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BANK PROFITABILITY AND TAXATION

by Ugo Albertazzi* and Leonardo Gambacorta*

Abstract

This paper investigates how bank profitability is affected by corporate income tax (CIT) using aggregate data on the banking sector of the main industrialized countries for the period 1981-2003. Two main novelties emerge with respect to the existing literature. First, the paper explicitly considers that CIT is not specific to the banking sector, so that changes in the CIT rate can affect both banks and borrowing firms' behaviour. Thus, with the help of a simple theoretical model we derive a set of predictions about the impact of CIT on banks' income statement. Second, by considering all the main components of banks' profit and loss accounts, we are able to test such predictions and to disentangle the extent to which a bank is able to shift its tax-burden onto its borrowers, depositors, and purchasers of fee-generating services. It turns out that CIT has a substantial impact on the composition of banking sector revenues but cannot explain large differences in the level of profitability across countries.

JEL Classification: C53, G20, G21.

Keywords: Tax-Shifting, Corporate Income Tax, Bank profitability.

Contents

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1. Introduction[1]

The banking sector plays a crucial role in the allocation of resources and any form of distortion in its functioning is likely to have economy-wide effects. This has motivated a large body of research mainly devoted to the analysis of banking industry liberalization, privatization and regulation. Surprisingly, although fiscal issues are likely to exert a significant influence on banks' behaviour, the taxation of the financial sector has received little attention (Caminal, 2003).

The macroeconomic consequences of the taxation of the banking sector are analyzed in the theories of fiscal repression, that stress the link between the efficiency of the financial sector and the process of capital accumulation (Demirgüç-Kunt and Huizinga, 1999). From a more microeconomic point of view, the standard optimal taxation theory suggests that intermediate goods and services should not be taxed (the connected distortions to the production process make taxing these markets more costly than taxing the final outputs). Given that banks operate both with firms and retails consumers, the loss of efficiency connected with the distortion engendered by the taxation of banks depends on who is actually bearing the fiscal burden. For these reasons, it is important to assess both if banks actually bear the burden of taxes formally levied on their activities and, should this not be the case, onto which category of clients they can manage to transfer it.

This paper studies how corporate income tax (CIT) influences bank profitability. The theoretical part derives a set of predictions about the effects of CIT on banks' income statements taking into account that such taxation affects the investment policy of the entire corporate sector and, consequently, also the demand schedules for banking services. This mechanism, which we label the "market effect" of CIT, has been neglected by the literature which focuses mainly on the distortions on the capital structure posed by CIT which, in fact, can be seen as a tax on equity. Although such "cost of equity effect" is admittedly particularly important for banks (capital requirements limit their opportunities to substitute equity with

[1] We would like to thank Marcello Bofondi, Ramon Caminal, Harry Huizinga, Stefania Zotteri and one anonymous referee for helpful comments. We also thank the participants at the Bank of Italy Regional Economics seminar and at the 2006 CEF conference held in Cyprus. The usual disclaimer applies. The opinions expressed in this paper are those of the authors and do not involve the Bank of Italy.
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other forms of financing), it will be shown that by neglecting the market effect one cannot explain the empirical evidence.[2]

The econometric part of this paper studies the link between bank profitability and taxation by using data for ten industrialized countries (Austria, Belgium, France, Germany, Italy, the Netherlands, Portugal, Spain, United Kingdom and United States) over the period 1981-2003. The dataset includes annual figures from the balance sheet and the income statement of the aggregated national banking industries, collected by OECD in a harmonized way that minimizes the effects of differences in accounting and statistical definitions and allows meaningful comparisons across countries. As a measure of taxation we use the corporate income tax rate that can be reasonably considered exogenous for two reasons: it is not affected by banks' choices, as the effective tax rate would be (the ex-post tax rate); it is not industry-specific, so that it is unlikely to be determined by policy makers just because of its effects on the banking sector.

One of the main novelties of the paper lies in the comprehensive analysis of the effect of CIT on all income statement components and on banks' prices. In particular, the analysis of the impact of the CIT on the interest rate for loans and on deposits helps us to assess the presence of tax shifting for different customers separately. In other words, we try to understand not only if the net interest margin (the difference between interest received from borrowers and that paid to depositors) is affected by the level of the corporate income tax levied on banks' profits, but also if the potential tax shifting is against borrowers or depositors.

The empirical findings are coherent with the predictions of the theoretical model and can be summarized in the following points. First, the evidence is consistent with the existence of two types of mechanisms through which the CIT influences banks' behaviour. On one hand, a higher CIT rate raises the costs of bank equity making capital requirements tighter. On the other hand, a higher CIT rate brings a reduction of investments from the incorporated sector and a downward shift of the demand for bank loans and other bank services. Second, the CIT

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[2] Although the financial sector is subject to general corporate income taxation, it is worth mentioning that with regard to other forms of taxes it often receives special treatments like, for instance, VAT exemption. Banks are also subject to implicit subsidization or taxation (below-cost deposit insurance, bailouts in cases of financial collapse, reserve requirements and capital requirements). They also serve as tax collecting subsidiaries of their clients (withholding taxes on the capital income). For a complete analysis of the taxation of financial firms see De Bonis, Monacelli and Pazienza (2005).

rate influences the interest rate demanded on loans with no significant impact on the interest rate paid on deposits, in line with the so called separability hypothesis. Third, banks are able to shift a large part, approximately 90 per cent, of the CIT burden.

The remainder of the paper is organized as follows. The next section presents a simple theoretical model on the effect of the corporate income tax on bank profitability. Section 3 describes the dataset and briefly discusses how bank profitability and taxation evolved in the period under investigation. Section 4 presents the econometric model and the empirical results. The last section summarizes the main conclusions.

2. A theoretical model

This section presents an adapted version of the basic Monti-Klein model which allows one to study the effects of corporate income taxation on banks' behavior and profitability.[3]

The demand for loan is described by the inverse demand function $l = l(L, \tau)$. It provides the interest rate borrowers are willing to pay for a given amount of loans L and a given CIT rate τ.

The partial derivatives of $l(L, \tau)$ are both assumed to be negative: $l'_L(L, \tau) < 0$ and $l'_\tau(L, \tau) < 0$. These two conditions simply derive from the fact that for higher interest rates on loans or for higher corporate income tax rates fewer investment projects have positive net present values. In particular, following an increase in τ, the level of l at which the demand of loans L remains unchanged is lower.

Similarly, the inverse demand function for fee-generating services is given by $f = f(S, \tau)$ with $f'_S(S, \tau) < 0$ and $f'_\tau(S, \tau) < 0$, where S is the quantity and f are the fees. The assumption $f'_\tau(S, \tau) < 0$ reflects the fact that part of these services are related to firm production activities.

The supply of deposits by households is given by the increasing function $d = d(D)$, denoting the interest rate required by depositors in order to supply an amount of deposits equal to D.

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[3] Detailed comments on the standard Monti-Klein model are in Freixas and Rochet (2007).

The economy is populated by N identical banks characterized by a cost function which, for simplicity, is assumed to be linear and separable:

$$C_j = \gamma_D D_j + \gamma_L L_j + \gamma_S S_j \tag{1}$$

where D_j, L_j and S_j are the quantities of deposits, loans and services for bank j, with $j = 1, ..., N$ and γ_D, γ_L and γ_S are all positive parameters.[4]

Provisions are assumed to be a constant fraction π of loans. Banks can borrow (or lend) on the interbank market at a given money market rate r. Denoting M_j their net interbank liabilities, the profit function for bank j is therefore given by:

$$P_j = lL_j - dD_j - rM_j + fS_j - \pi L_j - C_j \tag{2}$$

To consider the effect of τ on the cost of bank capital two additional factors need to be considered. One is the presence of prudential capital requirements which, for simplicity, are assumed to be always binding. This assumption, quite common in the literature (see for instance Bolton and Freixas, 2006), requires the amount of equity to be a given fraction $0 < \rho < 1$ of loans:

$$E_j = \rho L_j \tag{3}$$

Second, in the spirit of Caminal (2003) we introduce a fiscal effect of the corporate income tax on the cost of equity. It is therefore assumed that the decision maker is a "bank licence holder" with no private wealth who needs to raise equity on the market.

