence particularly among EEC countries.

2. Frontier analysis and multi-factor productivity growth

The most important difference between the frontier approach and the traditional index number approach to productivity growth analysis lies in one assumption : the existence of an unobservable function, the production frontier, corresponding to the set of maximum attainable output levels for a given combination of inputs. We represent this so called "best practice" function g [.], for production unit i and time t, as follows :

$$y^F_{it} = g\,[x_{it}, t]\ , \qquad (1)$$

where y^F_{it} is the potential output level on the frontier at time t for production unit (here country) i, and x_{it} is a vector of inputs. It is assumed that function g [.] satisfies the usual regularity conditions and that an appropriate aggregate index of output exists.

Then, any observed output y_{it} using x_{it} for inputs may be expressed as :

$$y_{it} = y^F_{it}\, e^{u_{it}} = g\,[x_{it}, t]\, e^{u_{it}} \qquad (2)$$

where $u_{it} \leq 0$ is the rate of technical efficiency $[0 < e^{u_{it}} = y_{it}/ y^F_{it} \leq 1]$ corresponding to observed output y_{it}.

The derivative of the logarithm of (2) with respect to time is then given by :

$$\frac{\dot{y}_{it}}{y_{it}} = g_x \frac{\dot{x}_{it}}{x_{it}} + g_t + \dot{u}_{it} \qquad (3)$$

where g_x and g_t denote respectively the output elasticities of g $[x_{it}, t]$ with respect to x_{it} and t and dotted variables indicate time derivatives.

As indicated by (3), output growth can be broken down into three components. The first corresponds to input growth weighted by output elasticities, the second is the rate of technological progress of the "best practice" frontier, and the last represents technical efficiency change.

Following Nishimizu and Page (1982), we define the rate of multi-factor productivity growth, ΔMFP, as the growth in output not explained by input growth[2]. That is :

$$\Delta MFP_{it} = g_t + \dot{u}_{it}, \qquad (4)$$

the sum of technological progress, measured at the frontier level, and the change in efficiency observed at the individual level.

In order to estimate this indicator of productivity growth, the starting point is the estimation of the unobservable production frontier indicated by (1). From all methods proposed to build this frontier and based on observable data, parametric methods are employed for the estimation of functional forms. A stochastic approach is used[3]. For this purpose, let us write (2) in the form :

$$y_{it} = g\,[x_{it}, t]\, e^{\varepsilon_{it}} \qquad (2')$$

where $\varepsilon_{it} = u_{it} + v_{it}$ is a composed error term combining technical efficiency, u_{it}, and a random term, v_{it}, assumed to have the usual properties, that is, normal distribution, null mean and standard error σ_v.

The major difficulty raised by the stochastic method is the decomposition of ε_{it} into the random and the inefficiency elements. We use "the time varying effects approach"[4] proposed by Cornwell *et al.* (1990). In this approach discussed in Chapter 2, the efficiency term is expressed as a parameterized function of time with parameters that vary across countries :

$$u_{it} = \theta_{i0} + \theta_{i1}\, t + \theta_{i2}\, t^2, \qquad (5)$$

where θ_{i0} are the fixed effects pertaining to individual countries and θ_{i1} and θ_{i2} are other country related parameters allowing for variation in technical efficiency over time.

As to the specification of the function g[.], we adopt a Cobb-Douglas form. Thus (2') becomes :

$$\ln y_{it} = \alpha + \sum_{k=1}^{K} \beta_k \ln x_{k,it} + \gamma\, t + \varepsilon_{it} \qquad (6)$$

2 This approach is discussed in Chapter 4 of this volume.

3 For a survey of alternative econometric approaches to efficiency measurement, see Lovell and Schmidt (1988) and Chapter 2.

4 Barla and Perelman (1989) have used this method for airlines.

where t, i and k indicate respectively time, country and production factor. There are two production factors : labor with coefficient β_1 and capital with coefficient β_2.

