

Are Privatization and Consolidation vehicles of Bank Productivity? Comparative Evidence from Italy and Germany *

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Abstract

We compare total factor productivity (TFP) changes of the Italian and German banking systems and relate them to both privatization and consolidation developments between 1994 and 2004. While many studies concentrate only on efficiency measures, we estimate the different components of TFP changes (economies of scale, technological progress, and cost efficiency) with stochastic frontier analysis (SFA). We use balance sheet and profit and loss account data reported to the Banca d'Italia and the Bundesbank, respectively, and find that both industries have experienced productivity growth during the period of analysis. But Italy's growth has been significantly higher than Germany's. TFP improvements in both countries are mainly due to technological progress while cost efficiency seems to have played a marginal role and Italian and German banks face diseconomies of scale. Moreover, we estimate the impact of the privatization and consolidation processes on TFP changes. Our results show that in Italy mergers and acquisitions as well as the privatization process have influenced positively TFP changes; in Germany the consolidation process seems to do not have had an influence on the evolution of productivity.

Keywords: Banking market integration, Deregulation, Total Factor Productivity, Italy, Germany.

JEL:D24, G21, G28, L33

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1 Introduction

Banking industries throughout the world have changed dramatically during the last two decades. Technical progress and the globalization of financial services exposed banks to increased competitive pressure and forced them to optimize their operations and productivity, often through mergers and acquisitions (M&A) (Amel et al., 2004; Angelini and Cetorelli, 2003). This development was supported by the deregulation of the banking industry in many countries in an effort to increase its efficiency (Megginson, 2005; Barth et al., 2000).

In this study we examine the Italian and German banking system, which until the 1990s shared similar characteristics, in particular with regard to the existence of a large public banking sector. Both banking systems have experienced a profound process of consolidation, still ongoing, but while Germany has still a considerable share of state owned savings banks, Italy privatized its public banking sector during the 1990s. We argue that comparing the evolution of these two important European banking industries over the last decade will shed new light on the effects of consolidation and privatization. In particular we address the following questions: How did the productivity of German and Italian banks develop during the 1990s, and how was it affected by privatization and mergers? What are the most important components of productivity growth, technical progress, efficiency gains, or the realization of scale economies?

Extensive literature already exists on the effects of M&A but the empirical evidence on the effects of bank privatization is relatively scarce (Megginson, 2005) and even failing when it comes to compare the relative effects of consolidation and privatization. In addition, while a number of studies analyzed individual components for both banking markets, only few address all three components simultaneously.¹ We aim to fill this gap by analyzing how privatization and merger events affected the banks' total factor productivity (TFP). We use a unique dataset provided by the central Banks of Italy and Germany, respectively, and estimate three different components of TFP changes: (i) efficiency changes, (ii) scale economy changes and (iii) technical changes.

We expect differences in the development of productivity for the two countries. As privatization is said to remove some constraints in the efficient allocation of resources we furthermore expect a positive sign on the privatization dummy variables, at least in the longer run when the restructuring of the bank is completed. The effects of merger activities are not determined *ex ante*. They may contribute to productivity growth if banks are seeking the synergies of combined production but they can also impair productivity, if e.g. one of the merging banks is in financial distress. We expect a positive sign on the merger dummy variables, especially in the long run and eventually a negative sign on the distress merger dummies.

Our results show that both industries have experienced productivity growth during the period of analysis. But Italy's growth has been significantly higher than Germany's. The privatization process has had a positive impact on productivity growth for Italian banks. We find mixed results for the consolidation process: In Italy the

¹For example, Lang and Welzel (1996), Altunbas et al. (2001), Maudos et al. (2002) or Casu et al. (2004).

effect is positive while in Germany neither distressed nor non-distressed mergers have affected productivity growth.

We structure the remainder of the paper as follows. In section 2 we describe both industries in terms of structural and regulation peculiarities. We review the relevant literature relating bank productivity to ownership changes in section 3. In section 4 we introduce our two-stage methodology. First, we discuss how we estimate total factor productivity changes from industry cost functions and in particular how we obtain the three components of TFP change: efficiency, scale and technical changes. In the second step, we employ regression to analyse how privatization and consolidation affected TFP growth and its components for German and Italian banks. After presenting our data in section 5, we discuss our results in section 6. We conclude with some final remarks in section 7.

2 The Italian and German Banking Systems

At the end of the 1980's the Italian banking system consists of private banks, public banks (both saving institutions and state owned banks) ², and credit cooperatives. The system is highly fragmented, has a large number of relatively small institutions and a significant presence of the state in the ownership share (see Figure 1). At that time there are no universal banks and the institutions are classified according to the mandatory business specialization as commercial banks or as special credit institutions. ³ In addition, the regional spread and business activities are strictly regulated. In the course of the 1990's this structure is radically altered. In 1990 public banks are transformed into joint-stock companies and split into two separate entities, a "foundation" and a "stock corporation". ⁴ The foundation represents the original legal entity, confers its banking division to the stock corporation and holds the stock. The "stock corporation" (the bank) conducts the banking business. In 1994 and 1999 tax incentives are introduced for foundations shedding their bank shareholders. ⁵ Together with the reform of the ownership structure of public banks, a set of other important reforms take place in the 1990's, in part as a consequence of the implementation of the Second Banking Directive (89/646/EEC). The mandatory specialization is gradually removed after 1990 and thanks to the new universal bank model credit institutions can raise funds in any form and undertake any business activities (such as factoring, leasing, medium- and long-term credit, and merchant banking). The limit to geographical diversification for all special credit institutions is lifted and the notion of banking group is introduced in the legislation. As a consequence of this wave of reforms the nature of the banking system changes substantially. The share of total assets controlled by public banks decreases dramatically, from 57.2 to less than 1 percent and the number of banks drop by 26.5% per cent to 784 (see Figure 1). These trends are also the result of a process of mergers and acquisitions among banks which, measured in terms of the number of institutions involved, reaches its peak in the course of the 1990's. Between 1990 and 2004 a total of 620 mergers are recorded, involving more than half of the total assets of the Italian banking system. At the same time, thanks to the liberalization of branching, the number of bank offices increase by around 78 per cent and the availability of banking services improves. The average size of banks increases, both at the individual and the group level.⁶

In contrast to Italy, the German banking system does not experience fundamental deregulation measures during the 1990's. Despite the consolidation process and the implementation of the Second Banking Directive (89/646/EEC) no substantial

²The presence of the Government in the banking system traces back to the creation of IRI ("Istituto per la Ricostruzione Industriale") after the Great Depression. It was a publicly-owned holding company controlling the three largest private banks Banca Commerciale Italiana, Credito Italiano, and Banca di Roma.

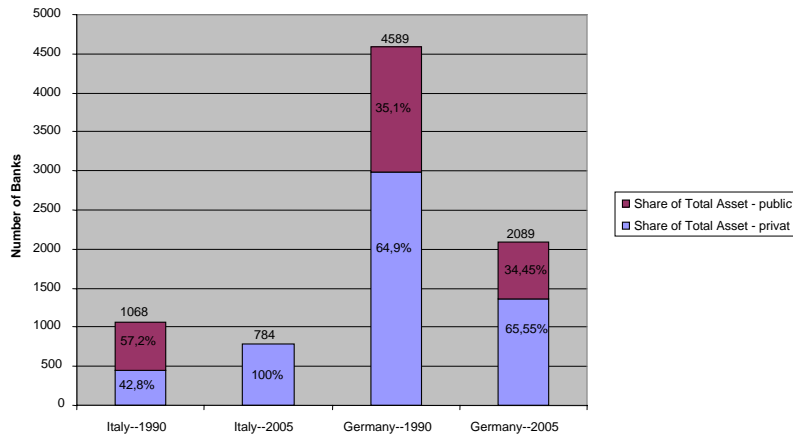
³Commercial banks are specialized in the short-term business, i.e. shorter than 18 months while special credit institutions are specialized in the medium- and long-term business and in one particular sector, such as agriculture, building, public works or industry (Carletti et al., 2005).

