Bank Profitability and Taxation[*]

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Abstract

This paper investigates how bank profitability is affected by the corporate income tax (CIT). For this purpose it uses aggregate data of the banking sector of the main industrialized countries, for the period 1980-2003. The main novelties with respect to the existing literature are two. First, it explicitly considers that the CIT is not specific to the banking sector so that changes in CIT rate can affect both banks and borrowing firms. With the help of a simple theoretical model we derive a set of predictions about the impact of the CIT on banks' income statement. Second, we consider all main components of banks' profit and loss accounts: net interest income, interest expenses, non-interest income, operating costs, and provisions. In this way, we are able to disentangle the extent to which a bank is able to shift its tax-burden forward to its lenders, depositors, and purchasers of fee-generating services.

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1 Introduction

The issues related to the taxation of financial intermediaries are of great interest because the banking sector plays a crucial role in the allocation of resources and the growth process. Nevertheless, as noted by Caminal (2004), most of the attention of economic research has been devoted to the effects of liberalization of the financial industry, privatization of banks, optimal design of the regulatory environment; on the contrary, bank taxation has received relatively little attention, in spite of the fact that it is often a significant source of tax revenue in many countries. Interest in the taxation of financial firms has been recently increasing in connection with policy issues in the European Union, where the attempt of creating a common market for banking services has not yet achieved satisfactory results despite massive deregulation. In this respect, it has been argued that the persistent segmentation of national markets can also be connected with differences in the fiscal treatment of resident banks (Huizinga, 2003).

This paper focuses on the effects of the corporate income tax on bank profitability.[1] We take into account possible interactions between the banking and the firm sector: an increase in the corporate income tax rate could modify loan and deposit demand schedules, so that banks' prices are modified taking into account this effect. For this reason it is difficult to establish a priori what is the total effect on bank margins, that will depend upon demand and supply elasticities.[2] This effect can be influenced also by institutional and other credit market characteristics. In particular, economic theory suggests that the possibility for a bank to shift an increase in the tax burden to its customers directly depends on the competitiveness of the market in which it operates. The analysis should therefore take into account the great changes due to the effect of deregulation over time.

The literature stresses the fact that corporate income tax distorts the capital structure and raises the average cost of capital. In the case of banks the effects of corporate taxes are quite different since banks are subject to regulation that influences their liability structure. For example, in the presence of a minimum capital requirement, substitution effects between equity

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[1]Although the financial sector is subject to general income taxation, with regard to other forms of taxes, in most countries it receives a special treatment. For instance, financial services are often exempted by VAT, mainly in connection with difficulties in measuring value added (De Bonis, Monacelli and Pazienza, 2005); banks enjoy below-cost deposit insurance and bailouts in cases of financial collapse. On the other hand, banks bear special taxes such as unremunerated reserve requirements (Fama, 1980) and 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 Monacelli and Pazienza, 2005.

[2]For a general reference on the issue of tax shifting, see Atkinson and Stiglitz, 1980.

and other forms of financing are very limited for a bank (Gambacorta and Mistrulli, 2004). This means that after a reduction of the CIT rate, loan supply may simply reduce as it would happen with any other firm after an increase of the marginal cost.

The macroeconomic consequences of a tax-shift are analyzed in the theories of fiscal repression (Demirgüç-Kunt and Huizinga, 1999); this part of the literature stresses the fact that the growth possibilities of an economy are largely affected by the size and efficiency of its financial sector, which govern the capital accumulation and allocation processes. Nevertheless, it is reasonable to presume that the importance of the distortions generated by the taxation of financial services are closely dependent on whether who is actually carrying the tax burden is the bank or its customers.

This paper studies the link between bank profitability and taxation by using data for ten industrialized countries over the period 1981-2003. The dataset includes yearly figures from the balance sheet and income statement of aggregated national banking industries reconstructed on a comparable basis using OECD and national central banks data. Data are collected and treated in an harmonized way that minimizes the effects of differences in accounting and statistical definitions and allows meaningful comparison across countries. It's worth stressing that OECD data area collected on an individual basis and are not consolidated. As a measure of taxation we use the corporate income tax rate that can be reasonably considered exogenous for two reasons: i) it is not affected by banks' choices, as the effective tax rate would be (the ex-post tax rate); ii) it is not industry-specific, so that it can not be said that its level is somewhat determined by policy makers by taking into consideration how it will affect the banking sector.

The main novelty of the paper lies in a comprehensive analysis of the effect of tax-shifts on all income statement components. This helps us to assess the effects among the different customers. For example, we try to understand not only if the net interest margin (the difference between the interests received from borrowers and those paid to depositors) is affected by the level of the corporate income tax levied on banks' profits, but also if the possible tax shifting is against depositors or borrowers.

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

2 Some facts on bank profitability and taxation

Since the mid-eighties, dramatic changes in regulation, demand composition and technology have modified the structure and the boundaries of credit markets.[3] All these changes have strengthened competition, especially in the traditional lending activity, reduced intermediation margins and stimulated banks to diversify their sources of revenues and increase efficiency in production and distribution. The introduction of the euro has eliminated most of the residual barriers to competition among the banking system of the countries that have adopted the common currency.[4] However, the taxation of banking in Europe is far from being integrated: the overall fiscal treatment of banks remains the purview of national authorities, subject to European directives and regulations that impose minimum standards on their policies (Huizinga, 1999).