Denoting v the value of the licence, η the net rate of return required by outside investors and ϕ_j the proportion of the bank owned by them, then ϕ_j is determined by the following no arbitrage condition:

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[4] Separability refers to the marginal costs only. This form of separability does not exclude other forms of economies of scope. For example, there could be economies of scope in fixed costs (setting the branch network). However, since fixed costs play no role in the analysis they are totally ignored.

$$\frac{\phi_j P_j (1-\tau)}{E_j - v} - 1 = \eta \tag{4}$$

The numerator of the fraction on the left hand side is the amount of net profits accruing to outside investors, the denominator is their disbursement. The term on the left hand side corresponds to the net rate of return obtained by outside investors which is assumed to be equal to η, their alternative option.

The bank licence holder decides a level for E_j, L_j, D_j, S_j and M_j by maximizing his profits:

$$U_j = (1-\tau)\left(1-\phi_j\right) P_j \tag{5}$$

The balance-sheet constraint is given by:

$$L_j = D_j + E_j + M_j \tag{6}$$

Taking into account equations 1-6, the maximization problem can be written as:

$$\begin{aligned} \max_{L_j, D_j, S_j} (1-\tau) \left[L_j \left(l\left(L_j + L_{-j}, \tau\right) - \widetilde{\gamma} \right) - D_j \left(d\left(D_j + D_{-j}\right) + \gamma_D - r \right) + \right. \\ \left. + S_j \left(f\left(S_j + S_{-j}, \tau\right) - \gamma_S \right) + \tfrac{1+\eta}{1-\tau} v \right] \end{aligned} \tag{7}$$

where $L_{-j} = \sum_{h=1, h\neq j}^{N} L_h$, $D_{-j} = \sum_{h=1, h\neq j}^{N} D_h$, $S_{-j} = \sum_{h=1, h\neq j}^{N} S_h$ and $\widetilde{\gamma}_L = \gamma_L + \pi + \rho \frac{1+\eta}{1-\tau} + (1-\rho)\, r$.

Some interesting remarks can already be made. First, the addend $\frac{1+\eta}{1-\tau} v$ is constant and can be neglected from the analysis so that v does not play any role (it just affects the parameter ϕ_j determining how profits are divided between the licence holder and outside investors).

Second, the unique impact of provisions and, more importantly, of capital requirements is on the marginal cost of loans. Indeed, the positive quantity $\widetilde{\gamma}$ can be seen as an

adjusted marginal cost: beyond operational expenses, loans imply additional costs in terms of provisions (π), in terms of capital requirements $\rho\frac{1+\eta}{1-\tau}$ and, for the part that does not need to be financed by equity, in terms of interest rate to be paid on the money market $(1-\rho)\,r$.

Third, the additive form of equation 1 and the presence of the interbank market implies full separability so that the three quantities (L_j, D_j, S_j) are chosen independently from each other. An important consequence of separability is that τ has no influence on the market for deposits: the unique channels through which τ operates are the marginal cost of outside equity $\frac{1+\eta}{1-\tau}$ and the demand for loans $l\,(L,\tau)$. It is therefore already possible to state that changes in τ will have no effect on the equilibrium interest rate paid on deposits nor on their quantity. It remains therefore to understand the effect of τ on both the market for loans and that for fee-generating services.

As in standard models of competition *à la* Cournot, from the first order conditions and those of symmetry it is possible to show that the equilibrium quantities L^* and S^* in these two markets are characterized by:

$$
\begin{aligned}
l\,(L^*,\tau) &= \widetilde{\gamma}_L \Big/ \left(1-\tfrac{1}{N\varepsilon_L(L^*,\tau)}\right)\\
f\,(S^*,\tau) &= \gamma_S \Big/ \left(1-\tfrac{1}{N\varepsilon_S(S^*,\tau)}\right)
\end{aligned}
\tag{8}
$$

where $\varepsilon_L\,(L^*,\tau)$ and $\varepsilon_S\,(S^*,\tau)$ are two positive quantities denoting the coefficients of elasticity of the (direct) demand functions of loans and fee-generating services respectively.[5]

As usual, both $l\ (L^*,\ \tau)$ and $f\,(S^*,\tau)$ are decreasing functions of N and for $N\to\infty$ they converge to the adjusted marginal costs $\widetilde{\gamma}_L$ and γ_S. Moreover, by applying the implicit function theorem to conditions 8, it can be seen that N has a positive effect on equilibrium quantities L^* and S^*, a standard result in models of competition *à la* Cournot.

In order to understand how τ affects the equilibrium in these two markets it is useful to start by computing its effect on quantities. A restriction which extremely simplifies the notation with no significant changes on the qualitative results is that of constant coefficients of elasticity, $\varepsilon_L\,(L,\tau)=\varepsilon_L$ and $\varepsilon_S\,(S,\tau)=\varepsilon_S$.[6] With this assumption, by applying the implicit

[5] In symbols: $\varepsilon_L\,(L,\tau) = -\,(dL/di_L)\,(i_L/L)$ and $\varepsilon_S\,(S,\tau) = -\,(dS/df)\,(f/S)$. Other implicit and standard assumptions are that second order conditions are satisifed and that all elasticities are greater than zero.

[6] This assumption simplifies the analysis by removing the effects that marginal changes in the elasticity

function theorem to equations 8 we obtain:

$$\begin{array}{c} \frac{dL^*}{d\tau} = \frac{l'_\tau(L^*,\tau)}{-l'_L(L^*,\tau)} + \frac{\widetilde{\gamma}'_\tau}{l'_L(L^*,\tau)\left(1-\frac{1}{\varepsilon_L N}\right)} \\ \frac{dS^*}{d\tau} = \frac{f'_\tau(S^*,\tau)}{-f'_S(S^*,\tau)} \end{array} \tag{9}$$

The first equality in expression 9 reveals that $\frac{dL^*}{d\tau} < 0$. There are two factors at work both pushing in the same direction. The first addend is a negative quantity and corresponds to what has been defined as the market effect: an increase in τ provokes a downward shift in the demand curve ($l'_\tau < 0$) always bringing a decrease in the equilibrium quantity. The second one is also negative and can be defined as the cost effect: an increase of τ, by increasing the adjusted marginal cost $\widetilde{\gamma}$, leads to a higher price l and a smaller quantity L.

Similar comments can be made on the expression for $\frac{dS^*}{d\tau}$, which is therefore also negative, although in this case the cost effect is absent (γ_S does not depend on τ since fee-generating services are not subject to capital requirements).

In order to understand the effect of τ on equilibrium prices it can be noted that:

$$\begin{array}{c} \frac{dl(L^*,\tau)}{d\tau} = l'_L\left(L^*,\tau\right)\frac{\partial L^*}{\partial \tau} + l'_\tau\left(L^*,\tau\right) \\ \frac{df(S^*,\tau)}{d\tau} = f'_S\left(S^*,\tau\right)\frac{\partial S^*}{\partial \tau} + f'_\tau\left(S^*,\tau\right) \end{array} \tag{10}$$

From conditions 9 and 10 one can obtain:

$$\begin{array}{c} \frac{dl(L^*,\tau)}{d\tau} = \widetilde{\gamma}'_\tau / \left(1 - \frac{1}{\varepsilon_L N}\right) \\ \frac{df(S^*,\tau)}{d\tau} = 0 \end{array} \tag{11}$$

Given the assumption of a constant coefficient of elasticity, τ has an impact on l only through the cost effect and its sign is positive ($\widetilde{\gamma}'_\tau > 0$): an increase in τ implies an increase in the equilibrium interest rate, as intuition would suggest. On the contrary, since capital requirements do not affect fee generating services, there is no cost effect and τ does not influence the equilibrium price.