⁴Law No. 218 of 1990 (Amato-Carli Law): The restructuring and integration of the equity of public sector banks.

⁵Law No.474 of 1994 (Dini Directive) and Law No.461 of 1998 (Ciampi Law)

⁶See Table 6 to Table 8 in the Appendix to get some inside in the structure and performance of the Italian banking system during the period of analysis.

Figure 1: Privatization and Consolidation of Italian and German banks



changes regarding deregulation take place (Carletti et al., 2005). The banking industry in Germany is composed of a variety of public and private credit institutions, the activities of credit institutions are not limited and this universal banking system is structured along three pillars: commercial, savings and cooperative banks (Krahen and Schmidt, 2004). During the 1990's the structure of the banking system with respect to the three pillar taxonomy does not change. However, the number of institution differs dramatically. The banking system witnesses an unprecedented bank merger wave: The number of banks operating in Germany drops from 4,589 in 1990 to 2,089 units in 2005 (see Figure 1). As a result the average size of banks increases by almost 60% during the same period. But other than in Italy, the consolidation process takes place within pillars rather than across pillars. Regional and central savings in each state are governed by state-specific law and cannot be taken over by an institution of another pillar unless their legal status is changed (privatized), a process that requires majority support in the state parliaments. The same holds for mergers between public sector banks of different states (Brunner et al., 2004). With the exception of the Postbank, no single public bank has been privatized in Germany since 1990. The number of publicly owned banks declines steadily solely due to intra-pillar mergers rather than privatization and as a consequence the asset share of public banks does not change significantly (35.1% in 1990 and 34.5% in 2005).⁷

⁷See Table 6 to Table 8 in the Appendix to get some inside in the structure and performance of the German banking system during the period of analysis.

3 Related Literature

Whether deregulation and privatization leads to better performing banks is a matter of a long-standing debate (Megginson, 2005). For example, Bhattacharyya et al. (1997) analyze TFP growth of privatized public banks in India between 1970 and 1992. In the initial aftermath of deregulation productivity collapsed, potentially due to a costly adjustment process banks have to face within the new competitive market conditions. However, TFP gradually improves by 2% on average and peaks in the course of ongoing liberalization an impressive 7% at the end of the observation period. Kumbhakar and Sarkar (2003) also analyze the relationship between deregulation and TFP growth in the Indian banking industry using a generalized shadow cost function approach during 1985 and 1996. They find a significant decline in regulatory distortions, but report in contrast to Bhattacharyya et al. (1997) the absence of anticipated TFP improvements. According to their results, public sector banks do not respond well to deregulation. Hence, the relative merits of privatization to boost banking productivity remain mixed.

Other studies on less developed and developing economies contribute to this ambiguity. On the one hand, Nakane and Weintraub (2005) (Brazil), Mohieldin and Nasr (2007) (Egypt) and Gilbert and Wilson (1998) (Korea) report positive performance development of privatized state-owned banks. On the other hand, Bonaccorsi di Patti and Hardy (2005) (Pakistan), Omran (2007) (Egypt) and Isik and Hassan (2003) (Turkey) find that efficiency gains are not sustained shortly after privatization or even that privately owned banks experienced slower TFP growth compared to government owned peers.

These contradicting findings across different countries do not only highlight the need of empirical evidence for industrialized countries. Since even results on identical countries during similar time spans contradict each other, methodological choices warrant particular care. In the following we can only highlight some of the aspects that are also relevant for our study.

Wheelock and Wilson (1999) use a Malmquist productivity index to decompose productivity into different components. They find that U.S. banks became technically inefficient between 1984 and 1993. However, non-parametric methods for TFP measurement, such as Malmquist indices, neglect the effects of random noise and measurement error. In contrast, Stiroh (2000) employs parametric methods and finds improving cost productivity among US bank holding companies (BHC) between 1991 and 1997. Only few studies incorporated explicitly a measure of inefficiency when estimating productivity changes. Berger and Mester (1997) and Berger and Mester (2003) estimate productivity changes of US banks between 1984 and 1995⁸. Their results indicate, first, a modest decline in cost efficiency, second, cost improvements due to more favorable business conditions and, third, negative technological change both before and after 1990. On balance, cost changes have been very small due to these countervailing effects. Their results corroborate that cost productivity worsened considerably during the early 1990's when productivity changes distinguish between changes in efficiency and shifts of the frontier. But since their sample just

⁸They employ the Distribution Free Approach (DFA) (Berger, 1993), which assumes that core efficiency is time-invariant over intervals of six years. However, the choice of an appropriate time interval remains arbitrary. In the follow-up study the sample period is extended to 1997.

excludes the years after the interstate branching act, no direct proxy for deregulation policies can be specified to assess the effect of the latter.

4 Methodology

We state the productivity analysis of Italian and German banks in a cost-output framework. In this context productivity changes when the real value of output grows at a different rate than the real costs of production.⁹ Frequently productivity changes are measured with index number methods, as the Divisia Index. A disadvantage of these indexes is that they do not provide information about the sources of productivity changes. For this reason we follow Bauer (1990) as well as Kumbhakar and Lovell (2000) by estimating a cost function and deriving TFP changes from its components. We use parametric techniques rather than non-parametric methods to estimate the cost function because the latter have been found to be very sensitive to outliers (Coelli et al., 1997).¹⁰

The components of TFP change that we consider are efficiency changes, technological progress and the realization of scale economies. To ensure the comparability of these relative measures across Italy and Germany we estimate an optimal cost frontier for both banking markets together. While assuming a common cost frontier for both countries we account for bank and country specific effects in the variables included in the regression equation. In particular, we assume that every bank k is subject to a technology constraint $T(\bullet)$. At any time t , and given an input price vector w , each bank k chooses an input vector x in order to produce an output vector y . In terms of a cost function:¹¹

$$\ln C_{kt} = \alpha_k + f(y_{kt}, w_{kt}, z_{kt}, t) + v_{kt} + u_{kt} \quad (1)$$

where $f(y_{kt}, w_{kt}, z_{kt}, t)$ is the bank-individual optimum cost function, z is a vector of banks observable characteristics and $\varepsilon = v_{kt} + u_{kt}$ is the composed error term. In any year t , a bank can deviate from optimal costs due to random noise, v_{kt} , or inefficient management, u_{kt} . The random error term v_{kt} is assumed *i.i.d.* with $v_{kt} \sim N(0, \sigma_v^2)$ and independent of the explanatory variables. The inefficiency term is *i.i.d.* with $u_{kt} \sim N|(0, \sigma_u^2)|$ and independent of the v_{kt} ¹². Bank-specific point estimates of efficiency are obtained as $E(u_{kt}|\varepsilon_{kt})$, i.e. the mean of u_{kt} given ε_{kt} (Jondrow et al., 1982).

It is important to note that the optimum cost function is determined by bank specific characteristics z_k and un-observable bank individual effects α_k (Greene,

⁹In the traditional input-output framework productivity changes occur when an index of output changes at a different rate than the corresponding index of input (Kumbhakar and Lovell, 2000).