The aim of this section is to investigate if changes in the corporate income tax brackets (CIT rate, from now on) may have influenced some pattern that we observe in the banking industry. For example, since the mid-nineties cross-country variability of both gross income and profit before taxes (as a percentage of total assets) has decreased in the euro area (Fig. 1a). This fact matches with the convergence of corporate income taxation among main Euro area countries (Fig. 2a). On the other hand, when we include in the analysis Anglo-Saxon banking systems both the dispersion in bank profitability (Fig. 1b) and taxation (Fig. 2b) remain ample, even if the CIT rate declined considerably everywhere.

Tables 1 and 2 show the main macroeconomic and bank indicators dividing the sample in two sub-periods: 1981-1992 and 1993-2003. Strong differences in the two periods emerge not only in the real and financial indicators but also in the CIT rate.

The inflation rate has been sharply decreasing in every country considered (see Table 1). The sharpest declines are observable in the euro area, where inflation went down from an average of 6.7 in the years 1981-1992 down to 2.5 per cent in the years 1993-2003. This is largely connected with the

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[3]We can think, for example, of the liberalization of branching in Italy in 1990 (Ciocca, 2000), 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). For an analysis of credit market deregulation on banking activity see, among others, Bhattacharya, Boot and Thakor (1998).

[4]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.

convergence process towards the adoption of the single currency. Within the euro area the most visible shrinking has been recorded in those countries, like Italy, where the inflation rate started from the highest levels.

Following the behavior of the inflation rate, interest rates also show a marked decline. 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. The spread is often taken as a proxy for the level of competition in the national banking industry. Its reduction reflects the process of deregulation of the banking sector which came together with the financial stabilization. This indicator remains still above that registered in the Anglo-Saxon countries.

Financial stabilization and deregulation had important implications on the income statements of banks. First, there has been a shift from net interest income to other income not depending on traditional financial intermediation. Following the reduction in the spread, net interest income, as a percentage of total assets, declined sharply in the euro area while it remained stable in the United States and in United Kingdom (see Table 2).[5]

On the contrary, non-interest income has increased its importance in the last years (Fig. 3a). The decline in interest margins has changed the traditional role of banks and has forced them to search for new sources of revenues such as trading, services and other financial operations. Diversification has been sustained by the greater propensity of households to invest in financial assets other than government bonds, and by the higher opportunities for firms to access the capital markets. Moreover, structural changes like industry deregulation, new information technologies and financial innovation have increased the importance of fee income.[6] The ratio between non-interest income and gross income has increased sharply in every country considered. The smallest increase is observed in United Kingdom, which is where this ratio started from the highest level. In the United Kingdom, the main European financial market, banks have been traditionally prone to provide different services other than those related to the pure intermediation activity. In this respect, Italian, German and Spanish banks lag behind (net interest income is still a large part of their gross income); this could reflect the strong

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[5]However, as noted by DeYoung and Rice (2004a) the stability of the net income-to-total assets ratio in the U.S. basically depends on lending securitization activity that reduced loan assets by 10 percentage points between 1986 and 2003. In the same period net interest income as a percentage of gross income decreased by 15 percentage points to 55 per cent.

[6]DeYoung and Rice (2004b) stress the fact that fee-based activities like trust services, mutual fund sales and cash management require little or no regulatory capital. This should allow banks to use a greater "degree of financial leverage".

lending relationship which is often said to characterize these countries and the lower development of their stock markets. Given such sharp differences, it becomes interesting to check whether these changes have been fostered or opposed by taxation (we will see that, because of capital requirements, corporate income taxation has an impact on revenue diversification); tax-shifts are indeed dependent on the demand elasticities of each bank product to price changes, the market power of a bank with respect to her customers and the effects of fiscal change on firms and households maximizing choices.

Provisions and operating cost show a sharp reduction comparing the two periods. These income statement components are less likely to be strongly affected by changes in income taxation. The reduction in the level of provisions is not easy to interpret; it can be seen as a signal of a lower level of risk faced by banks but also as a less prudent strategy followed by their managers. The downward trend in operating expenses (fig. 3b) is mainly due to advances in information, communications and financial technologies that have allowed banks to render many of their traditional services more efficiently (see Albertazzi and Gambacorta, 2005).

Bank profitability (measured by the return on equity, ROE) has slightly diminished in the euro area, possibly in connection with the increase in competition. In the United Kingdom and the United States, where the banking system liberalization process started earlier,[7] the ROE remains well above the euro area average. The higher level of profitability of Anglo-Saxon banks in the past is usually explained by structural factors or by different macroeconomic performance. In the past higher profits were due to the greater capacity of Anglo-Saxon banking systems to diversify their revenues on non-traditional markets (Bowen, Hoggarth and Pain, 1999) or to expand their activities on off-balance sheet items, such as derivatives (Boyd and Gertler, 1993).[8] Though the determination of the factors underlying the different

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[7]In the United Kingdom, bank despecialization, the reduction of segmentation in the credit markets and the developing of a more market oriented economy started in the seventies (Llewelling, 1990). In the United States changes in market regulation, bank organization and market structures has started in the eighties (Berger, Kashyap and Scalise, 1995).