With the notation (5), equation (6) can be written :

$$\ln y_{it} = \alpha + \sum_{k=1}^{K} \beta_k \ln x_{k,it} + \gamma t + \theta_{i0} + \theta_{i1} t + \theta_{i2} t^2 + v_{it} \qquad (7).$$

The decomposition of the error term ε_{it} into its two components is implemented in two steps. In the first step one estimates (6) by OLS with estimated residuals denoted $\hat{\varepsilon}_{it}$. In the second step one estimates θ_{i0} , θ_{i1} and θ_{i2} by estimating the following equation by OLS :

$$\hat{\varepsilon}_{it} = \theta_{i0} + \theta_{i1} t + \theta_{i2} t^2 + v_{it}, \qquad (8)$$

where $v_{it} \sim N(0, \sigma_v^2)$. The fitted values from (8) provide an estimate of u_{it} which is the efficiency indicator. This indicator $\hat{u}_{it}$ has to be normalized to satisfy the non-negativity constraint. So in order to estimate the levels of technical efficiency $\hat{\mu}_{it}$ we calculate :

$$\hat{\mu}_{it} = e^{(\hat{u}_{it} - \hat{u}_{max})} , \qquad (9)$$

where $\hat{u}_{max}$ indicates the most efficient observation in the panel that is assumed to lie on the production frontier.

Note that technical progress is assumed to be neutral and to occur at a constant pace. This means that second order terms, allowing for accelerated or embodied technological progress, are neglected. As a consequence, differentiating (7) with respect to time, we obtain multi-factor productivity growth as a linear function of time and it consists of the rate of technical progress and the rate of change in technical efficiency.

$$\Delta MFP_{it} = \gamma + \theta_{i1} + 2\,\theta_{i2}\, t \qquad (4').$$

3. Variable definitions and data

The data used in this study have recently been made available from the OECD International Sectoral Data Base (ISDB) whose detailed description is given in Meyer-zu-Schlochtern (1988).

Output is value added net of indirect taxes, at constant prices and in US dollars corresponding to 1980 purchasing power parities. Note that this variable, like capital formation, is obtained on a national accounts basis and corresponds to sectoral aggregates in accordance with the International Standard Industrial Classification (ISIC).

Labor is defined as total employment, self-employed included, and is measured by the number of individuals. Capital is estimated by the way of a perpetual inventory model. The data source for the estimation of the capital stock is gross fixed capital formation, assumed to have specific service lives and scrapping rates in each country considered.

Measuring the output with the national accounts value added indicator is questionable in the particular case of financial services. Several authors have questioned the relevancy of such an indicator to assess the actual output of banks and insurance companies[5]. Focusing on the latter, two alternatives are often suggested : on the one hand, gross premiums or incurred losses, and on the other hand the number of policies contracted weighted by their value. The issue is obvious : considering that the objective of an insurance company is to provide risk coverage to its insurees and to invest their premiums, can we say that its value added, that is wages plus capital consumption and profits, reflects the extent of those two activities ? In the banking sector, studies of microunits rely on total deposits or on the number of accounts or transactions to proxy output[6].

Using value added as a measure of output for banks and insurance companies is not entirely satisfactory. In financial services, where the main input is labor, the national accounts measure of production is in most countries no more than an index of labor and hence, the calculation of labor productivity growth can be a tautological exercise. However, up to now, alternative comparable data on the real activities of financial services is not available.

4. Measures of multi-factor productivity growth and of technical efficiency

We use "the time varying effects approach" presented above with two additional assumptions : the financial service branch is taken as a single service firm and the production set is homogeneous both across countries and over time, up to a trend term for the latter. We are thus able to obtain for each country the level of efficiency averaged over the whole period and the average annual rate of growth in efficiency. We further get a figure for technical progress, the same for all countries. Adding the rate of technical progress to the rate of growth in technical efficiency gives the rate of growth in multi-factor productivity. Fecher and Perelman (1990) have proceeded with that decomposition as far as manufacturing sectors are concerned. We here apply it to financial services.