¹⁰See Fiorentino et al. (2006) for a comparison of parametrical and non-parametrical methods applied to the German banking system.

¹¹We assume that the function has a translog form. A detailed description as well as estimated parameters are provided in the Appendix at page 19.

¹²Since the cost function is homogeneous of degree one in input prices, we impose the linear homogeneity restrictions by dividing the prices and total variable cost by the price of one input

2005).¹³ Moreover, the inefficiency component u_{kt} is allowed to vary over time. In contrast to many other studies that have studied the evolution of efficiency, we choose a specification that leaves the development of efficiency unrestricted over time.¹⁴ In our context, it would be inappropriate to impose any simple functional form for the change in efficiency because the privatization of banks may lead to an initial slump of efficiency but it will gradually recover in the following years when the restructuring is completed.

From equation (1) we derive the following decomposition of pure TFP change $TFPC$:¹⁵

$$\dot{TFP}_{kt} = \left[1 - \frac{\partial \ln C_{kt}(y, w, z, t)}{\partial \ln y}\right] \dot{y} - \frac{\partial \ln C_{kt}(y, w, z, t)}{\partial t} - \frac{\partial u_{kt}}{\partial t}. \quad (2)$$

The first expression on the right-hand side of equation (2) represents the component of TFP change resulting from banks' realization of scale economies, (in the following SC), the second term describes technological change, (in the following TEC), and the last expression depicts the change in technical efficiency, (in the following EFC)¹⁶. The component that describes the realization of scale economies depends on two effects, scale elasticities as captured by the term inside the brackets, and the changes in output volume. Importantly, if a bank exhibits constant returns to scale, i.e. $(\partial \ln C_k(y, w, z, t)/\partial \ln y) = 1$, a change in the level of outputs does not influence TFP change. Only if a bank exhibits increasing returns to scale, $(\partial \ln C_k(y, w, z, t)/\partial \ln y) < 1$, does an increase in output, $\dot{y} > 0$, lead to an increase in productivity. The second component of equation (2) depicts changes in technology. If technological progress prevails identical input quantities are converted into larger volumes of output at lower costs. Many papers estimate technical changes by estimating separate frontiers per year and then disentangling cost changes due to changed parameters from those due to changing variables. In our view the estimation of separate functions renders difficult to compare efficiency scores. Efficiency is a relative concept since it is measured as the distance from a benchmark (optimal frontier). Therefore the comparison of efficiency levels obtained from separate analysis may be questionable (comparability problem). On this account, we follow Baltagi and Griffin (1988) and amend the cost frontier with both direct and interacted time trends. This allows us to avoid the comparability problem and to derive technical change as the sum of partial time derivatives.¹⁷ The final component of equation (2) captures the contribution to productivity change of changes in the cost of technical inefficiency¹⁸. Until very recently econometric models of productivity ignored the

¹³A decisive advantage in light of our study is that non-random cost differences due to inefficiency, as for example, systematic differences due to banking group membership, regional scope of activities or bank specific characteristics not captured by the included variables, are captured by α_k .

¹⁴Most banking studies employing panel estimators parameterize the dynamic evolution of inefficiency as a linear trend (Battese and Coelli, 1988; Lang and Welzel, 1996).

¹⁵We assume the input mix is allocative efficient. Therefore, the additional component of TFP growth that captures the impact of deviation of actual input cost shares from efficient input cost shares and the one due to allocative inefficiency are not included in the decomposition of TFP change we consider here.

¹⁶A dot over a variable indicates its rate of change.

¹⁷For an application to European banking see Altunbas et al. (1999).

¹⁸If efficiency is time invariant, then this component drops out.

contribution of efficiency. However if inefficiency exists, its change provides an independent contribution to productivity. In fact, if efficiency improves costs decrease and productivity grows.

In a second step we test the impact of privatization and consolidation on TFP change and its components, both in the short and in the long run. In order to capture unobserved bank individual effects we employ panel estimation techniques. As privatization and merger activities are likely to be endogenously determined we apply GMM techniques and use lagged endogenous and other pre-determined variables as instruments. In this regard we follow Blundell and Bond (1998) who extend the well-known dynamic panel estimator of Arellano and Bond (1991) by deploying a system GMM estimator for the equations in levels and in differences.¹⁹ The specification used for the estimation is:

$$g_{it} = g_{i(t-1)}a_1 + \dots + g_{i(t-p)}a_p + \mu_{it}b_1 + \varrho_{it}b_2 + e_{it}. \quad (3)$$

where g_{it} are TFPC and its components; μ_{it} is a vector of strictly exogenous covariates; ϱ_{it} is a vector of predetermined covariates; e_{it} is the error term. We capture the privatization and consolidation effects as well as public ownership by means of dummy variables. The estimation uses all available lags of the specified variables dated $t - 1$ and earlier ($t - p$) as instruments in the difference equation, and uses first difference dated t and earlier in the level equation. We use lagged endogenous variables, as well as lagged performance and size indicators as instruments in our regression equation.

The instruments (ρ_{it} in equation (3)) we use are the lagged values of the return on assets (ROA), the cost income ratio (CI), the lagged values of the dependent variables and the privatization and consolidation dummies. We use the log value of total assets as a proxy for size. We control for the macroeconomic developments in each country by including real GDP growth rates and interest rates into the regression equations (GDP growth rates, interest rates and year dummies correspond to the regressors μ_{it} in equation (3)).²⁰ A full description of the variables used in the regression analysis can be found in the appendix at page 23.

We estimate equation (3) both pooled and separately for Italy and Germany. We did include both short and long run effects in the country specific regression equations. The short run effects are captured by the contemporaneous merger and privatization variables whereas we use 4 year lags for the longer run effects. In both cases we interacted the bank specific variables with the country dummies.

5 Data and variables

We use balance sheet as well as profit and loss account data on an annual basis for all universal banks operating in Germany and Italy between 1994 and 2004.

¹⁹Their estimator uses all available lags of the endogenous variables dated $t - 2$ and earlier as instruments in the difference equation, and uses first difference dated $t - 1$ and earlier in the level equation.

²⁰Any remaining macroeconomic effects are captured by time dummies for each year.

²¹ The data are obtained from the Deutsche Bundesbank and the Banca d'Italia. We use balance sheets and profit and loss accounts data to define the inputs and outputs of banking production process. To estimate the cost frontier, we follow the intermediation approach of Sealey and Lindley (1977) and define three input and output categories. Input quantities are fixed assets x_1 , such as branches and administrative buildings; labor x_2 , measured as full-time equivalents (FTE) and borrowed funds x_3 , measured as the volume of deposits and bonds. Input prices w_i are derived per bank as depreciation relative to fixed assets, personnel expenses relative to FTE and interest expenses relative to total borrowed funds, respectively. As outputs we define the volume of interbank and customer loans, y_1 and y_2 , on the one hand and investment in stocks and bonds, y_3 , on the other. In addition, we add a time trend t alongside with interaction terms of time and input prices as well as output quantities, respectively (Baltagi and Griffin, 1988). We also include equity capital z_1 and non performing loans z_2 as part of the transformation technology (Mester, 1993). Descriptive statistics of all variables for the period 1994-2004 are included in the appendix at page 22 (Table 9).²²