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would imply on the pricing of non-competitive banks and which might work in any direction.

For the purpose of this paper it is crucial to analyze the link between the CIT rate and bank profit components, in other words as τ influences banks' revenues lL^* and fS^*. This is particularly important for the empirical analysis of the effects of corporate income taxation on the market for fee-generating services since for this segment, which includes several types of non directly comparable services, there are no separate measures of prices and quantities. From the definitions of L^* and S^* one directly obtains:

$$\begin{array}{c} \frac{d}{d\tau} l\left(L^*,\tau\right) L^* = \frac{dl(L^*,\tau)}{d\tau} L^* + \frac{dL^*}{d\tau} l\left(L^*,\tau\right) \\ \frac{d}{d\tau} f\left(S^*,\tau\right) S^* = \frac{dS^*}{d\tau} f\left(S^*,\tau\right) \end{array} \tag{12}$$

The total effect of τ on banks' net interest margin depends on the effect it exerts on prices and quantities which, as shown above, are respectively positive and negative ($\frac{dl(L^*,\tau)}{d\tau} > 0$ and $\frac{dL^*}{d\tau} < 0$). Under some mild regularity conditions it will be true that $\frac{d}{d\tau} l\left(L^*,\tau\right) L^* > 0$ for a sufficiently low τ (L^* is large and l is small, so that the sign of l'_L prevails) while the opposite is true for a sufficiently large τ.[7]

As already pointed out, the absence of a cost effect and the assumption of constant coefficients of elasticity make the equilibrium f invariant with respect to τ. Therefore, fee-income $f\left(S^*,\tau\right) S^*$ depends on the CIT rate only through S^* which is a decreasing function of τ. It follows that $\frac{d}{d\tau} f\left(S^*,\tau\right) S^* < 0$.

The main predictions of the model are therefore the following. First, the effect of an increase of CIT rate on the net interest margin can be of either sign. In particular, given the presence of a bank capital cost effect and of a market effect, a marginal increase in τ implies an increase (reduction) in the net interest margin if τ is sufficiently low (high). Second, the effect of τ on bank revenues from fee generating services, not concerned by capital requirements, is always negative. Third, as a joint consequence of the assumptions of an additive cost function and of an interbank market with an exogenous interest rate, an increase in the CIT rate should be reflected in an increase of the interest rate demanded on loans with no significant impact on the interest rate paid on deposits. Finally, the corporate income taxation can be expected to influence both operating costs and provisions through the negative effect it exerts on the amount of loans and on the quantity of fee-generating services.

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[7] The regularity conditions just require that as $\tau \to 1$ ($\tau \to 0$) the quantity demanded gets arbitrarily small (large).

3. Some facts on bank profitability and taxation

In the last twenty years, changes in regulation, demand composition and technology have modified the structure and the boundaries of credit markets.[8] All these changes have strengthened competition, especially in traditional lending activity, reduced intermediation margins and encouraged banks to diversify their sources of revenue and increase efficiency in production and distribution. The introduction of the euro has eliminated most of the residual barriers to competition among the banking systems of the countries that have adopted the common currency.[9]

The aim of this section is to investigate if, given the type of relationships suggested by the theoretical model presented above, the changes we have observed in the banking industry could at least partly be explained also by changes in corporate income taxation. Establishing such a relationship is important not only to interpret the dramatic changes that have occurred in the banking systems of industrialized economies but also to understand why we still observe substantial segmentation of the European national banking sectors (ECB, 2005). In fact, although European directives and regulations impose minimum standards, the overall fiscal treatment of banks and other corporations remains the purview of national authorities, and residual differences may constitute a barrier to full integration (Huizinga, 2004).

Tables 1 and 2 show the main macroeconomic and bank profitability indicators dividing the sample in two sub-periods: 1981-1992 and 1993-2003. This sample split, based on the date of the Maastricht Treaty, should take into account the effects of the convergence process towards the adoption of the single currency. Strong differences in the two periods emerge not only in real and financial indicators but also in the CIT rate.

Since the beginning of the 1990s cross-country variability of gross income as a share of total assets has decreased in the euro area (Figure 1). This fact reflects the progressive convergence of corporate income taxation among main Euro area countries (Figure 2). When one includes the Anglo-Saxon banking systems the picture becomes less clear-cut: the

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[8] We can think, for example, of the abolition of geographical constraints to banking activity in the US after the introduction of the Riegle-Neal Interstate Banking and Branching Efficiency Act in 1994 (Berger, Kashyap and Scalise, 1995) or, in Italy, of the liberalization of branch networks in 1990 (Ciocca, 2000). For an analysis of credit market deregulation see Bhattacharya, Boot and Thakor (1998).

[9] Berger, DeYoung and Udell (2000) stress the fact that linguistic, cultural, regulation differences and long distance coordination problems may still counterbalance the benefit of cross-country consolidation activity.

dispersion in bank profitability turns out to be increasing while that of corporate income taxation is decreasing. However, the reduction of the dispersion in the CIT rate appears less pronounced than when we consider only euro area member states. This is coherent with the notion that even the differences observed in bank profitability between the euro area and the Anglo-Saxon countries can be partly ascribed to different patterns of CIT.

Following the reduction in the inflation rate, interest rates have also declined markedly. It is even more important to point out that the difference between the short-term lending rate and the deposit rate (the spread) also declined. It is commonly argued that its reduction reflects the process of deregulation of the banking sector that came with financial stabilization. According to the theoretical analysis above, the CIT rate should display a positive correlation with the interest rate spread (the CIT rate exerts a positive effect on the interest rate and no effect on that on deposits). Again, this suggests that at least part of the decline shown by the spread could be explained by the reduction of corporate income taxation.

As shown in Table 2 and Figure 3 there has been a shift from net interest income to other income not dependent on traditional financial intermediation. The decline in interest margins has changed the traditional role of banks and has forced them to search for new sources of revenue such as trading, services and other financial operations. Diversification has been sustained by the increased propensity of households to invest in financial assets other than government bonds, and by the greater opportunities for firms to access the capital markets. Structural changes such as industry deregulation, new information technologies and financial innovation are recognized to have increased the importance of fee income. DeYoung and Rice (2004) stress the fact that fee-based activities like trust services, mutual fund sales and cash management require little or no regulatory capital. However, even with regard to this trend towards diversification, changes in the fiscal regime may have played a role. Indeed, the theoretical model suggests that a decline in corporate income taxation may be associated, somewhat counter-intuitively, with both a reduction of net interest income, at least for not too high levels of CIT, and a rise of non-interest income.

In summary, the descriptive statistics suggest that the changes observed in corporate income taxation and the effects they are predicted to exert on bank profitability according to the theoretical model could provide a plausible, although partial, interpretation of the main developments in the profit and loss accounts of credit intermediaries in industrialized

countries. In the next section we provide an econometric framework allowing us to test the main predictions of the theoretical model and, therefore, to check the robustness of this interpretation.