We turn first to the estimation of the production function (6) that constitutes the standard first stage in the estimation of technical efficiency. The estimated parameters,

5 See, e.g., O'Brien (1991), Hornstein and Prescott (1991), Hirshorn and Geehan (1977).

6 See, e.g., Ferrier and Lovell (1990).

obtained by OLS, are presented in Table 1.

Elasticities of production illustrate the basic characteristics of production structure. Technological progress is estimated by the γ coefficient.

Table 1

Stochastic production function for financial services

α	β_1	β_2	γ	R^2	σ_ε^2
- 2.96*** (-34.08)	0.59*** (29.05)	0.42*** (20.64)	0.007*** (3.64)	0.99	2.13

The t-tests are presented in parentheses
*** significant at the 1 percent level

We also observe that the variance of the technical efficiency term, σ_u^2, which is obtained by estimating (8) and is equal to 2.06, represents more than 90 % of total variance, σ_ε^2. This confirms the importance of technical inefficiency.

The second step in the estimation of multi-factor productivity growth consists in the estimation of technical efficiency for each observation. Summing up changes in efficiency and technological progress gives this measure. The results are given in Table 2. As the rate of technical progress is the same for all countries (γ = 0.7 %), it is not presented but used to compute multi-factor productivity change. It thus appears that there is some technical progress over the period covered and yet there is almost no growth in multi-factor productivity.

Table 2 allows us to qualify Baumol's statement on the cost disease in financial services. Based on just multi-factor productivity change, he is entirely right to underline the poor performance of financial services : 5 countries (including the US) out of 11 have negative growth. Where growth is positive, it is hardly significant. Only in (West) Germany does the estimated growth rate exceed 1% per annum. However, what Baumol has in mind is technical progress, which is low but positive. This positive technical progress is offset by poor performance in terms of technical efficiency change (negative in 7 countries), and this can be imputed to poor management.

Table 2

Financial services
Technical efficiency, annual rate of growth
in technical efficiency and multi-factor productivity,
1971-1986, 11 OECD countries

Country	Mean Efficiency level	Mean Efficiency change	Mean Multi-factor productivity change
Australia	0.78	- 0.010	- 0.003
Belgium	0.84	0.002	0.009
Canada	0.85	- 0.002	0.004
Germany	0.88	0.011	0.018
Denmark	0.67	- 0.009	- 0.002
France	0.91	- 0.009	- 0.002
United-Kingdom	0.86	0.002	0.009
Japan	0.98	0.001	0.008
Norway	0.90	- 0.009	- 0.002
Sweden	0.76	- 0.001	0.005
USA	0.71	- 0.008	- 0.001
ALL	0.82	- 0.002	0.004

Indeed, Baumol makes an interesting distinction between what he calls "impersonal technical imperatives" as opposed to "villainous behavior". In his view, the former are the only responsible for negative productivity growth. We show here that in a number of countries including the US this could be the other way around.

5. Competition, regulation and performance

5.a. The conceptual link

Recent theory in the economics of information shows that within a setting of uncertainty and asymmetric information, competitive pressures are the most effective way to foster productive efficiency.[7] Competition induces managers to operate as closely as possible to their production frontier and further it gives their principal, the owners or the State, the relevant information for better monitoring their activities. It also goes without saying that competition induces allocative efficiency.

In trying to eliminate managerial slack, shareholders, governments, or any other principals face difficulties arising from lack of information. Hence they cannot directly sort out the sources of inefficiencies : managerial weaknesses or the firm's true opportunities. Observations of the performance of competing firms in the same market, or of firms in similar environments, do provide relevant information for the development of more efficient incentive schemes.

Even without going to explicit incentive schemes, it is clear that competition fosters efficiency. If a management team performs poorly in competition to reduce costs, its utility is likely to suffer as a consequence. One of the issues one should raise in that respect is that the link between competition and deregulation on the one hand and efficiency, both allocative and technical, on the other hand is not necessarily monotonic. One knows for sure that a firm operating in a setting without any competition and subject to heavy regulation is going to be less efficient than the same firm operating in a setting with competition and full deregulation. Yet, it is not clear that in the process of deregulating an economy and increasing its competitiveness, efficiency always increases monotonically.