Bank history data such as the date of transformation of the saving bank in stock company and foundation and the date of the disposition of the banking share by the foundation are used to analyze the impact of privatization on TFP change. Data on bank mergers are used to determine the effect of consolidation. In particular, we proxy the privatization effect by a dummy variable (PRIVATIZED), which takes the value 1 if the bank was a public owned bank in year t and is private in $t + 1$.²³ In order to also control for the longer-term effects we additionally include a dummy variable (PRIVATIZED4) that takes the value 1 if the bank was privatized during the last four years, excluding the current year, i.e PRIVATIZED4 is equal to 1 if either L1.PRIVATIZED, L2.PRIVATIZED or L3.PRIVATIZED is equal to 1. ²⁴

Also by means of a dummy variable, we measure whether a bank was involved in a merger during the observation period and we separate between distressed mergers (DISTRESS DUMMY) and non-distressed mergers (MERGER DUMMY). Since most of distressed banks rarely go into outright default we use prudential information of the Bundesbank and the Bank d'Italia that collects information on banks considered under distress.²⁵ Some of the merger effects might not be immediately observable, which is why we also include lagged dummy variables (with a lag of 4 years). Differences in the ownership are captured by a dummy variable (PUBLIC) that takes the value 1 if the bank is publicly owned at time $t - 1$ and 0 otherwise. As we also include the current privatization variable into the regression the ownership variable enters the regression equation with a one-year lag. We control for the macroeconomic developments in each country by including real GDP growth rates and real interest rates into the regression equations. Any remaining macroeconomic effects are cap-

²¹Data are available for the Italian banks back to 1986 while for the German banks to 1993. With respect to the Germany this is mainly because East German banks were not included in the statistics prior to 1993. Moreover the year 1993 presents a large number of missing value. For comparability reasons between the two banking systems we therefore decide to restrict our sample to the period 1994-2004.

²²All data were converted into 1995 prices using own country GDP deflators.

²³Please note that the privatization year varies considerably during the period of analysis.

²⁴We define LP.X as the variable X with a lag of (t-P) years

²⁵Most of the banks rarely go into outright default so problem cases usually do not become public.

tured by time dummies for each year. In the pooled regression we include a country dummy (GERMANY) that takes the value 1 if the bank is located in Germany and 0 in Italy.

6 Results

In table 1 we report average productivity changes results using both the Divisia Index (Divisia) and the econometric techniques (*TFPC*). We calculate the Divisia Index as the ratio of total costs to total output: In this case productivity grows when $\frac{C^{t+1}}{y^{t+1}} < \frac{C^t}{y^t}$.²⁶ According to Kumbhakar and Lozano-Vivas (2005) a wide gap between the two measures is often observed, especially when *TFP* growth (which is the sum of the *TFP* growth components) is estimated using parametric models. On this account, Hulten (2000) points out that in productivity analysis the Divisia Index approach should be used with the parametric approach to check the consistency of the results. In our analysis productivity changes obtained from the parametric technique and the non parametric Divisia Index provide similar results, in fact according to both methods bank productivity improves in Italy and Germany during the period of analysis (1994-2004).²⁷ We consider henceforth only the parametric results.

Table 1: Average Productivity Growth and TFP Decomposition (1994-2004)

Country/Bank Type	Divisia	<i>TFPC</i> = <i>SC</i> + <i>TEC</i> + <i>EFC</i>				N
Germany Total	0.027	0.040	-0.011	0.049	0.002	23797
Saving banks	0.028	0.037	-0.016	0.051	0.002	5276
Private banks	0.015	0.035	-0.006	0.040	0.001	649
Cooperatives	0.027	0.041	-0.010	0.049	0.002	17872
Italy Total	0.074	0.050	-0.015	0.065	0.001	5241
Formerly State owned¹⁾	0.086	0.068	-0.013	0.081	-0.0001	64
Formerly Saving banks¹⁾	0.074	0.058	-0.001	0.063	-0.004	620
Private banks	0.052	0.035	-0.045	0.077	0.003	430
Cooperatives	0.063	0.042	-0.016	0.067	-0.009	673
Mutual banks	0.078	0.052	-0.014	0.063	0.003	3454

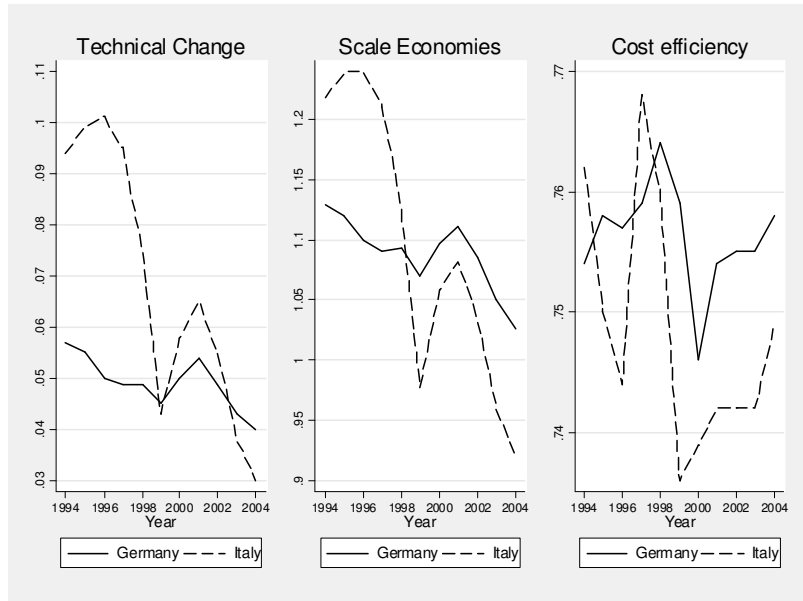
¹⁾ Privatized during the sample period.

Both banking systems experienced a similar trend in the improvement of productivity (measured as the reduction of cost given the output) but in Italy the banking sector grows at a greater average rate. In Germany there are almost no differences between banking groups: private banks face a productivity growth of 3.5 percent, saving banks of 3.7 percent and cooperatives of 4.1 percent. On the contrary, Italian banks differ a lot in the productivity gains according to the banking group: the banking groups involved in the privatization process show a higher level of *TFP* change. In fact formerly state owned banks (now private commercial) have a growth on average of 6.8 percent, formerly saving banks (now private commercial) of 5.8 percent,

²⁶In case of productivity growth the Divisia index measures are negative while the estimated rates of *TFP* are positive. We choose to report the negative of the Divisia Index for comparative reasons.

²⁷With the exception of the year 1995, 2000, 2001 in Italy and 2000 in Germany the two measures are consistent.

Figure 2: TFP Components over time



while cooperatives, mutual and private banks have on average a TFP growth of 4.1 percent. In both countries commercial banks do not seem to have taken advantages of the banking reforms of the 1990s: $TFPC$ scores of private commercial banks are the smallest both in Germany and in Italy.

One important advantage of using parametric techniques is that they permit to decompose TFP change into its various sources: the contribution associated with returns to scale (SC), technical change (TEC) and change in cost efficiency (EFC). These three components are depicted in the according columns in Table 1. In addition Figure 2 shows the evolution of the economies of scale, technical change and efficiency level over time. Recall that output growth in the presence of diseconomies of scale reduces productivity growth, as does output contraction in the presence of scale economies. The results of the TFP change decomposition show that the scale effect was a source of decline in TFP change both for Italy and for Germany. The rate of change due to scale effects is -1.5 percent in Italy and -1.1 percent in Germany. Since the output grows during the entire period of analysis the negative sign of the scale components is due to the presence of diseconomies of scale as it can be seen in Figure 2 for both Italian and German banks. Especially private commercial banks in Italy suffered for the presence of diseconomy of scale. As a consequence their productivity decreases. At first sight this observation might seem surprising in view of the large number of small banks in both countries. However, it is in line with other research that finds diseconomies of scale for the majority of banks except perhaps for the very large ones. It is noteworthy, that both banking systems were able to reduce their diseconomies over time. In the case of Italy, scale economies turned to be less than one in recent years (see Figure 2).