4. The empirical evidence

4.1 *The econometric model*

Following the discussion in Section 2 we base the econometric analysis on this model:

$$Y_{j,t} = \sum_{k=1}^{2} \alpha_k Y_{j,t-k} + \sum_{k=0}^{2} \beta_k' X_{j,t-k} + \left(\gamma_1 \tau_{j,t} + \gamma_2 \tau_{j,t}^2\right) + \theta_t T_t + \eta_j + \varepsilon_{j,t} \tag{13}$$

where index j denotes countries, t represents years, $Y_{j,t}$ is the income statement component examined, $X_{j,t}$ is a vector of control variables, T_t is a vector of year-dummies, η_j is an unobservable time-invariant country effect and $\varepsilon_{j,t}$ is a well behaved error term. In particular, $X_{j,t} = [GDP_{j,t}, DCPI_{j,t}, MMR_{j,t}, LTR_{j,t}, SMC_{j,t}, BL_{j,t}, SMV_{j,t}, TA_{j,t}]$ where $GDP_{j,t}$ is the level of real gross domestic product of country j in year t, $DCPI_{j,t}$ is the rate of inflation, $MMR_{j,t}$ is the money market rate, $LTR_{j,t}$ is the long-term government bond interest rate, $SMC_{j,t}$ is the stock market capitalization divided by GDP, $BL_{j,t}$ is the total amount of bank lending divided by GDP, $SMV_{j,t}$ is the stock market volatility, $TA_{j,t}$ is the total assets of the entire banking sector. All variables are taken in logs except interest rates and ratios.[10]

The emphasis of the analysis is on the term $\gamma_1 \tau_{j,t} + \gamma_2 \tau_{j,t}^2$ which is the impact on $Y_{j,t}$ of the corporate income tax rate ($\tau_{j,t}$). The data used are statutory tax rates which include both national corporate income tax and (an average of) local taxes. Such a component includes a quadratic term in order to capture non linear effects postulated by the theoretical model in Section 2.

The model has been estimated using the GMM estimator suggested by Arellano and Bond (1991), which ensures efficiency and consistency provided that the residuals do not show serial correlation of order two and that the instruments used are valid (which is tested with the Sargan test). Table 3 shows the results for equation 16 where $Y_{j,t}$ is in turn, net interest income,

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[10] See the Appendix for other details on the dataset. Albertazzi and Gambacorta (2006) provide other references and more detailed comments on the econometric model and on the interpretation of the results for the control variables.

other income, operating costs, provisions, and profit before tax. While lagged values of the dependent variable are significant, lags of the independent variables turned out to be almost always not significant and were not reported in the table (if not stated differently). In all regressions, diagnostic tests resulted to be well behaved.

4.2 *Net interest income*

The first column of Table 3 reports the results for net interest income.

Profits obtained by banks through their traditional lending activity are correlated to business cycle indicators like GDP and long term interest rates. Moreover, they are higher in those countries where both the financial markets and the banking sector are more developed.

As shown in the estimation results, both γ's turn out to be significant; the coefficient for the linear term with a positive sign, while the one for the quadratic term with a negative sign. In Figure 4a, we use the coefficients of Table 3 to plot the estimated marginal effect of τ on net interest income ($\hat{\gamma}_1 + 2\hat{\gamma}_2\tau$). Consistent with the prediction of the theoretical model, this expression is decreasing, significantly greater than zero for small levels of τ and significantly less than zero for large levels of τ. In particular, it should be pointed out that the presence of a cost of equity effect (the CIT rate alters the cost of bank external equity) is a necessary condition for having a positive impact of the CIT rate on bank profits. At the same time, considering the cost of equity effect alone, by neglecting the market effect, would not generate an interval of τ in which its marginal impact on the net interest income is negative.

4.3 *Non-interest income*

The second column of Table 3 shows the results for non-interest income. Only one lag of the dependent variable is significant.

Non-interest income is not significantly influenced by real GDP fluctuations, in line with the intuitive idea that these services provide an effective tool to stabilize banks profits. Non-interest income shows a negative correlation with long-term interest rates, which may be connected with the losses of value of fixed rate securities in banks' portfolios. Finally, it is positively affected by the stock market size and volatility. The first effect is in line with the idea that the possibility to provide a variety of banking services together is higher when local financial markets are more developed. The effect of volatility is likely to be connected to the

fact that these services are needed more needed when uncertainty is higher (portfolios are more often readjusted and firms buy more derivatives for hedging purposes).

With regard to the effect of CIT, it can be seen that both the coefficients associated with τ and its square are significant. As shown in Figure 4b and as predicted by the theoretical model, the marginal effect of τ is negative although not significantly different from zero for large levels of τ. The interpretation is the following: given that capital requirements do not involve fee-generating activities, the unique way in which CIT has an impact on non-interest income is through a shift in the demand of such services which always leads to a reduction in revenues (if the demand shifts downward, both the quantity and the price decrease). Therefore, a necessary condition for the existence of a negative effect of τ on non-interest income is the presence of a demand effect.[11]

4.4 *Operating expenses*

The fourth column of Table 3 reports the results for operating costs. Two lags of the dependent variable are included.

As intuition would suggest, operating expenses show a low correlation with the business cycle. They are instead influenced by inflation (probably in connection with some level of wage indexation) and by the level of development of local financial markets (consistent with the idea that the more sophisticated the services, the higher the personnel costs).

Here only the linear term for τ turns out to be statistically significant and with a negative coefficient. This is as predicted by the theoretical model, given that operating costs are a function of quantities and given that both L^* and S^* are a (monotonic) decreasing function of τ.

4.5 *Provisions*

The fourth section of Table 3 displays the results for provisions. Credit losses and readjustment values are negatively correlated with real gross domestic product and long-term interest rates, while they increase with short-term interest rate and stock market volatility.

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[11] The fact that the coefficient for the quadratic term is significant and such that it implies that for τ large the marginal effect is not different from zero, is also consistent with the theoretical model. Consider, for example, the family of demand functions given by: $S = h\left(1-\tau\right)^n / f^m$ with h, n and m positive quantities. These demand functions have a constant coefficient of elasticity and satisfy both $\frac{d}{d\tau} f\left(S^*, \tau\right) S^* < 0$ and, for $n > 1$, $\frac{d}{d\tau} f\left(S^*, \tau\right) S^* \underset{\tau \to 1}{\longrightarrow} 0$.

The negative sign for GDP is in line with Salas and Saurina (2002) and Laeven and Mainoni (2003): when real economic conditions improve, banks expect lower future credit losses and diminish provisions accordingly. The negative impact of the long-term interest rate is related to the fact that such a variable tends to rise in periods of good economic conditions, which are characterized by a smaller probability of default. Provisions increase with the money market rate, consistently with the "financial instability hypothesis" (Fisher, 1933; Minsky, 1975 and Kindleberger 1978): high short-term interest rates increase the burden for borrowers and their default probability.

With regard to taxation, given the link between the CIT rate and the amount of loans, the predicted sign of the estimated coefficient is negative. The results show indeed a negative γ_1, although not significant. The relatively low predictive power of this equation is likely to be connected with two factors. First, provisions are a rather subjective and arbitrary component of bank profits and may be influenced by "window dressing" accounting policies. Second, the simplified framework used in the theoretical model does not take into account that the average riskiness of the loan portfolio is in general not independent on their quantity.[12]

4.6 *Profit before taxes*

The final column of Table 3 presents the results for profit before taxes.

Given that these are defined as gross income (the sum of net interest income and non-interest income) net of operating expenses and provisions, this regression represents a summary of the previous four.

Contrary to what happens when we consider the different components separately, the square of the CIT rate is not statistically significant, showing that the opposite signs of the two relevant coefficients in the regressions for the net interest income and the non interest income cancel each other out. The overall effect of an increase in the CIT rate is an increase in profit before taxes which shows that banks can shift at least part of the CIT. This is coherent with findings of Demirgüç-Kunt and Huizinga (2001).

[12] This link could derive from many sources. For example, one might think that as the amount of loans shrinks the degree of diversification would also decrease.

4.7 *Borrowers or depositors?*

The results described above, in particular those concerning net interest income, suggest the presence of tax shifting from the bank to its clients. Such tax shifting may occur in two ways: through an increase of the interest rate on lending (l) or through a decrease in the interest rate on deposits (d); it is therefore interesting to disentangle the effects on the spread ($l-d$) via the mark-up ($l-r$, where r represents the money market interest rate) and via the mark-down ($r-d$). Moreover, this exercise provides an empirical test of the separability hypothesis.