In the wave of recent policies of deregulation and privatization[8], a number of studies were issued showing that performance is positively related to the degree of openness and competitiveness; in particular, they often show that for better performance, competition matters more than private ownership.

These studies call for two comments. First, they generally rely on a narrow set of data, e.g., rather short time series of an industry before and after deregulation or privatization. Second, they use performance indicators which are not only partial but the meaning of which varies with the organizational form, the ownership regime, the market structure and the regulatory intensity of the firms analyzed. The usual indicators are prices to evaluate allocative efficiency, labor productivity or the cost of capital to evaluate

7 Hayek (1945), Hart (1983).

8 Yarrow (1986), Vickers and Yarrow (1988).

technical efficiency, share prices or profit margins to assess profitability.

5.b. Empirical findings

We would have liked to use readily available indicators of regulation and competition to control part of the variation in efficiency levels and efficiency changes found in the previous section. Unfortunately, there are no such indicators. We used all the information available for banks and insurance companies which pertains to the degree of concentration, the intensity of regulation and the lack of openness to foreign competition.

Part of this information comes from surveys among practitioners (regulation in insurance); most of it comes from published data on concentration ratios and market shares. Depending on data availability, two variants are considered. The first includes 5 EEC countries (Belgium, Germany, Denmark, France and the U.K.) and the second 7 countries, that is those EEC countries plus Norway and Sweden.

To aggregate this heterogeneous data set, we use the principal component analysis. Even though its limitations are known, this approach is useful in cases as here where one deals with a complex multidimensional process about which is little known a priori. For the two variants, we retain the first two components which explain most of the variance. In either variant, the first component is positively related to openness of the insurance market and negatively related to concentration in insurance and in banks. The second component is positively and strongly correlated with regulation in banks and insurance markets. Thus, one can use component I as an index of competiton and component II as an index of regulation.

Table 3
Indicators of regulation and concentration. Principal components analysis

Variables / Countries	Belgium	Germany	Denmark	France	United Kingdom	Norway	Sweden	Correlation with variables: Comp I Variant I	Comp II (5 countries)	Comp I Variant II	Comp II (7 countries)
INSREG1	1.45	2.35	1.66	2.15	1.40	---	---	0.48	0.26	---	---
INSREG2	1.25	2.25	1.25	1.75	1.50	0.25	1.25	---	---	0.50	0.50
BANKREG	1	0	0	1	0	0	0	- 0.33	0.53	- 0.52	0.47
INSCOMP	20.25	39.25	8.00	18.75	30.50	4.50	5.00	0.34	0.56	0.45	0.54
BANKCOMP	0.378	0.740	0.440	0.574	0.549	---	---	0.59	0.15	---	---
INSMARKET	37.0	85.5	85.7	79.2	80.2	88.0	97.2	0.42	- 0.55	0.52	- 0.48
% variance explained								53	30	38	50
Variant I (5 countries)											
Comp I	- 2.12	2.42	- 0.46	0.17	- 0.003	---	---				
Comp II	1.26	0.73	- 1.76	0.50	- 0.74	---	---				
Variant II (7 countries)											
Comp I	- 1.90	1.93	0.06	- 0.42	0.88	- 0.81	0.26				
Comp II	1.73	1.16	- 0.94	1.04	0.32	- 1.96	- 1.34				

Sources

INSREG 1	Indicator of insurance regulation (obtained from a survey)	(1) Finsinger, J., (1991).
INSREG 2	Indicator of insurance regulation (obtained from a survey)	(2) Andersen Consulting, (1990), p. 27-28.
BANKREG	Indicator of bank regulation (regulation of interest rates)	(3) OCDE, (1989), p. 55.
INSCOMP	Indicator of competition in insurance (number of insurance companies accounting for 80 % of premiums in 1990)	(2) Andersen Consulting, (1990), p. 29-30.
BANKCOMP	Indicator of competition in banks (1 - threebank concentration ratio in 1973)	(4) Revell, J., (1987), p. 52.
INSMARKET	Indicator of foreign competition in insurance (market share of national insurance companies in 1990)	(2) Andersen Consulting, (1990), p. 22-25.