The efficiency change of Italian and German banks appear on average not relevant

in comparison to the other components of $TFPC$. In fact it is close to zero for both countries. Nonetheless by looking at the development of efficiency over time in Figure 2 we can observe different trends in the two banking markets. The efficiency of German banks improves during the period of analysis, with the only exception of the years 1999 and 2000 while in Italy the evolution of efficiency is fragmented over the time horizon. In fact after a period of decline between 1994 and 1996, efficiency has a positive pick in 1996, reduces one more time in 1999 and increases again after that. It has to be noted, though, that our concept of efficiency is a relative measure as it addresses, roughly speaking, the relative distance of actual costs to optimal costs. If, for example, a bank did not change its way of production over time, its efficiency would necessarily suffer due to a flattening optimal cost curve. On comparison, German banks seem to be more efficient on average than their Italian peers but the difference to the Italian banks sectors is modest.

Much of the increase in $TFPC$ is the result of technological progress, that ameliorates at a rate of 6.5 percent in Italy and of 4.9 percent in Germany. Thus we observe a downward shift in the cost frontier, *ceteris paribus*, for both countries from 1995 to 2004.

Next, we investigate by regression analysis how ownership and ownership changes as well as M&Aqs affected total factor productivity growth of individual banks. Apart from TFP change we also analyze efficiency change, technical change and gains from the realization of scale economies. The results of the regression analysis that we separately carried out for each country are reported in Table 2.

The effects of merger activities are not determined *ex ante*. They may contribute to productivity growth if banks are seeking the synergies of combined production but they can also impair productivity, if e.g. one of the merging banks is in financial distress. In fact, other papers have shown that distress resolution is an important motive for mergers, in particular in Germany (Koetter et al., 2007; Focarelli et al., 2002). This motive is often relevant also in the case the bank is not in-direct financial distress but its long-term profitability is questioned.²⁸ Our results show that the consolidation process in the Italian banking system has had a positive impact on productivity growth. This productivity growth mainly derives from a boost in technology both in the long and in the short run as we can see from the coefficient of $MERGER$ and $L4.MERGER$ which are positive and significant. On the contrary mergers seem to impair the realization of economies of scale (the coefficient of $L4.MERGER$ is negative for the realization of scale economies). Distressed mergers enhance productivity in the long run: after a distressed bank is merged its productivity decreases, possibly due to the already bad situation in which the bank operates (TFP , efficiency and technical change coefficients are all negative and significant). Formerly distress banks which still operate in the market 4 years after a merger show a positive development in TFP and efficiency. Besides, the merging banks seem to benefit from the realization of scale economies.

In contrast to Italy we do not find evidence for the effects of mergers in the German banking system: neither distressed nor non-distressed mergers have affected productivity growth. One possible explanation is that the German banking system might be a mature and saturated system where individual events such as M&Aqs

²⁸(Koetter et al., 2007) have shown that those mergers often take place in order to arrange an orderly exit from the market.

have little effects on the improvement of productivity. The analyzed M&Aqs exclusively have a positive effect on technical changes both in the short and in the long run and impair the realization of economies of scale in the short run.

As expected the privatization process has a positive effect on the *TFP* change of Italian banks and the effect is still visible after 4 years. In fact the coefficients of *PRIVATIZED* and *PRIVATIZED4* are positive and significant. It seems that the privatization has the effect of a "weak up call" for the banks and force them to adjust the managerial inefficiency directly after the change in ownership (as can be seen from the coefficient of *PRIVATIZED* which is positive and significant for the efficiency component). In the long run the gain in productivity comes from innovation as a proof for the ability of banks in investing in technology after the binding constraints due to public ownership are left (*PRIVATIZED4* is positive and significant for technical change). The privatization has a negative effect on the realization of economies of scale in the short run but a positive effect in the long run. The negative sign of the scale component might be the result of both a worsening in the economies of scale or a reduction in output. Since in our analysis the output grows during the entire period, the privatization affects negatively the return to scale characteristics of the banks.

Given our results a possible interpretation of the dynamics of the privatization process might be the following: after a bank is privatized its main interest is concentrated in cutting the cost and reorganizing the production (the coefficient of efficiency is positive and significant in the short run for privatized banks); In the long run the focus changes and the bank seeks to increase output and improve the production process by investing in technology (the coefficient of technical change and scale economies are positive and significant in the long run). Besides, given that the consolidation boosts the productivity only of Italian banks we argue that the privatization might have had a positive indirect effects on M&Aqs too. Privatization might enhance productivity directly by removing binding constraints in the production and indirectly by making the market as a whole more dynamic.

After the Amato Law of 1990 Italian public banks formally finished to exist. Nevertheless the Banca d'Italia still classifies formerly state owned and formerly saving banks which are still owned by a foundations for more than 50% as public institutions. To our understanding those banks should be interpreted as institutions which are involved in the privatization process but do not complete it yet. We identify those banks with the ownership dummy *PUBLIC*. In our analysis productivity and efficiency decrease for Italian banks which have been only partly privatized (the coefficients of *TFP* and efficiency change are positive and significant). Those banks invest in technology and realize economies of scale (the coefficient of technical change and scale economies are positive). Our interpretation is that partially privatized banks still do not receive a "weak up call" which forces them to reduce managerial inefficiency (the efficiency coefficient is negative). Public ownership in Germany has a positive effect on technical change. Note however, that we address productivity *changes* rather than productivity *levels*. Therefore, even if public banks were less productive, this may not show up in our results, simply because productivity of both public and private may grow at the same rate.

By looking at the components of *TFP* change we can sum up the main finding as follows. As (Altunbas et al., 1999) we find a positive improvement in technical

change. Technical change ameliorate in Italy for banks that have been privatized both completely and partially. On the same time also banks that has been merged improved in technology in the long and in the short run. In case of a distressed merger the management does not seek to improve the technology. In Germany public and merged banks invest in technology. Regarding the effect on scale economies we find only mixed evidence: In Italy the coefficient is negative in the short-term but positive in the long-run for privatized banks, and negative in the short run for merged banks. Distressed mergers favorite the realization of economies of scale. In Germany we see only a negative effect of merger and distressed mergers in the short run. Privatized and distressed merged banks increase their cost efficiency during the period of analysis.

As a stability check we also ran a regression analysis on the pooled data set of German and Italian banks. The result are reported in Table 12 in the Appendix. By and large, it confirms our main results above. It also shows that on average Italian banks exceeded German banks in *TFP* growth. In contrast to the separate regressions the pooled analysis indicates that public ownership had a positive albeit small effect on *TFP* growth in Germany. The effect of mergers, distressed or non-distressed, is statistically insignificant.

Table 2: The effect of privatization and merger events on TFP and its components

The sample period covers the years from 1994 to 2004. During this period the number of banks operating is 526 in Italy and 2,442 in Germany. Due to the regression design the number of observations reduce to 1,942 for Italy, and 9,813 for Germany.