We have therefore estimated the following models:

(14)

$$(l-r)_{j,t} = \sum_{k=1}^{2} \alpha_{L,k} \, (l-r)_{\,j,t-k} + \sum_{k=0}^{2} \beta'_{L,k} \Psi_{j,t-k} + \gamma_{L,1} \tau_{j,t} + \theta_{L,t} T_t + \eta_{L,j} + \varepsilon_{L,j,t}$$

$$(r-d)_{j,t} = \sum_{k=1}^{2} \alpha_{D,k} (r-d)_{\,j,t-k} + \sum_{k=0}^{2} \beta'_{D,k} \Psi_{j,t-k} + \gamma_{D,1} \tau_{j,t} + \theta_{D,t} T_t + \eta_{D,j} + \varepsilon_{D,j,t}$$

where, in dealing with a spread variable, we used as control regressors $\Psi_{j,t} = [\Delta GDP_{j,t}, (TA/GDP)_{j,t}, MMV_{j,t}]$, in which $MMV_{j,t}$ stands for money market volatility. Only the linear term of the CIT rate has been considered (the quadratic term is never significant).

Table 4 shows the results of this exercise. Consistent with the predictions of the dealership model by Ho and Saunders (1981) and its extension by Angbazo (1997) the mark-up and the mark-down are positively correlated with higher money market volatility. However, only the effect on the mark-up is statistically significant. The same occurs for the size of the banking sector, measured by the ratio between total banking assets and GDP, that tends to reduce mostly the mark-up. The positive effect of real GDP growth on the mark-down is likely to reflect the increase of the deposit holdings by households in periods of expansion. On the contrary the effect of an increase in real GDP on the lending interest rate, although positive, is statistically not significant, probably reflecting a concomitant increase in self-financing (Friedman and Kuttner, 1993).

Overall, these results reveal that a one per cent increase in the CIT rate increases the spread by 7 basis points. The effect concerns borrowers almost exclusively. Again, these findings are consistent with the predictions of the theoretical model and in particular with

those deriving from the assumption of separability: an increase in the CIT rate determines a higher interest rate demanded on loans with no significant impact on the interest rate paid on deposits.

As a check on robustness we reestimated an equation regression similar to the benchmark model (13) for both the interest received on loans (lL) and those paid on deposits (dD). Again the effect of the CIT rate on net interest income comes via the interest rate on loans, leaving all the other results unchanged.

4.8 *Analysis of the tax burden*

As shown in the fifth column of Table 3, in the equation for profit before taxes, the CIT rate turns out to be significant and with a positive sign. This suggests the possibility for banks to shift part of the tax burden.

The specification adopted does not permit a quantitative appraisal of the extent to which banks are actually able to operate such tax shifting. An initial attempt consists of estimating a regression similar to equation 13 for the profit after taxes. The results of this exercise reveal that the CIT rate τ has a negative but non significant coefficient (-0.312 with a standard error of 1.158)[13]. This means that an increase in taxation is likely to determine a drop in banks' profits after taxes which is not significantly different from zero; in other words, this evidence says that banks are able to shift a large part of their tax burden.

A more precise quantification of the tax burden for banks may be obtained by computing the impact on profits of an additional unit of currency of taxes. Few calculations allow us to derive these quantities from the estimated coefficients of equation 13 for profit before taxes and profit after taxes.[14] The result of this exercise shows that, for example, if taxes are raised by one euro, the reduction in banks' profit after taxes are on average equal to 3 cents, a value that is not significantly different from zero.

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[13] Results are unchanged if we include the quadratic term for τ and we consider the derivative for any value of τ, as we did in figure 4 for the net interest and the non-interest income.

[14] Denoting T, PBT and PAT the amount of taxes, profit before taxes and profit after taxes respectively, we have $T = PBT\tau$ which implies $\partial T/\partial \tau = \partial (\tau PBT)/\partial \tau = PBT + \tau \partial (PBT)/\partial \tau$. This expression can be used to get the following derivative $\partial PAT/\partial T = \frac{\beta_{PAT}(1-\tau)}{1+\beta_{PBT}*\tau}$, where $\beta_{PAT} = \partial \ln (PAT)/\partial \tau$ and $\beta_{PBT} = \partial \ln (PBT)/\partial \tau$.

Given that the above calculations are based on an approximation,[15] as a robustness check we have tried to corroborate the results by running a regression for banks' profits similar to equation 13 but in which the tax rate has been substituted by the amount of taxes actually paid.[16] It turned out that while in the regression for profit after taxes the amount of taxes is not significant (-0.108 with a standard error of 0.137), in the case of profit before taxes the coefficient is almost equal to one and highly significant (0.945 with a standard error of 0.149).[17]

To sum up, banks display the ability to shift at least 90 per cent of their corporate income tax burden, although this is also influenced by the competitive pressure they face. This happens mainly through an increase of net interest income, although this is not true at high rates of CIT, and through a reduction in operating costs and provisions. Finally, coherent with predictions of the theoretical model tax shifting on net interest income takes place through a rise in the interest rate on loans. No significant effect on the interest rate on deposits is detected.

4.9 *Differences across periods and groups of countries*

In section 2 it has been stated that important structural changes concerning both the real economy and the banking sector occurred from the first part of the sample (1981-1992) to the second one (1993-2003). For this reason it is natural to investigate whether the results presented above hold indifferently across sub-periods. In order to do so we estimated the benchmark model for all income components by allowing the effect of $\tau_{j,t}$ and $\tau_{j,t}^2$ to differ between the first and the second sub-period. In particular we have inserted in equation (13) the following term $\left(\gamma_1^* \tau_{j,t} d_t + \gamma_2^* \tau_{j,t}^2 d_t\right)$ where d_t is a dummy that takes the value of 1 in the period 1993-2003 and 0 elsewhere. It turned out that both coefficients γ_1^* and γ_2^* were not significant at conventional levels in all the equations.

As a second test, we estimated the model by allowing the effect of $\tau_{j,t}$ and $\tau_{j,t}^2$ to differ between the euro area and Anglo-Saxon countries. In this case we have estimated the benchmark model for all income components by adding in equation (13) the following term

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[15] The starting equality $T = PBT\tau$ is valid for the effective (ex-post) CIT rate, while the one we use in the regressions, for reasons related to possible problems of endogeneity, is the ex-ante one.

[16] Moreover, all variables previously taken in logarithm are left in levels, so that the coefficient for taxes can be interpreted as the impact on profits of an additional unit of currency.

[17] This test is also useful in order to corroborate the findings with respect to another issue emphasized in the literature. In fact, Huizinga and Laeven (2007) show that multinational firms engage in substantial international profit shifting activities. This may render the statutory tax rate not a perfect measure of the taxation actually borne by banks (a criticism which does not apply to the amount of taxes actually paid).

$\left(\gamma_1^*\tau_{j,t}d_t^A + \gamma_2^*\tau_{j,t}^2 d_t^A\right)$ where d_t^A is a dummy that takes the value of 1 in the case of the United States and the United Kingdom. Even in this case both coefficients γ_1^* and γ_2^* were never significant at conventional levels.

5. Conclusions

In this study we have investigated, both from a theoretical and an empirical perspective, how bank profitability is affected by corporate income taxation.

The main innovation of the theoretical model is to consider that the link between bank profits and corporate income taxation is determined by two factors. One is denoted the "market effect" of the CIT: an increase in the CIT rate modifies the demand for bank services and bank price setting should take these demand shifts into account. The second factor is the "cost of equity effect", due to the presence of capital requirements that render the CIT rate equivalent to a tax on equity.

The empirical findings, obtained using data for the main industrialized countries over the period 1980-2003, are consistent with the predictions of the model and with the presence of these two effects. Moreover, in line with the separability hypothesis between loan and deposit markets, changes in the CIT rate have an impact only on the interest rate demanded on loans with no significant impact on that paid on deposits. This finding provides some empirical ground for theories of fiscal repression, stating that any form of taxation eventually born by borrowers may determine a financial disintermediation and an overall loss of efficiency connected with higher agency costs (Caminal, 2003). The presence of separability may also explain why ceilings on deposit interest rates, popular during the 1980s, did not succeed in keeping low rates on loans (Freixas and Rochet, 2007).