Table 4 gives partial correlation coefficients between those components and our indicators of efficiency level and efficiency change. They are positive in 7 out of 8 cases. Even though, our sample of countries is too narrow to draw any firm conclusions, the positive correlation between regulatory intensity and either the level or the change in efficiency is noteworthy. There are instances where indeed regulation can foster productive efficiency. A good example of this is the German insurance market. It is known for its rigid supervisory system which inhibits product innovation and restricts certain types of investments. At the same time, it has been shown to exhibit a high technical efficiency but a low allocative efficiency[9].

Table 4

Correlation coefficients

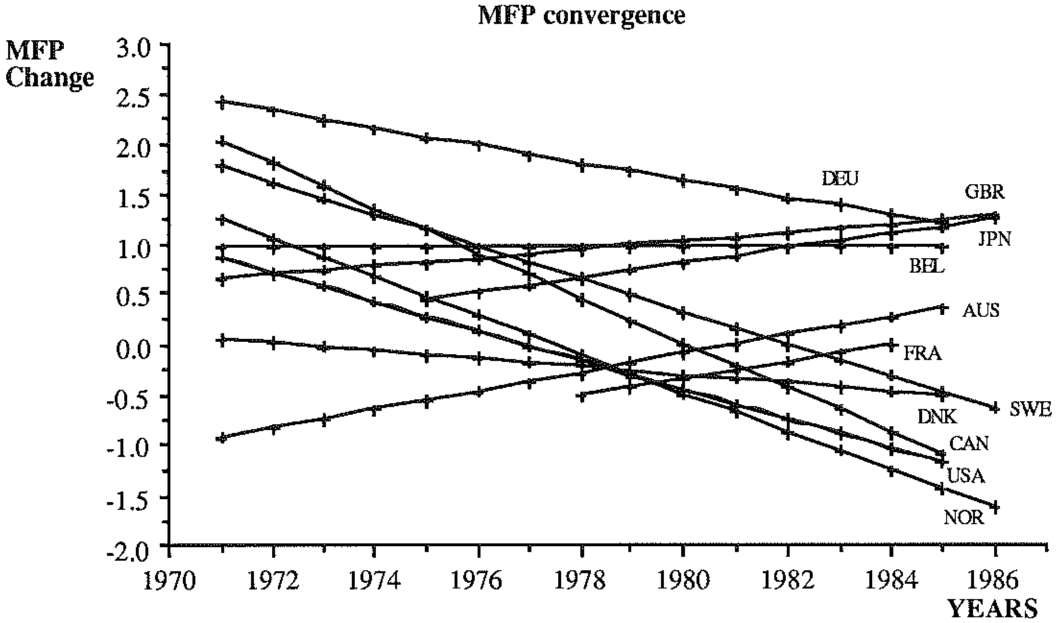
	Variant I		Variant II	
	Comp.I Competition	Comp.II Regulation	Comp.I Competition	Comp.II Regulation
Efficiency level	0.30	0.75	- 0.02	0.37
Efficiency change	0.45	0.49	0.52	0.54

Quite clearly, the data are too preliminary and the number of countries too small to reach any definitive statement. This however shows that regulation and technical efficiency are not necessarily incompatible. On the other hand, competition as measured by the inverse of the concentration ratio is in general positively correlated with technical efficiency.

Finally, it is worth checking whether over the period 1971-1986 which coincides with that of the development of the European Community one observes a trend towards converging changes in MFP. In Figure I, the variation in MFP for our 11 countries is represented. One clearly sees that the EC member countries tend to converge as opposed to the non-EC countries. This appears clearly when comparing the coefficients of variation in the beginning and at the end of the period. It falls for the EC countries and it increases for the non-EC countries.