	TFP Change (TFP)		Efficiency Change (EFC)		Technical Change (TEC)		Realization of Scale Economies (SC)	
	Italy	Germany	Italy	Germany	Italy	Germany	Italy	Germany
PRIVATIZED	0.103*** [8.12]		0.117*** [9.96]		0.001 [0.74]		-0.009*** [4.13]	
PRIVATIZED4	0.005*** [3.86]		-0.001 [0.55]		0.003*** [9.32]		0.003*** [5.28]	
L.PUBLIC	-0.021*** [4.02]	-0.003 [0.19]	-0.031*** [6.12]	-0.017 [1.53]	0.008*** [6.21]	0.042** [2.55]	0.003** [2.20]	-0.001 [0.32]
MERGER	0.008** [2.22]	0.003 [0.06]	-0.003 [1.00]	0.060 [1.33]	0.008*** [16.34]	0.084*** [2.85]	-0.001 [1.41]	-0.013*** [2.94]
L4.MERGER	-0.002 [0.66]	-0.029 [0.57]	-0.003 [1.26]	-0.001 [0.04]	0.004*** [19.38]	0.091** [2.07]	-0.005*** [16.21]	0.001 [1.15]
DISTRESS	-0.037*** [5.41]	0.044 [1.00]	-0.049*** [21.29]	0.083 [2.09]	-0.003** [2.11]	0.038 [1.58]	0.013*** [13.34]	-0.018*** [3.33]
L4.DISTRESS	0.048** [2.09]	-0.030 [0.78]	0.057*** [2.69]	-0.012 [0.35]	-0.002 [0.65]	-0.001 [0.05]	0.017*** [5.16]	0.000 [0.69]
Δ GDP	-0.004*** [7.70]	-0.009*** [8.34]	-0.001 [1.31]	-0.005*** [6.51]	-0.004*** [34.17]	-0.002 [1.66]	-0.001*** [8.35]	0.000 [0.11]
Δ INTR	0.016*** [43.71]	0.014*** [7.79]	0.001*** [3.77]	0.000 [0.28]	0.016*** [114.93]	0.009*** [3.85]	0.000 [1.61]	0.000 [1.07]
Test for AR(1) in first differences (p-value):								
	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000
Test for AR(2) in first differences (p-value):								
	0.580	0.020	0.550	0.390	0.100	0.690	0.130	0.230
Sargan test of overid. restrictions (p-value):								
	0.060	0.050	0.070	0.190	0.100	0.400	0.240	0.320

Absolute value of z-statistics in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%

7 Conclusions

In this study we compare the evolution of productivity in the Italian and German banking markets. At the beginning of 1990s these two important European banking industries shared a similar structure characterized by a high number of institutions and a large presence of the state in the ownership share. Over the last decade both countries have experienced a profound process of consolidation, currently still ongoing but went into two different directions with respect to the presence of publicly-owned banks in the industry. In fact Italy privatized its public banking sector during the 1990s while Germany has still a considerable share of state owned savings banks. The comparative analysis of the evolution of two important European banking industries, Italy and Germany, over the last decade may shed some light on the likely consequences of partly different development paths.

In our analysis we use a unique dataset provided by the central Banks of Italy and Germany, respectively and calculate productivity changes (Total Factor Productivity Change, TFP change) as the sum of technical change, gains from economies of scale and efficiency change. We then relate these measures to the consolidation and privatization processes occurred in Italy and Germany.

Our results on TFP change show that both industries have experienced productivity growth during the period of analysis. But Italy's growth has been significantly higher than Germany's. In both countries most of the productivity growth is due to improvements in the banking technology, potentially reflecting strong IT progress recently. Cost efficiency seems to have added little value to productivity. Our results also show that, in line with many banking empirical studies, banks in both countries face diseconomies of scale. The results of a multivariate regression of $TFPC$ and its components show that in Italy the privatization process has had a positive influence on the dynamics of productivity: TFP change, efficiency changes (in the short run) and technical changes (in the long run) have been larger for banks that have been totally or even partially privatized. Mergers have had a positive effect on TFP change and technical change but negatively affected economies of scale. Distressed mergers decreases TFP change in the short run but let to an improvement in productivity in the long run. This negative effect is mainly the results of the impact of distressed mergers on efficiency and technical change. Banks which went into a distressed merger have been benefiting from the realization of economies of scale.

Stochastic Frontier Model

$$\begin{aligned}
 \ln C_{kt} = & \alpha_k + \sum_{i=1}^3 \alpha_i \ln w_{ikt} + \sum_{m=1}^3 \beta_m \ln y_{mkt} + \sum_{r=1}^2 \delta_r \ln z_{ktr} + \frac{1}{2} \sum_{i=1}^3 \sum_{j=1}^3 \alpha_{ij} \ln w_{ikt} \ln w_{jkt} \\
 & + \sum_{i=1}^3 \sum_{m=1}^3 \gamma_{im} \ln w_{ikt} \ln y_{mkt} + \frac{1}{2} \sum_{m=1}^3 \sum_{n=1}^3 \beta_{mn} \ln y_{mkt} \ln y_{nkt} + \frac{1}{2} \sum_{r=1}^2 \pi_r (\ln z_{ktr})^2 \\
 & + \sum_{r=1}^2 \sum_{i=1}^3 \omega_i \ln w_{ikt} \ln z_{ktr} + \sum_{r=1}^2 \sum_{m=1}^3 \zeta_m \ln y_{mkt} \ln z_{ktr} + \eta_0 t + \frac{1}{2} \eta_1 (t)^2 \\
 & + \sum_{i=1}^3 \kappa_i \ln w_{ikt} t + \sum_{m=1}^3 \tau_m \ln y_{mkt} t + \sum_{r=1}^2 \theta_r \ln z_{ktr} t + \varepsilon_{kt}.
 \end{aligned}$$

Table 4: Stochastic Frontier Model - Estimated Parameters

Variable	Coefficient	P[Z >z]	Variable	Coefficient	P[Z >z]	Variable	Coefficient	P[Z >z]
$\ln \omega_1$	0.3241	0.000	$\ln \omega_1 \ln y_1$	0.0200	0.000	t	-0.1045	0.000
$\ln \omega_2$	0.2668	0.000	$\ln \omega_1 \ln y_2$	-0.0311	0.000	t^2	-0.0008	0.000
$\ln y_1$	0.2835	0.000	$\ln \omega_2 \ln y_1$	-0.0420	0.000	$\ln y_1 t$	0.0019	0.000
$\ln y_2$	0.5769	0.000	$\ln \omega_2 \ln y_2$	-0.0677	0.000	$\ln y_2 t$	0.0202	0.000
$\ln y_3$	0.4261	0.000	$\ln \omega_3 \ln y_1$	0.0360	0.000	$\ln y_3 t$	-0.0004	0.2728
$\ln z_1$	-0.3131	0.000	$\ln \omega_3 \ln y_2$	-0.0757	0.000	$\ln \omega_1 t$	0.0149	0.000
$\ln z_2$	0.1060	0.000	$\ln y_1 \ln z_1$	0.0215	0.000	$\ln \omega_2 t$	0.0132	0.000
$\ln \omega_1 \ln \omega_1$	0.0112	0.0006	$\ln y_1 \ln z_2$	0.0070	0.000	$\ln z_1 t$	-0.0229	0.000
$\ln \omega_1 \ln \omega_2$	-0.1132	0.000	$\ln y_2 \ln z_1$	0.0244	0.000	$\ln z_1 t$	0.0036	0.000
$\ln \omega_2 \ln \omega_2$	0.1468	0.000	$\ln y_1 \ln z_2$	-0.0193	0.000			
$\ln y_1 \ln y_1$	0.0368	0.000	$\ln y_1 \ln z_2$	-0.0193	0.000			
$\ln y_1 \ln y_2$	-0.0445	0.000	$\ln y_1 \ln z_2$	-0.0193	0.000			
$\ln y_1 \ln y_3$	-0.0201	0.000	$\ln \omega_1 \ln z_1$	-0.0285	0.000	σ	0.43549635	0.000
$\ln y_2 \ln y_2$	0.0696	0.000	$\ln \omega_1 \ln z_2$	0.0065	0.000	λ	3.80702776	0.000
$\ln y_2 \ln y_3$	-0.0480	0.000	$\ln \omega_2 \ln z_1$	0.1990	0.000			
$\ln y_3 \ln y_3$	0.0595	0.000	$\ln \omega_2 \ln z_2$	-0.0391	0.000			
$\ln z_1 \ln z_1$	-0.0522	0.000						
$\ln z_2 \ln z_2$	0.0077	0.000						

Observations 34076;

Log likelihood function 14374.79; Iterations completed 6.