Finally, the results show that banks have the ability to shift at least 90 per cent of their corporate income tax burden. No significant differences in the link between bank profitability and taxation emerge when comparing the eighties with the nineties or euro area and Anglo-Saxon countries.

Appendix: technical details on the data

The dataset includes figures for 10 countries over the period 1981-2003. We have analyzed 8 euro area countries (Germany, France, Italy, Spain, The Netherlands, Austria, Portugal and Belgium), the United States and the United Kingdom. Data on income statements (net interest income, non-interest income, operating costs, provisions, and profit before taxes) and total assets are taken from OECD Bank Profitability.

Total lending and interest rates have been obtained by national harmonized statistics for countries belonging to the euro area and from IMF Financial Statistics for United Kingdom and United States. Data on total lending for euro area countries were not always available for the entire time period. For those years we have reconstructed them backwards using IMF growth rate statistics.

From IMF Financial Statistics we also obtained a set of macroeconomic indicators: consumer price index, gross domestic product, the interest rate paid on long-term government bonds and the money market interest rate.

Data on national stock market capitalization and volatility were collected from Thomson Financial Datastream. From the Institute for Fiscal Studies we obtained information on statutory tax rates which include both national corporate income tax and local taxes (their average across regions), where they exist. In the case of Netherlands, where corporate income tax is progressive, we have used the maximum marginal rate.

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Table 1

Main economic indicators
(percentage values)

Countries	GDP per capita (1)	Corporate income tax (statutory rate)	Real GDP growth rate	Inflation rate	Credit/GDP	Stock market capitalization/ GDP (2)	Volatility in the stock market	Money market rate	Volatility in the money market	(a) Lending interest rate	(b) Deposit interest rate	(a)-(b) Spread
						(1981-1992)						
Austria	14.70	0.53	2.45	3.56	86.24	3.36	13.60	7.12	0.10	9.93	3.78	6.15
Belgium	13.49	0.43	1.96	4.29	67.80	13.01	13.94	8.35	0.12	12.70	6.20	6.51
France	14.44	0.44	2.17	5.79	82.89	8.73	16.11	10.53	0.07	11.09	5.81	5.28
Germany	15.10	0.62	2.43	2.94	98.63	10.99	14.65	6.76	0.08	10.88	5.80	5.09
Italy	8.83	0.45	2.07	9.21	57.87	10.13	19.59	14.85	0.06	16.59	9.61	6.98
Netherlands	14.42	0.41	2.24	2.59	88.65	28.05	13.58	7.12	0.09	10.35	4.02	6.33
Portugal	3.34	0.48	2.67	16.09	59.69	9.09	12.72	15.05	0.12	22.55	18.38	4.17
Spain	5.75	0.35	2.75	8.79	70.67	18.94	15.30	14.24	0.11	14.73	10.58	4.15
Euro area	*11.26*	*0.46*	*2.34*	*6.66*	*76.55*	*12.79*	*14.94*	*10.50*	*0.09*	*13.60*	*8.02*	*5.58*
United Kingdom	7.46	0.40	2.14	6.29	87.78	49.99	15.53	11.35	0.12	11.45	10.17	1.28
United States	18.76	0.44	2.89	4.56	43.57	33.12	17.25	8.64	0.09	10.67	8.63	2.04
						(1993-2003)						
Austria	24.06	0.34	1.87	1.93	100.78	13.17	11.14	3.97	0.08	6.91	2.47	4.45
Belgium	22.25	0.40	1.98	1.85	83.25	48.75	11.32	4.21	0.09	8.01	3.62	4.40
France	22.42	0.37	1.82	1.59	82.10	54.48	18.39	4.40	0.10	6.94	3.45	3.49
Germany	23.44	0.51	1.17	1.88	124.01	36.09	17.46	3.91	0.09	10.10	3.38	6.72
Italy	18.56	0.46	1.45	3.12	75.07	34.38	21.94	6.10	0.10	8.77	3.88	4.88
Netherlands	22.90	0.35	2.34	2.62	122.63	117.90	16.76	3.90	0.09	5.88	3.27	2.60
Portugal	10.10	0.37	2.08	3.73	96.08	38.57	13.75	6.12	0.10	9.20	5.15	4.05
Spain	13.44	0.35	2.77	3.40	88.22	42.32	18.67	5.76	0.11	6.74	4.49	2.25
Euro area	*19.65*	*0.39*	*1.94*	*2.51*	*96.52*	*48.21*	*16.18*	*4.80*	*0.09*	*7.82*	*3.71*	*4.10*
United Kingdom	14.74	0.31	2.77	2.31	126.23	130.29	16.65	5.39	0.10	5.63	2.98	2.65
United States	31.38	0.39	3.14	2.49	43.58	96.53	19.55	4.28	0.09	7.27	4.41	2.86

Note: (1) Thousands euros for all countries except United States (thousands Dollars) and United Kingdom (thousands Pounds Sterling). - (2) Data for Portugal refers to 1990-1992; those for Spain to 1987-1992.

Source: Authors' calculations based on data from International Financial Statistics.

Table 2

BANK PROFITABILITY

(as a percentage of total assets)

Countries	(a) Net Interest Income	(b) Non interest income	(b)/(a+b) Diversification	(c)=(a)+(b) Gross income	(e) Operating expenses	(f) Provisions	(g)=(c)-(e)-(f) Profit before tax	(h) Taxed paid	(i)= (g)-(h) Profit after tax	(h)/(g)	ROE (1)
					(1981-1992)						
Austria	1.62	0.64	0.28	2.26	1.46	0.52	0.28	0.16	0.12	0.57	6.99
Belgium (2)	1.64	0.41	0.20	2.05	1.41	0.34	0.30	0.12	0.18	0.39	5.96
France	2.09	0.50	0.19	2.59	1.88	0.30	0.41	0.14	0.28	0.33	8.13
Germany	2.26	0.59	0.21	2.85	1.79	0.43	0.63	0.39	0.24	0.62	6.30
Italy	3.45	1.05	0.23	4.50	2.79	0.76	0.95	0.44	0.51	0.47	9.72
Netherlands	2.19	0.77	0.26	2.97	1.95	0.41	0.61	0.10	0.51	0.16	10.74
Portugal	3.28	1.02	0.24	4.29	2.32	1.20	0.77	0.14	0.47	0.22	7.18
Spain	4.08	0.82	0.17	4.90	3.12	0.77	1.01	0.24	0.77	0.24	8.39
Euro area	*2.58*	*0.73*	*0.22*	*3.30*	*2.09*	*0.59*	*0.62*	*0.22*	*0.41*	*0.35*	*7.93*
United Kingdom (3)	3.05	1.85	0.38	4.89	3.20	0.97	0.72	0.32	0.40	0.45	8.91
United States	3.42	1.45	0.30	4.87	3.28	0.74	0.84	0.24	0.60	0.29	9.27
					(1993-2003)						
Austria	1.48	1.10	0.43	2.59	1.75	0.39	0.45	0.06	0.38	0.15	7.65
Belgium	1.12	0.68	0.38	1.80	1.18	0.17	0.45	0.12	0.33	0.26	10.81
France	0.98	1.08	0.53	2.05	1.37	0.33	0.36	0.10	0.26	0.27	5.71
Germany	1.66	0.62	0.27	2.29	1.48	0.42	0.39	0.20	0.19	0.51	4.71
Italy	2.56	1.03	0.29	3.59	2.24	0.60	0.75	0.36	0.39	0.48	5.20
Netherlands	1.71	1.08	0.39	2.78	1.91	0.20	0.68	0.19	0.49	0.28	11.52
Portugal	2.17	0.91	0.30	3.08	1.83	0.46	0.80	0.14	0.66	0.17	6.11
Spain	2.53	1.00	0.28	3.52	2.11	0.57	0.84	0.17	0.67	0.20	7.37
Euro area	*1.78*	*0.94*	*0.35*	*2.71*	*1.73*	*0.39*	*0.59*	*0.17*	*0.42*	*0.28*	*7.39*
United Kingdom	2.06	1.50	0.42	3.56	2.13	0.32	1.11	0.36	0.76	0.32	16.45
United States	3.58	2.39	0.40	5.97	3.66	0.45	1.86	0.63	1.23	0.34	14.03

Note: (1) Profit after tax as a percentage of capital and reserves. Data for Austria in the first sample period refer to 1989-92. - (2) 1982-1992. - (3) 1984-1992.