9 See on this, Finsinger, Hammond and Tapp (1985).

Figure I



6. Conclusion

The purpose of this paper is to decompose the variation in multi-factor productivity growth in financial services into technical progress and technical efficiency change to better understand the often observed low gains in productivity in banks and insurance companies. We have shown that most of that poor performance is imputable to slacks in technical efficiency.

We then tried to see whether regulation and lack of competition can explain differentials in MFP change across countries. Unfortunately the only available indicator of regulation is restricted to seven countries. On the basis of such a small sample the findings are rather mixed. Competition and regulation both seem to favor both efficiency level and efficiency change. Further, one observes some convergence in the rate of productivity changes among EC countries.

References

Andersen Consulting (1990), Insurance in a changing Europe 1990-1995, Special Report n° 2068, 27-28.

Barla, Ph. and S. Perelman (1989), "Technical efficiency in airlines under regulated and deregulated environments", Annales de l'Economie Publique, Sociale et Coopérative, 1, 103-24.

Baumol, W.J., S.A. Batey Backman and E.N. Wolff (1989), Productivity and American Leadership, The MIT Press, Cambridge, Ma.

Baumol, W. (1991), "Technological imperatives, productivity and insurance costs", The Geneva Papers, 59, 154-65.

Cornwell, C., Schmidt, P. and R.C. Sickles (1990), "Production frontier with cross-sectional and time-series variation in efficiency levels", Journal of Econometrics, 46, 185-200.

Fecher, F. and S. Perelman (1990), "Productivity growth, technological progress and R&D in OECD industrial activities", in G. Krause-Junk, ed., Public Finance and Steady Economic Growth , The Public Finance Foundation, The Hague.

Ferrier G. and C.A.K. Lovell (1990), "Measuring cost efficiency in banking - Econometric and linear programming evidence", Journal of Econometrics, 46, 229-45.

Finsinger, J. (1991), "European market integration and the European insurance industry. Reasons for trade, barriers to entry, distribution channels, regulation and price levels", in G.Winckler (ed.), Tax Harmonisation and Financial Liberalisation in Europe, Verlag MacMillan Press, forthcoming.

Finsinger, J., Hammond, E. and J. Tapp (1985), Insurance : Competition or Regulation, London, IFS.

Hart, O.D. (1983), ""The market mechanism as an incentive scheme", Bell Journal of Economics, 14, 366-82.

Hayek, F.A. (1945), "The use of knowledge in society", American Economic Review, 35, 519-30.

Hirshorn, R. and G. Geehan (1977), "Measuring the real output of the life insurance industry", Review of Economics and Statistics, 59, 211-19.

Hornstein, A. and E. Prescott (1991), "Measures of the insurance sector output", The Geneva Papers, 59, 191-206.

Lovell C.A.K. and P. Schmidt (1988), "A comparison of alternative approaches to the measurement of productive efficiency", in A. Dogramci and R. Färe, eds., Studies in productivity analysis. Applications of modern production theory. Efficieny and productivity, Kluwer Academic Publishers, Boston.

Meyer-zu-Schlochtern, F.J.M. (1988), "An international sectoral data base for thirteen OECD countries", W.P. 57, Department of Economics and Statistics, OECD.

Nishimizu, M. and J.M. Page (1982), "Total factor productivity growth, technological progress and technical efficiency change : dimensions of productivity change in Yugoslavia, 1965-78", Economic Journal, 92, 920-36.

O'Brien, C.D. (1991), "Measuring the output of life insurance companies", The Geneva Papers, 59, 207-35.

OECD (1989), La concurrence dans le secteur bancaire, Paris.

Revell, J. (1987), Mergers and the role of large banks, Institute of European Finance, Research Monographs in Banking and Finance, 2.

Vickers, J. and G. Yarrow (1988), Privatization. An Economic Analysis, MIT Press, Cambridge.

Wolff, E.N., (1991) "Productivity growth, capital intensity and skill levels in the US insurance industry, 1948-86", The Geneva Papers, 59, 173-90.

Yarrow , G. (1986), "Privatization in theory and in practice", Economic Policy, 1, 324-77.