[8]According to microeconomic studies, the differences in the level of profits observed in the nineties between Anglo-Saxon and European banking systems reflect only to a small extent differences in the average bank size or efficiency. For example, few studies (Berger and Mester, 1997, and Hughes and Mester, 1998, for the United States; Altunbas, Molineux and Thornton, 1997, and Schure and Wagenvoort, 1999, for Europe) show that the cost function has a very flat U shape (with a minimum at about 10 billion US dollars of total asset). Also managerial efficiency (the so-called x-efficiency) does not show appreciable differences across countries (Berger and Humphrey, 1997, for the United States, Schure and Wagenvoort, 1999, for Europe).

level of profitability observed in the two groups of countries is beyond the scope of this study, we want to underline how taxation could have played a role in each profit component.

In summary, the structural changes which took place starting from the mid-eighties, had important effect on the composition of the income statement of the banking sector: the ratio of non interest income to gross income increased, while operating expenses and provisions decreased. In order to understand whether these facts could have been somehow influenced by changes in the corporate income tax, we develop a simple theoretical framework model, whose main predictions will be tested in the empirical section.

3   A theoretical model

In this section we sketch out a simple model that can show what are the mechanisms by which a change in the economy wide CIT rate can affect the different items of the income statement of banks. It is useful to start with two preliminary remarks.

The first one is that the CIT is not specific to the banking sector; in other words the tax burden is on the profits of all firms, and not just on banks. Accordingly, a change of the CIT rate will determine distortions on the choices not only of banks but also of all other corporations. This implies that the tax shifting can go in both directions: on one hand banks will try to shift the tax burden by asking higher interest rates on loans and fees or by paying lower interest rates on deposits; on the other hand, firms will try to shift their CIT toward their counterparts, banks included.[9]

A second remark is that, as it is well known in public economics,[10] the CIT can generate two different effects. One is the output substitution effect which postulates that an increase of the CIT determines a decrease of production in the incorporated sector.[11] On this basis we assume that the demand of loans faced by banks is a downward sloping function of the CIT tax rate. The input substitution effect instead is connected with the fact that CIT can be seen as a tax which makes convenient to substitute equity with other "inputs", like labor or debt.

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[9]In principle, we could expect an analogous effect also for depositors. For the sake of simplicity, we neglect this channel since deposits held by corporations are a small portion of total deposits (16.5 per cent in the euro area at the end of 2004).

[10]The classical theoretical reference about the effects of the corporate income tax is given by the model of Harberger (1962). See Atkinsons and Stiglitz (1980) for a critical survey.

[11]The name output substituion effect refers to the fact that such contraction may be partially compensated by an expansion of the production of the non incorporated sector.

Let's consider a bank under monopolistic-competition (for example, the location of its branches makes its services non-perfect substitutes with those of its competitors). Such bank faces a downward sloping demand curve for any service provided which are classified into loans and other services different from loans. Supposing, for the sake of simplicity, linear schedules, the demand for loans (L) and the demand for other services (S) can be written:[12]

$$
\begin{aligned}
L &= l - l_i i_l - l_\tau \tau \\
S &= s - s_f f - s_\tau \tau
\end{aligned}
\tag{1}
$$

In these definitions, l, l_i, l_b, s, s_f, s_τ are all positive parameters; i_l is the interest rate on loans, f is the fee required on other services; τ is the (economy-wide) CIT rate. These two demand functions are decreasing in the relevant price (i_l and f, respectively) and they are also negatively affected by τ.

The latter term is simply meant to capture the idea that a higher level of corporate income taxation is in equilibrium associated with a lower level of investment and of economic activity.[13] In other words, allowing l_τ and s_τ to be non-null is a short way to capture general equilibrium features of the problem of tax shifting. As we will show below, this simple change has important and previously neglected consequences on the theroetical predictions about the effect of the CIT rate on the income statement of banks.

The parameters l_i and s_f are important since they depends on bank's market power in the two segments.

Symmetrically, it can also be assumed that the bank faces the following schedule of deposit demand by households.[14]

$$
D = d + d_i i_d \tag{2}
$$

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[12] We assume that parameters are such that all these expressions are always non negative.

[13] This is the ultimate effect of both the input substitution effect and the output substitution effect of the CIT on non financial firms which reduces their propensity to produce and therefore to invest. In principle l_τ and s_τ may not be necessarily positive. For example, one can argue that an increase in τ may induce firms to substitute equity with bank loans or with non-bank debt (which may correspond to an increase in the demand of fee-generating services). In what follows we consider that these effects are of second order importance. We will discuss these hypotheses in Section 4.3.

[14] The aim of this paper is not to determine whether deposits are input or output of a bank's production function (see Freixas and Rochet, 1997). Talking about demand of deposits by savers is a mere terminological convention since in the present context this distinction is irrelevant.

The non negative parameter d_i represents the semi-elasticity of D with respect to the interest rate paid on deposit (i_d).

Total operating costs are equal to:

$$C = Sc + Dc' + Lc'' + F \qquad (3)$$

where F is the level of fixed costs, c, c', and c'' are the constant marginal costs on other services, deposits, and loans respectively. For the sake of simplicity, we assume that the marginal cost to carry out the traditional intermediation activity is zero $(c' = c'' = 0)$; moreover, also fixed costs can be normalized to zero $(F = 0)$.[15] This hypothesis simplifies the algebra without any effect on the main results of the paper and captures the intuitive idea that once the fixed costs connected with the branch network are paid, an additional loan (deposit) can be granted (taken) at negligible additional administrative costs. On the contrary, this is not necessarily true for fee generating services.