Source: Authors' calculations based on data from OECD, Bank Profitability.

Table 3

REGRESSION RESULTS [1]

	(i) Net interest income			(ii) Non-interest income			(iii) Operating cost (2)			(iv) Provisions			(v) Profit before taxes		
	Coeff.		S. error	Coeff.		S. error	Coeff.		S. error	Coeff.		S. error	Coeff.		S. error
Endogenous var. $_{jt-1}$	0.974	***	0.072	0.532	***	0.054	0.772	***	0.101	0.268	***	0.087	0.233		0.800
Endogenous var. $_{jt-2}$	-0.210	***	0.073				-0.209	***	0.069	0.164	**	0.081	0.206	***	0.078
log of real GDP $_{jt}$	0.552	***	0.181	-0.228		0.390	0.022		0.175	-1.690	*	1.001	2.030	*	1.170
Inflation rate$_{jt}$	0.138		0.419	1.844	*	1.080	0.470	*	0.283	5.377	*	3.247	3.470		2.620
Money market rate $_{jt}$	0.382		0.388	0.607		0.977	-0.025		0.307	4.853	*	2.778	-7.850	***	2.820
Long term rate $_{jt}$	1.061	**	0.515	-1.954	*	1.025	0.438		0.441	-6.967	*	3.896	5.742	**	2.680
Log of total assets $_{jt}$	0.141	***	0.048	0.009		0.095	0.141	**	0.058	0.754	**	0.297	-0.260		0.282
Lending /GDP $_{jt}$	0.087	*	0.045	0.071		0.132	0.149	***	0.044	0.072		0.385	0.079		0.390
Stock Mark. Cap. /GDP $_{jt}$	0.093	***	0.031	0.071		0.071	0.122	***	0.029	-0.064		0.220	0.396	*	0.210
Stock Mark. Volatility $_{jt}$	0.020		0.111	0.655	**	0.293	0.038		0.095	4.066	***	0.932	-2.043	**	0.945
Corporate Income Tax Rate$_{jt}$	2.388	***	0.803	-4.900	***	1.890	-0.128	*	0.069	-0.865		0.928	1.449	**	0.588
(Corporate Income Tax Rate$_{jt}$)^2	-2.620	***	0.842	4.522	**	2.000									
Sargan test (2nd step; p-value)			0.18			0.18			0.02			0.22			0.78
MA(1), MA(2) (p-value)	0.00		0.25	0.00		0.76	0.00		0.61	0.00		0.19	0.00		0.72
No. of countries, no. of observations	10		184	10		194	10		187	10		164	10		178

Notes: (1) The model is given by equation (1), which includes two lags in order to obtain white noise residuals. Dependent variables are in logarithm. The model has been estimated using the GMM estimator suggested by Arellano and Bond (1991), which ensures efficiency and consistency provided that the residuals are not subject to serial correlation of order two and that the instruments used are valid (which is tested for with the Sargan test). The sample goes from 1981 to 2003. *Significant at the 10% level. ** Idem, 5%. *** Idem, 1%. Lagged values of the independent variables turned out to be not significant and have been removed to save degrees of freedom except where indicated. - (2) Inflation rate is one period lagged.

Table 4

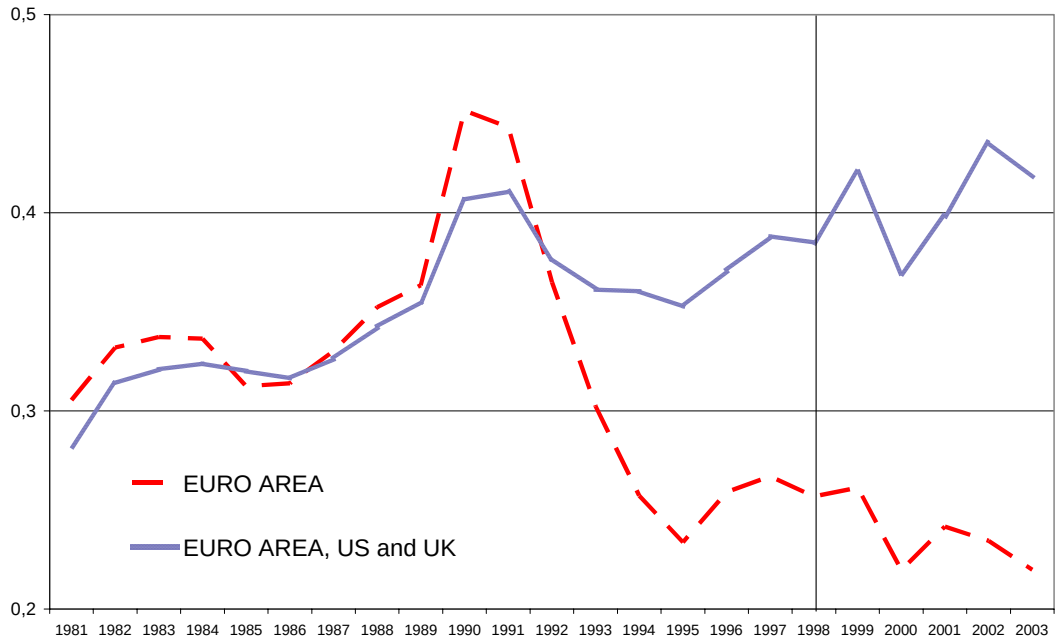
REGRESSION RESULTS FOR THE SPREAD [(1)]

	(i) Mark-up= short term interest rate on loans - money market rate			(ii) Mark-down= money market rate- interest rate on deposits		
	Coeff.		S. error	Coeff.		S. error
Endogenous var. $_{jt-1}$	0.350	***	0.072	0.567	***	0.073
Endogenous var. $_{jt-2}$				0.131	**	0.063
Real GDP growth rate $_{jt}$	0.001		0.001	0.003	***	0.001
Total bank assets/GDP $_{jt}$	-0.011	**	0.005	-0.001		0.003
Money market volatility $_{jt}$	0.044	***	0.016	0.014		0.016
Corporate Income Tax rate $_{jt}$	0.059	**	0.027	0.009		0.021
Sargan test (2nd step; p-value)			0.74			0.32
MA(1), MA(2) (p-value)	0.00		0.71	0.00		0.41
No. of countries, no. of observations	10		207	10		199

Notes: (1) The model is given by equation (1), which includes two lags in order to obtain white noise residuals. The model has been estimated using the GMM estimator suggested by Arellano and Bond (1991), which ensures efficiency and consistency provided that the residuals are not subject to serial correlation of order two and that the instruments used are valid (which is tested for with the Sargan test). The sample goes from 1981 to 2003. *Significant at the 10% level. ** Idem, 5%. *** Idem, 1%. Lagged values of the independent variables turned out to be not significant and have been removed.