Table 5: Structure of the Italian Banking System between 1990 and 2005

	1990			2005								
	No. of banks	No. of branches	Assets million EUR ¹	Assets share in %	No. of banks	No. of branches	Assets million EUR ¹	Assets share in %				
Public-sector banks	6	2,449	134,664	20.1	Private/Comm. banks	243	1,879,945	79.3				
Banks of national interest	3	1,459	86,466	12.9								
Savings banks	84	4,695	162,427	24.2								
Private Commercial banks	106	3,981	137,362	20.5								
Cooperative banks	108	3,290	95,004	14.2								
Mutual banks	715	1,792	29,096	4.3					Mutual banks ²	439	126,369	5.3
Group central institutions	5	5	15,875	2.4								
Branches of foreign banks	37	50	10,475	1.6								
Total	1,064	17,721	671,409	100					784	31,501	2,371,909	100

Source: Banca d'Italia

(1) data on a solo-individual basis referred to the banking units operating in Italy (2) "banche di credito cooperativo"

Public-sector banks ("Istituti di diritto pubblico"), Banks of national interest ("Banche di interesse nazionale"), Savings banks ("Casse di risparmio" and "Monti di credito"), Private commercial banks ("Banche di credito ordinario"), Cooperative banks ("Banche popolari") Mutual banks ("Casse rurali e artigiane"), Group central institutions ("Istituti centrali di categoria")

Table 6: Structure of the German Banking System between 1990 and 2005

	1990			2005				
	No. of banks	No. of branches ³	Assets million EUR	Assets share in %	No. of banks	No. of branches	Assets million EUR	Assets share in %
Commercial banks ¹	281	6,919	1,332,688	25.4	163	14,194	1,829,872	26.5
Savings banks	771	20,220	1,080,855	20.6	463	14,413	1,013,955	14.68
Regional giro institutions	11	410	761,769	14.5	Land banks		1,365,045	19.77
Credit cooperatives	3,392	21,197	591,889	11.3	1,294	14,015	591,886	8.57
Regional institutions of credit cooperatives	4	37	216,687	4.1	2	11	223,702	3.24
Specialized banks ²	70	300	1,183,663	22.6	66	2,837	1,775,365	25.71
Branches of foreign banks	60	96	76,291	1.4	89	207	103,344	1.49
Total	4,589	49,179	5,243,842	100	2,089	46,269	6,903,169	100

Source: Bundesbank

1. In 1990 include: big banks, regional and other commercial banks. In 2004 include: big banks, regional and other commercial banks. 2. In 1990 include: mortgage banks, special purpose banks, post office and post saving banks. In 2004 include: mortgage banks, building and loan associations, special purpose banks. 3. Data from 1991 (not available for 1990).

Table 7: Banking Performance Indicators - Italy

Year	Average total assets (1) (2)		Net-interest income (3)		Non-interest income (3)		Operating costs (3)		Profit before tax (3)		Net-interest income/ Total income		Operating costs / Total income		Staff costs/ Operating costs		ROE		
	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system
1994	100,0	100,0	2,48	1,87	0,91	0,80	2,36	1,98	0,30	0,14	26,9	30,0	69,5	74,0	47,4	53,7	1,1	0,9	
1995	107,3	111,3	2,77	2,20	0,88	0,79	2,44	2,18	0,43	0,26	24,1	26,4	66,9	72,9	44,9	51,5	2,0	2,7	
1996	119,2	115,3	2,63	2,10	1,06	0,92	2,43	2,14	0,60	0,34	28,6	30,5	65,8	70,9	45,2	51,3	5,1	4,4	
1997	130,9	118,5	2,41	1,94	1,12	0,99	2,35	2,07	0,42	-0,11	31,7	33,9	66,7	70,6	44,6	49,9	1,9	-7,5	
1998	137,8	140,5	2,33	2,12	1,51	1,51	2,30	2,14	0,93	0,83	39,2	41,5	60,0	58,9	39,1	39,8	9,2	11,1	
1999	157,4	156,6	2,12	1,97	1,58	1,61	2,23	2,06	0,91	1,00	42,7	45,0	60,3	57,6	39,0	39,2	11,0	16,3	
2000	180,7	201,0	2,21	1,99	1,74	1,72	2,27	2,11	1,16	1,09	44,1	46,4	57,5	57,1	36,4	37,1	13,3	17,5	
2001	193,8	201,3	2,18	1,91	1,47	1,47	2,16	1,95	0,79	0,74	40,3	43,4	59,0	57,7	37,4	37,8	9,1	12,5	
2002	199,0	202,7	2,25	2,04	1,30	1,28	2,15	1,99	0,67	0,53	36,7	38,5	60,7	60,2	38,8	39,5	6,5	5,8	
2003	206,7	199,2	2,19	1,96	1,41	1,49	2,12	1,98	0,70	0,77	39,1	43,3	59,0	57,3	38,2	38,0	6,7	9,2	
2004	210,7	210,7	2,15	2,02	1,37	1,50	2,05	2,06	0,97	0,97	38,9	42,6	58,2	58,5	38,3	39,1	10,7	12,5	

Source: Banca d'Italia

(1) Total banking system's assets divided by the total number of banking groups/banks

(2) index numbers 1994=100

(3) ratios to total asset

Table 8: Banking Performance Indicators - Germany

Year	Average total assets (1) (2)		Net-interest income (3)		Non-interest income (3)		Operating costs (3)		Profit before tax (3)		Net-interest income / Total income		Operating Costs/ Total income		Staff costs/ Operating costs		ROE		
	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system	Largest groups	Banking system
1994	100,0	100,0	1,91	1,43	0,43	0,43	1,43	0,50	0,50	18,5	60,9	57,7	60,9	57,7	6,8	6,8	6,6	6,6	
1995	105,9	105,9	1,72	1,38	0,43	0,43	1,38	0,50	0,50	19,8	64,1	57,9	64,1	57,9	6,6	6,6	6,0	6,0	
1996	112,6	112,6	1,63	1,30	0,41	0,41	1,30	0,46	0,46	20,0	64,0	56,5	64,0	56,5	6,7	6,7	6,0	6,0	
1997	121,7	121,7	1,46	1,19	0,42	0,42	1,19	0,45	0,45	22,2	63,3	55,9	63,3	55,9	6,7	6,7	6,0	6,0	
1998	124,6	124,6	1,34	1,15	0,46	0,46	1,15	0,62	0,62	25,6	63,7	55,5	63,7	55,5	6,7	6,7	6,0	6,0	
1999	130,9	130,9	1,23	1,14	0,49	0,49	1,14	0,37	0,37	28,5	66,2	54,2	66,2	54,2	5,9	5,9	5,8	5,8	
2000	142,3	142,3	1,13	1,17	0,58	0,58	1,17	0,34	0,34	34,0	67,9	53,4	67,9	53,4	6,1	6,1	6,1	6,1	
2001	171,6	171,6	1,10	1,15	0,51	0,51	1,15	0,24	0,24	31,6	71,0	52,3	71,0	52,3	4,4	4,4	4,4	4,4	
2002	161,7	161,7	1,20	1,14	0,48	0,48	1,14	0,20	0,20	28,4	67,7	52,4	67,7	52,4	2,2	2,2	2,2	2,2	
2003	155,8	155,8	1,15	1,13	0,54	0,54	1,13	0,10	0,10	31,7	66,9	53,0	66,9	53,0	-1,7	-1,7	-1,7	-1,7	
2004	158,0	158,0	1,15	1,07	0,47	0,47	1,07	0,20	0,20	29,0	66,0	53,5	66,0	53,5	1,8	1,8	1,8	1,8	