Provisions for credit losses are obviously commensurate to the amount of loans (L), with the parameter a_l that represent the riskiness of bank's portfolio:

$$A = a + a_l L \qquad (4)$$

Profit before taxes are defined as:

$$P = (i_l L - i_d D) + Sf - C - A \qquad (5)$$

The bank has to satisfy a balance sheet constraint according to which equity (E) and deposits should be equal to the sum of physical assets and total lending:[16]

$$L + K = E + D \qquad (6)$$

In order to limit agency problems bringing to excessive risk taking, the bank is also subject to minimum capital requirements which are assumed to

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[15]Equation (3) implies a strict separability of the costs of bank activities: we will remove this simplifying hypothesis in Section 4.3.

[16]Given their irrelevance with repect to the issues studied, physical assets are neglected $(K = 0)$.

be binding:[17]

$$E = L\rho \tag{7}$$

In a spirit similar to Caminal (2003) we introduce a fiscal effect of the CIT on the choice of a bank capital structure by assuming that the bank maximizes:

$$\max_{i_d, i_l, f, E} P - VE$$

$$\text{subject to (1)-(7)} \tag{8}$$

The maximand is a reduced form representation of the objective function of a bank licence holder who maximizes profits by setting prices taking into account the gross returns that the bank has to grant to outside equity holders (VE).[18] What is important to point out is that, since outside investors cares about net returns, V is an increasing function of the CIT τ; for simplicity we assume that $V = \phi\tau$ where $\phi \geq 0$ is a direct function of the percentage of E that is in the hand of outside investors.

To understand how this term influences the behavior of the management of the bank (licence holder) consider, for example, a reduction of the CIT rate. The bank, who is facing an expansion of the demand of loans, has to decide by how much to increase deposits and equity (capital requirements are binding). Raising more deposits requires paying a higher i_d. Raising more equity requires paying V, which because of the reduction of τ, is now lower.

This objective function provides, therefore, a concise way to introduce in the model these considerations by requiring the bank's managers to maximizes profits while taking into account the fiscal wedge imposed by the CIT between the two sources of funds: deposits and equity.

From the set of constraints and the first order conditions of the maximization problem 8, we get:[19]

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[17]Banks often hold excess capital in order to manage marginal and unpredictable fluctuations of the requirements which would take their capital below the threshold. However, in a deterministic world like this one, there would be no reason to hold excess capital (Bolton and Freixas, 2001).

[18]Note that if we assumed that the bank simply maximizes net profits we would not obtain any possible shifting of the bank's CIT burden. In the expression for net profits $P(1-\tau)$, the CIT enters as a multiplicative factor which leaves first order conditions unaltered. In that case, the unique effects exerted by τ would be those through L and S.

[19]Second order conditions are also satisifed. With no effect on the main findings we introduced the following restrictions on the intercepts: $a = d = 0$.

$$
i_d = (1-\rho)\frac{l - a_l l_i - \tau\left(l_\tau + l_i \phi\rho\right)}{2\left[d_i + l_i\left(1-\rho\right)^2\right]}
$$

$$
i_l = \frac{\left(1-\rho\right)^2 2l_i\left(l - l_\tau\tau\right) + d_i\left(l + a_l l_i - l_\tau\tau + \phi\rho l_i\tau\right)}{2l_i\left[d_i + l_i\left(1-\rho\right)^2\right]}
$$

$$
f = \frac{s - s_\tau\tau + c s_f}{2 s_f} \tag{9}
$$

It is interesting to see how the optimal level of i_d, i_l, and f depend on the different parameters. For example, the optimal i_d is positively affected by l: a higher demand of loans (reflecting, for example, an increase in expected profitability) allows the bank to charge higher interest rates on loans but also it requires it to hold more deposits by increasing their remuneration. For a symmetric reason, i_d is negatively affected by τ.

The effect of a higher τ on i_l is less straightforward since by increasing the CIT rate, the demand of loans shifts downward (which makes the bank choose a lower i_l in order to partially compensate such downward shift); at the same time, the bank obtains a higher marginal benefit from diminishing loans and therefore equity (and it does so by increasing i_l). The sign of the net effect on the interest rate on loans (i_l) is ambiguous.

For a large a_l, which represent a situation in which banks have very risky portfolios, the bank finds convenient to increase the optimal interest rate on loans i_l. On the other hand, a high i_l also means lower volumes of loans which in turn requires less D and a lower i_d. Accordingly, i_l and i_d are positively and negatively influenced by a_l, respectively.

The optimal f increases with c and decreases with s_f as intuition would suggest. It also decreases with τ since a change of the CIT rate also determines a shift in the demand for financial services.

It is interesting to point out the main differences with respect to Caminal (2003) who find that the CIT on banks is equivalent to a tax on loans which leaves unaffected the interest rate on deposits. First, Caminal (2003) does not consider that τ also has an impact on loan and other bank services demand. Second, Caminal considers perfect competition while here we coonsider a model of monopolistic competition. If we assume perfect competition (i.e. if we suppose $l_i = d_i = s_f \to \infty$) the derivative of i_d with respect to τ tends to zero, while the derivative od i_l does not, obtaining results which are coherent with those of Caminal (2003).