Figure 1

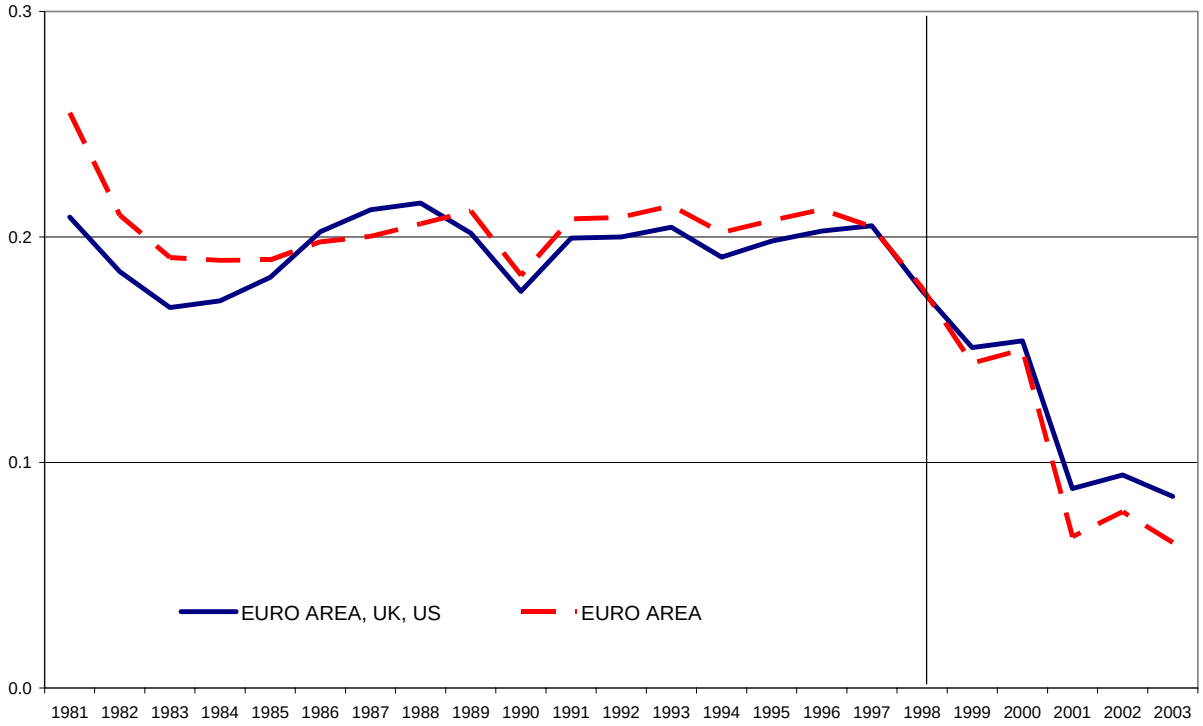
Cross-sectional dispersion of bank profitability[(1)]



(1) Coefficients of variation (ratio of cross-country standard deviation to simple average) of the gross income-to-total asset ratio. Source: OECD, Bank Profitability.

Figure 2

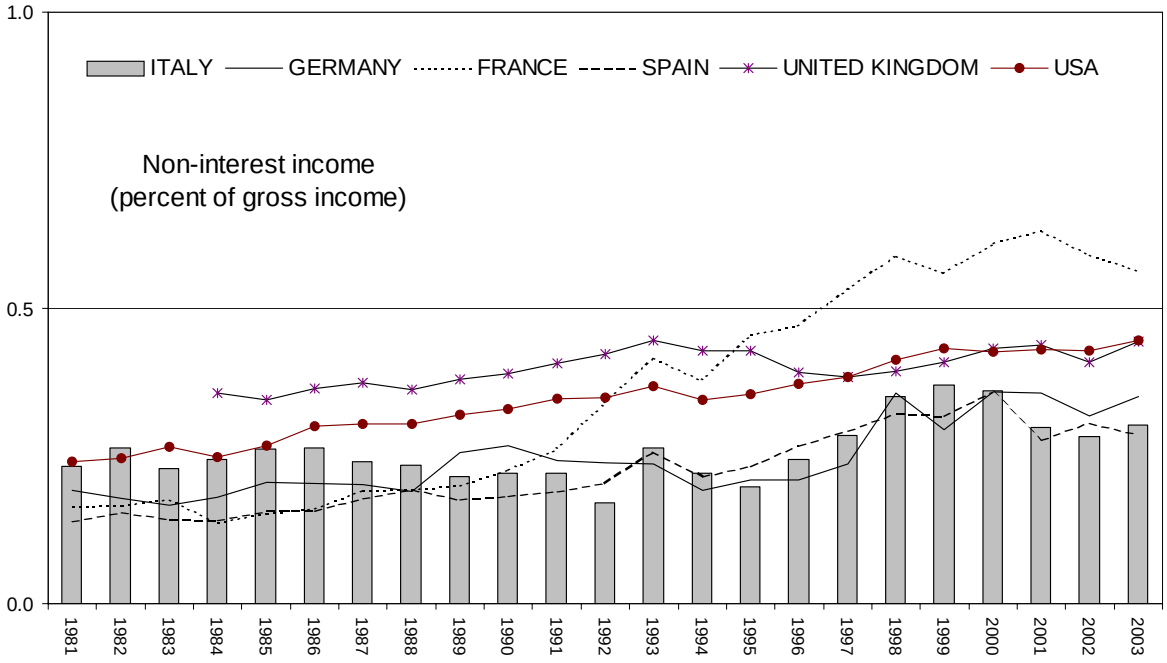
Cross-sectional dispersion of corporate income tax rates



Source: Institute for Fiscal Studies.

Figure 3

Revenue diversification

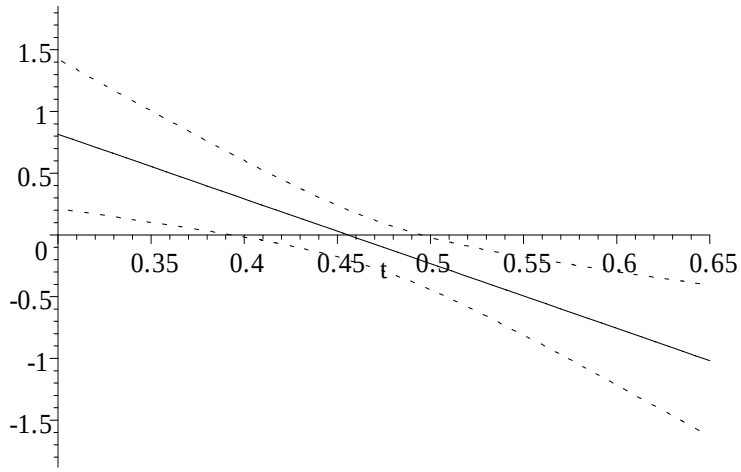


Source: Authors' calculations based on data from OECD, Bank Profitability.

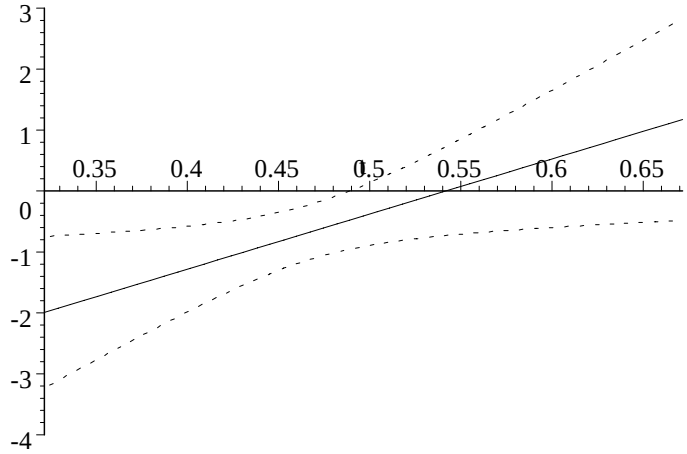
Figure 4

Marginal effect of the statutory tax rate (1)

Net Interest Income



Non Interest Income



(1) Plots of the derivative of each income component with respect to τ, the corporate income tax bracket ($\gamma_{1t}+2\gamma_2\tau_{j,t}$). The coefficients γ_1 and γ_2 are those reported in Table 3. Dotted lines represent confidence bands at the 95 per cent level of confidence.

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