Source: Deutsche Bundesbank

(1) Total banking system's assets divided by the total number of banking groups/banks

(2) index numbers 1994=100

(3) ratios to total asset

Table 9: Bank Production Data for Italian and German Banks (1994-2004)

Country	Variable		Mean	SD	Min	Max	N
Italy	Interbank loans	y1	212.432	1,117.340	0.004	22,396.290	6362
	Customer loans	y2	974.752	4,437.375	0.601	94,681.380	6362
	Securities	y3	250.871	835.180	0.008	13,160.680	6362
	Price of fixed assets	w1	5.890	2.455	1.993	19.671	6362
	Price of labor	w2	48.476	5.818	30.573	80.694	6362
	Price of funds	w3	3.697	1.936	1.010	15.689	6362
	Equity	z1	136.722	561.552	0.558	11,677.200	6362
	Non-performing loan share	z2	8.907	6.752	0.008	38.181	6362
Total Cost	C	110.015	486.868	0.569	9,280.111	6362	
Germany	Interbank loans	y1	127.124	1,869.644	0.001	103,324.500	27736
	Customer loans	y2	478.666	3,818.360	1.129	204,335.800	27736
	Securities	y3	185.887	1,667.635	0.002	99,729.890	27736
	Price of fixed assets	w1	14.532	8.033	5.135	74.130	27736
	Price of labor	w2	48.530	7.352	28.386	92.741	27736
	Price of funds	w3	3.515	0.651	1.868	5.475	27736
	Equity	z1	35.798	290.488	0.245	14,052.140	27736
	Non-performing loan share	z2	5.788	4.483	0.000	31.614	27736
Total Cost	C	46.129	396.123	0.356	21,705.730	27736	

Notes: All variables except input prices and non-per. loans share in millions Euros. Price of funds, fixed assets and non-per. loans share in percent. Price of labor in thousands Euros.

Table 10: Productivity Growth and TFP Decomposition (1995-2004)

Year	Country	Divisia	TFP =	SC +	TEC +	EFC	N
1995	Germany	0,026	0,048	-0,015	-0,056	0,007	2835
1996		0,061	0,042	-0,009	-0,050	0,001	2900
1997		0,032	0,043	-0,010	-0,049	0,004	2850
1998		0,014	0,036	-0,020	-0,049	0,007	2730
1999		0,043	0,033	-0,007	-0,045	-0,006	2530
2000		-0,062	0,036	0,001	-0,050	-0,015	2320
2001		0,006	0,046	-0,021	-0,054	0,013	2135
2002		0,050	0,041	-0,011	-0,049	0,002	1973
2003		0,052	0,029	-0,014	-0,042	0,0004	1824
2004		0,052	0,041	-0,003	-0,040	0,004	1700
Tot		0,027	0,040	-0,011	-0,049	0,002	23797
1995		Italy	-0,020	0,058	-0,028	-0,098	-0,013
1996	0,043		0,061	-0,034	-0,100	-0,005	490
1997	0,119		0,101	-0,029	-0,094	0,036	506
1998	0,171		0,055	-0,014	-0,076	-0,007	522
1999	0,195		0,015	0,004	-0,043	-0,032	552
2000	-0,039		0,038	-0,026	-0,058	0,005	559
2001	-0,0003		0,044	-0,028	-0,066	0,007	558
2002	0,087		0,057	-0,004	-0,055	0,007	544
2003	0,111		0,040	0,004	-0,037	-0,001	525
2004	0,064		0,042	0,003	-0,030	0,009	519
Tot	0,074		0,050	-0,015	-0,065	0,001	5241

Table 11: Regression variables

Variable	Acronym	Definition
Privatization	PRIVATIZED	Dummy variable that takes the value of 1 if the bank was a public owned bank in year t and is private in t+1
	LP.Privatized	Dummy variable that takes the value of 1 if the bank was public owned in year t and is privatized in t-P
	PRIVATIZED4	Dummy variable that takes the value of 1 if the bank was privatized during the last four years, excluding the current year, i.e Privatized4 is equal to 1 if either L.Privatized, L2.Privatized or L3.Privatized is equal to 1
Public Ownership	L.PUBLIC	Dummy variable that takes the value of 1 if the bank was public owned in year t-1
	L.PUBLIC×Germany	Dummy variable that takes the value of 1 if the bank was public owned in year t-1 and contemporarily operates in Germany
Consolidation	MERGER	Dummy variable that takes the value of 1 if the bank was involved in a merger in year t
	L4.MERGER	Dummy variable that takes the value of 1 if the bank was involved in a merger in year t-4
	DISTRESS	Dummy variable that takes the value of 1 if the bank was involved in a distressed merger in year t
	L4.DISTRESS	Dummy variable that takes the value of 1 if the bank was involved in a distressed merger in year t-4
	MERGER×Germany	Dummy variable that takes the value of 1 if the bank was involved in a merger in year t and contemporarily operates in Germany
	L4.MERGER×Germany	Dummy variable that takes the value of 1 if the bank was involved in a merger in year t-4
	DISTRESS×Germany	Dummy variable that takes the value of 1 if the bank was involved in a distressed merger in year t and contemporarily operates in Germany
	L4.DISTRESS×Germany	Dummy variable that takes the value of 1 if the bank was involved in a distressed merger in year t-4 and contemporarily operates in Germany
Location	GERMANY	Dummy variable that takes the value of 1 if the bank operates in Germany

Table 12: The effects of privatization and merger events on *TFP* change

The sample period covers the years from 1995 to 2004. The number of observations is 11,755, the number of banks is 2,968.

	<i>TFP</i> change
PRIVATIZED	0.325** [2.47]
PRIVATIZED4	0.006 [0.39]
L.PUBLIC	-0.11** [2.35]
L.PUBLIC×GERMANY	0.155*** [2.91]
MERGER	0.053 [0.85]
L4.MERGER	0.000 [0.02]
DISTRESS	0.016 [0.65]
L4.DISTRESS	0.201** [2.21]
MERGER×GERMANY	-0.027 [0.31]
L4.MERGER×GERMANY	-0.001 [0.07]
DISTRESS×GERMANY	0.058 [1.08]
L4.DISTRESS×GERMANY	-0.205** [2.24]
GERMANY	-0.021*** [2.97]
ΔGDP	-0.005*** [10.41]
ΔINTR	0.006*** [7.03]
Constant	0.037*** [7.50]
Test for AR(1) in first differences (p-value):	0.00
Test for AR(2) in first differences (p-value):	0.98
Sargan test of overid. restrictions (p-value):	0.09

Absolute value of z-statistics in brackets; * significant at 10%; ** significant at 5%;
*** significant at 1%

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