Using these expressions we obtain:

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$$NII = \frac{d_i}{4l_i} \frac{(l - l_\tau \tau)^2 - (a_l l_i - \phi \rho l_i \tau)^2}{\left[d_i + l_i (1 - \rho)^2\right]}$$

$$OI = \frac{(s - s_t \tau)^2 - (cs_f)^2}{4s_f}$$

$$C = \frac{c}{2} (s - s_\tau \tau - cs_f)$$

$$A = \frac{a_l d_i \left[l - a_l l_i - (l_\tau + l_i \phi \rho) \tau\right]}{2[d_i + l_i (1 - \rho)^2]} \tag{10}$$

where $NII = Li_l - Di_d$ is the net interest income and $OI = Sf$ is other income. A first result is that NII is positively influenced by l, the parameter reflecting the level of the general economic conditions. This is in line with the fact that better economic conditions increase the number of projects becoming profitable and hence increase the demand for credit (Kashyap, Stein and Wilcox, 1993). Similarly, we obtain that OI is positively affected by s that represents all exogenous factors influencing the demand for financial services (i.e. stock market capitalization and volatility). On the other hand, OI is negatively affected by s_f, the coefficient of elasticity of the demand of services S, which also is an inverse measure of the bank's market power in such segment. Similarly, NII is positively affected by d_i which is a direct measure of bank's market power enjoyed in the market for deposits.[20]

The model's interesting predictions concern the effect of τ. By taking the derivative with respect to τ we obtain:

$$\frac{d}{d\tau} NII = \frac{d_i \left[(a_l \phi \rho l_i^2 - l_\tau l) - \left(\phi^2 \rho^2 l_i^2 - l_\tau^2\right) \tau\right]}{2l_i \left[d_i + l_i (1 - \rho)^2\right]}$$

$$\frac{d}{d\tau} OI = -\frac{(s - s_\tau \tau) s_\tau}{2s_f}$$

$$\frac{d}{d\tau} C = -\frac{cs_\tau}{2}$$

$$\frac{d}{d\tau} A = -\frac{a_L d_i (l_\tau + l_i \phi \rho)}{2[d_i + l_i (1 - \rho)^2]} \tag{11}$$

The main result to be emphasized is that the effect of a change in τ on the net interest income can be of either sign. In the case of a cost of

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[20]Because of the combined effect of the CIT and of the capital requirements the sign effect of an increase of l_i on NII is ambiguous. However, it can be seen that for $\tau \phi \rho$ not too large, such derivative is always negative, as one would expect.

equity due to capital regulation sufficiently high ($\phi\rho > \max[\frac{l_t}{l_i}, \frac{l_\tau l}{a_l l_i^2}]$) the derivative $\frac{d}{d\tau}NII$ tends to be negative (positive) for high (low) values of the CIT rate. The intuition of this result can be easily understood noting that τ influences the banks income statement in two ways. First, because of the capital requirements, an increase in the CIT rate is equivalent to an increase of the marginal cost of providing loans which always brings to a drop in their quantity and a rise in their price (this effect is amplified if the cost of equity due to regulation ($\phi\rho$) or the elasticity of loan demand (l_i) are large). Second, given $l_\tau > 0$, an increase in τ determines a downward shift of the demand of loans which determines a (further) reduction in the quantity of loan in equilibrium but also a (compensating) reduction in lending rates. When the total impact on the price is positive (the cost effect on the price dominates the demand shift one), we obtain two contrasting forces on the net interest income: the amount of loans shrinks while their interest rate increases. What is important to point out is that the price (positive) effect dominates the quantity (negative) one only for small values of the CIT rate. In other words, a small τ implies a low overall impact of the cost of equity due to regulation and is compatibile with a large amount of loans in equilibrium: in this case an increase in the lending rate has a large impact on NII.

The mechanism is different for non interest income since bank services are not subject to capital requirements. In this case an increase of the CIT rate determines an immediate reduction of demand for bank services S and this has a negative effect on $OI = Sf$. Equation (9) shows that the bank reacts lowering fees f in order to counterbalance the demand shift; nevertheless the overall amount of fee-profits Sf at the optimum is reduced. Therefore in our simple model the sign of the derivative $\frac{d}{d\tau}OI$ is always negative. However, since $\frac{d^2}{d\tau^2}OI = \frac{s_\tau^2}{2s_f} > 0$, the impact of a marginal increase in τ on OI decreases as τ gets large.

Finally, both $\frac{d}{d\tau}A$ and $\frac{d}{d\tau}C$ do not depend on τ. Both derivaties are negative meaning that an increase in taxation reduce, other things being equal, the overall amount of provisions and operating expenses.

4   The empirical evidence

4.1   The econometric model

Following Albertazzi and Gambacorta (2005) we base the econometric analysis on this model:

$$Y_{i,t} = \sum_{k=1}^{2} \alpha_k Y_{j,t-k} + \sum_{k=0}^{2} \beta'_k X_{j,t-k} + \left(\gamma_1 \tau_{j,t} + \gamma_2 \tau_{j,t}^2\right) + \theta_t T_t + \eta_j + \varepsilon_{j,t} \quad (12)$$

Index j denotes the countries in the panel, 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 $GDP_{j,t}$ stands for the real GDP 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 loans divided by GDP, $SMV_{j,t}$ is the stock market volatility, $TA_{j,t}$ is total asset of the entire banking sector. All variables are taken in logs except interest rates and ratios. See the Appendix for other details on the dataset.

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 $(\tau_{j,t})$.[21] Such component includes a quadratic term in order to capture non linear effects postulated by the theoretical model in Section 3. For some of the other regressors $(GDP_{j,t}, SMC_{j,t}, VSM_{j,t})$ the theoretical model is able to produce some prediction which may be tested; the remaining regressors are used as control variables, coherently with previous studies which analyze the link between bank profitability and the business cycle.[22]

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 for with the Sargan test). Table 3 shows the results for: net interest income, other income, operating costs, provisions, and profit before tax. While lagged values of the dependent variable are significant, those of the regressors turned out to be almost always not significant and were not reported in the table (if not stated differently).

4.2 Net interest income

The first column of Table 4 reports the results for the net interest income. As already pointed out in the literature, profits obtained by banks in their tra-

[21]The data used are statutory tax rates which include both the national corporate income tax and (an average of) the local ones.

[22]See Albertazzi and Gambacorta (2005) for details and references.

ditional 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 market 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 4, we use the coefficients of Table 3 to plot the estimated marginal effect of τ on net interest income $(\hat{\gamma}_1 + 2\hat{\gamma}_2\tau)$. Such expression is decreasing, significantly greater than zero for small levels of τ and significantly less than zero for large levels of τ.

Expressions (11) reveals that a necessary condition for this pattern is that $\rho\phi l_i$ be sufficiently large. In other words, the effects of the capital requirements should be sufficiently strong.

What is interesting to point out is that these results confirm the idea that, when analyzing the effects of taxation on banks, it is important to adopt a general equilibrium approach: τ influences both banks' marginal cost, bacause of the capital requirements, and the intercept of the demand of loans.

4.3   Non-interest income

The second column of Table 4 shows the results for the non-interest income. The diagnostic tests are well behaved; one lag only of the dependent variable is significant.

Non interest income is not significantly influenced by real GDP fluctuations, coherently with the idea suggested in the literature that these services constitute an effective tool to stabilize banks profits. Non-interest income shows a strong 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 different types of banking services included is higher when local financial markets are more developed. The effect of volatility is likely to be connected with the fact that these services are more needed when uncertainty is higher (portfolio are more often readjusted and firms buy more derivatives for hedging purposes).

With regard to the effect of the CIT, it can be seen that both the coefficients associated with τ and its square are significant. The marginal effect of τ may be either negative or positive (for small and large levels of τ, respectively; see figure 4b). Coherently with the theoretical model, and contrary to what happens with the net interest income, these coefficients imply an increasing marginal impact of τ on non-interest income. Moreover, as shown

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in Figure 4, the marginal effect of τ on non-interest income is significantly different from zero only for small values of τ where it is negative, exactly as implied by the model. The interpretation is the following: given that capital requirements do not involve fee-generating activities, the unique way in which the CIT has an impact on non-interest income is through a shift of the demand of such services which always brings to a reduction of revenues (if the demand shifts downward, both the quantity and the price decrease).

4.4 Operating costs

The third column of Table 4 reports the results for the operating costs. The tests performed do not detect specification problems. Two lags of the dependent variable are included.

As intuition would suggest, operating expenses show a scarce correlation with the business cycle. They are instead influenced by inflation (probably in connection with some level of wage indexation, at least in the first part of the sample) and by the level of development of local financial markets (in coherence with the idea that the more sophisticated the services to be provided, the higher the personnel costs).

As suggested by the theoretical model, only the linear term turns out to be statistically significant and with a negative coefficient. When τ goes up, the demand for services decreases and the lower fees charged by the banking sector only partially compensate such shift and operating costs, which are proportional to S, diminish.

As suggested by alternative model specification and coherently with the theoretical model, the marginal impact of τ on C does not change significantly with the level of real economic activity.

4.5 Provisions

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

The negative sign for GDP is in line with Salas and Saurina (2002), Arpe et al. (2001), and Laeven and Mainoni (2003): when real economic conditions improve, banks expect lower future credit losses and diminish provisions accordingly. The negative impact of long-term interest rate is related to the fact that such variable (as GDP) 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

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the "financial stability hypothesis" (Fisher, 1933; Minsky, 1975 and 1982; Kindleberger 1978): high interest rates increase the burden for borrowers and their default probability.

With regard to taxation, the results show that γ_1 is negative, as expected from equation (10), but not significant.[23]

4.6 Profit before taxes

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

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

The tests performed are again well behaved. Two lags of the dependent variable turns out to be significant.

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, wash 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). As we emphasized above, for high level of τ banks tend to shift toward buyers of fee-generating services. On the contrary, for low level of τ banks tend to shift more toward borrowers and lenders. In the latter case, it becomes interesting to analyze if depositors or borrowers are bearing the cost of such tax shifting. This is what next paragraph is about.

4.7 Borrowers or depositors?

As we pointed out in section 4.2, the coefficients γ_1 and γ_2 in the regression for net interest income are both significant. From Figure 4, it emerges that for low levels of the CIT rate, a marginal increase in taxation has a positive effect on the net interest income, which signals tax shifting from bank towards borrowers and depositors. On the contrary for high levels of the CIT the bank suffers a reduction of the overall amount of profits in the "traditional" intermediation activity: the negative effect produced directly by the CIT

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[23]The uncertainty on the sign of the derivative $\frac{dA}{dt}$ is consistent with a more general formulation of the equation for provisions such that, for given L, A can be also considered a direct function of the interest rate paid on loans: $A = a + a_L L + a_i i_l$. The motivation for this exressions, which would have left unaltered all the main conclusions of the model, is that i_l represents a proxy for the risk faced by the bank in the lending relationship.

on loan demand and the higher costs of capital requirements more than compensate a possibile increase of the spread. In other words, for high level of the CIT rate the price effect is more than compensated by the quantity effect.

This aim of this section is to shed some light on the price effect. In our model tax shifting may occurr in two ways: through an increase of the interest rate on lending (i_l) or through a decrease in the interests rate on deposits (i_d); it is therefore interesting to disentangle the effects on the spread $(i_l - i_d)$ via the mark-up $(i_l - i_m)$ and via the mark-down $(i_m - i_d)$.

We have therefore estimated the following model:

$$(i_k - i_m)_{i,t} = \sum_{k=1}^{2} (i_k - i_m)_{j,t-k} + \sum_{k=0}^{2} \beta'_k Y_{j,t-k} + \gamma_1 \tau_{j,t} + \theta_t T_t + \eta_j + \varepsilon_{j,t} \quad (13)$$

where the subscript $k = (l, d)$ while i_m represents the money market interest rate. In dealing with a spread variable, we used as control regressors $Y_{j,t} = [\Delta GDP_{j,t}, (TA/GDP)_{j,t}, MMV_{j,t}]$, where $MMV_{j,t}$ stands for the money market volatility. Following equations (9) only the CIT rate in linear term has been considered (γ_2 is never significant).

Table 4 shows the results of this exercise. Consistently with the prediction 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 degree of financial deepness of the banking sector, measured by the ratio between total banking assets and GDP, that tends to reduce mostly the mark-up. Real GDP growth determines an increase of deposit demand and therefore, other things being equal, a positive effect on the mark-down. On the contrary the effect of an increase in real GDP on the lending interest rate, even if positive, is statistically not significant. As stressed by Melitz and Pardue (1973) this could be associated with an increase in self-financing that tends to reduce the proportion of bank debt and may counterbalance the positive effect exerted on lending demand by higher economic activity (Friedman and Kuttner, 1993).

A one per cent increase in the CIT rate increases the spread by 7 basis points. The effects is more pronounced for borrowers (6 basis points) than for depositors (1 basis point). This result is coherent with Caminal (2003) according to which competition and the presence of binding capital requirements makes the corporate income tax (essentially a tax on equity) work as a tax on loans, leaving therefore depositors unaffected. As discussed in Section

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3 these findings calls for a situation of perfect competition. In this case even in our model the derivative of i_d with respect to τ tends to zero, while the derivative od i_l does not, obtaining results which are coherent with those of Caminal (2003).

Results on the mark-up and the mark-down mirror the findings for net interest income (see figure 4a): since the effect on the spread is independent of the level of τ,only for high values of the CIT rate the negative effect on the volume of intermediated funds tend to dominate the positive price effect.[24]

4.8   Extensions and robustness checks

In order to better understand and to corroborate the results reported above, we carried out some more specific investigations and some robustness checks.

4.8.1   Analysis of the tax burden

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

However, the specification adopted does not allow to get a quantitive appraisal of the extent to which banks are actually able to operate such tax shifting. A first try consists in estimating a regression like equation (12) for the profit after taxes. The results of this exercise reveal that the CIT rate $\tau_{i,t}$ has a negative but non significant coefficient (-0.312 with a standard error of 1.158)[25]. 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 large part of their tax burden.

An interesting check which can be made at this regard is to see if this result is influenced by the market power held by banks which, in the present dataset, may be (roughly) measured by the interest rate spread. We rerun the model specification (12) for the profit after taxes adding an additional regressor given by $\tau_{i,t}(i_l - i_d)_{i,t}$. While the coefficient for $\tau_{i,t}$ remains not significant (-0.270 with a standard error of 1.170), the one for the interaction

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[24]In order to corroborate results for the mark-up and the mark-down we have reestimated the benchmark model (1) for both the interest received on loans ($i_l L$) and those paid on deposits ($i_d D$). Also in this case the effect of the CIT rate on NII comes via the interest rate on loans, leaving all the other results unchanged.

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

term turns out to be significant and of the predicted positive sign (0.139 with a standard error of 0.068).

A better 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 allows to derive these quantities from the estimated coefficients of equation (12) for profit before taxes and profit after taxes.[26] Figure 5 plots the result of this exercise and shows that if taxes are raised by one euro, the reduction in banks profit after taxes is a slightly decreasing function of the CIT rate, which is never significantly different from zero and with an average close to 3 cents.

Given that the above calculations are based on an approximation,[27] as a robustness check we tried to corroborate the results by running a regression for banks profits similar to equation (12) but in which the tax rate has been substituted by the amount of taxes actually paid.[28] It turned out that while in the regression for the profit after taxes the amount of taxes is not significant (-0.108 with a standard error of 0.137), in the one for profit before taxes the coefficient is almost equal to one and highly significant (0.945 with a standard error of 0.149).[29]

To sum up, banks display the ability to shift at least 90 per cent of their corporate income tax burden, depending also on the competitive pressure they face. This happens mainly through a reduction in operating costs and provisions and, though not for very high levels of the CIT rate, an increase of the net interest income. It is interesting to note that, such tax shifting occurs even if, at least for low levels of taxations, non-interest income decreases (the only effect that the CIT rate exerts on this income component is through a shift of the demand for fee-generating services which always implies a loss of revenues). Finally, coherently with the predictions of the theoretical model

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[26]Denoting T the amount of tax paid by the bank, 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 $\beta_{PBT} = \partial \ln (PBT)/\partial \tau$.

[27]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.

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

[29]This test is also useful in order to corroborate the findings with respect to another issue emphasized in the litearture. In fact, Huizinga and Laeven (2005) shows 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 beared by banks (a criticism which does not apply to the amount of taxes actually paid).

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(for sufficiently competitive banking sectors), tax shifting on net interest income takes place mainly through a rise in the interest rate on loans.

4.8.2 Differences across periods and groups of countries

In section 2 it has been argued 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 holds 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 (1) 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 euro area and Anglo-Saxon countries. In this case we have estimated the benchmark model for all income components by adding in equation (1) the following term $\left(\gamma_1^* \tau_{j,t} d_t^A + \gamma_2^* \tau_{j,t}^2 d_t^A\right)$ where d_t^A is a dummy that takes the value of 1 in the case of the US or the UK. Even in this case both coefficients γ_1^* and γ_2^* were never significant at conventional levels.

5 Conclusions

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

The theoretical model, though extremely simplified, has shed some light on the different channels through which the CIT operate and how they interact. A first "direct" effect is connected with the presence of capital requirements and with the fact that the CIT is a tax on equity: accordingly, the CIT influences banks' behavior by making lending more or less costly. A second "indirect" channel, not previously emphasized in the literature, is due to the fact the the CIT is not specific to the banking sector: accordingly, the CIT may indirectly influence banks by moving upward or downward the corporate demand of loans and of fee-generating services. In other words, the sign of tax shifting is uncertain a priori since the CIT affects banks and non financial corporations as well.

Both mechanisms determine the presence of non linear relationships which differ across the different components of the bank's profits. In particular,

with regard to the net interest income, the indirect channel implies an increasing marginal effect while the direct effect implies a descreasing marginal effect which may more than compensate the former. With regard to non interest income, only the indirect effect is relevant (capital requirements do not involve fee-generating services) so that an increasing marginal effect is expected. Moreover, the model suggests that the sign of the marginal impact depends on the level of the CIT rate but also on a set of parameters like the elasticity of the demand of loans and of other banking services. All these predictions find support in the evidence produced in the empirical section.

A further examination consisted in checking whether the effect on net interest income derives from the interests paid to depositors or from those received from borrowers. Confirming the theoretical conjectures put forward in the literature, at least for sufficiently competitive banking industries, it turns out that all the effect is through the interests received from borrowers.

Finally, banks display the ability to shift at least 90 per cent of their corporate income tax burden, depending also on the competitive pressure they face. This happens mainly through a reduction in operating costs and provisions while tax shift on net interest income is more likely to occur for low level of the CIT rate when the cost of equity due to regulation is low. No significant differences on the link between bank profitability and taxation emerges 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 for the period 1981-2001are taken from OCSE Bank Profitability. For the period 2002-2003 data have been reconstructed using data from Deutsche Bundesbank for Germany, Banco de Espana for Spain, Banca d'Italia for Italy, Dutch National Bank for the Netherlands, Banco de Portugal for Portugal, FDIC for the US and the BankScope database (Fitch-Ibca) for the remaining countries.

Total lending has 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 on the entire time period. For those years we have reconstructed them backwards using the growth rates of IMF statistics figures.

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 Institute for Fiscal Studies we obtained information on statutory tax rates which include both the national corporate income tax and the local taxes (their average across regions), where they exist. In the case of Netherlands, where the corporate income tax is progressive, we used the maximum marginal rate.

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Tables and figures

Table 1

Main economic indicators
(percentage values)

Countries	GDP per capita (1)	Corporate income tax	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 Sterling Pounds). - (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) Taxation	(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	13.54
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*	*8.75*
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	9.26
				(1993-2003)							
Austria	1.54	1.15	0.43	2.69	1.81	0.37	0.51	0.07	0.44	0.14	8.07
Belgium	1.17	0.68	0.37	1.85	1.17	0.19	0.49	0.12	0.37	0.24	10.90
France	1.04	1.18	0.53	2.22	1.45	0.39	0.38	0.11	0.28	0.28	5.79
Germany	1.66	0.64	0.28	2.29	1.47	0.41	0.41	0.20	0.21	0.50	4.67
Italy	2.56	1.03	0.29	3.59	2.24	0.60	0.75	0.36	0.39	0.48	5.20
Netherlands	1.70	1.07	0.39	2.77	1.90	0.20	0.68	0.19	0.49	0.28	11.52
Portugal	2.17	0.91	0.29	3.08	1.83	0.46	0.79	0.14	0.65	0.17	7.88
Spain	2.53	0.99	0.28	3.52	2.11	0.57	0.84	0.17	0.67	0.20	8.20
Euro area	*1.80*	*0.96*	*0.35*	*2.75*	*1.75*	*0.40*	*0.61*	*0.17*	*0.44*	*0.28*	*7.78*
United Kingdom	2.06	1.48	0.42	3.53	2.11	0.31	1.11	0.36	0.76	0.32	16.16
United States	3.59	2.39	0.40	5.97	3.66	0.45	1.87	0.60	1.26	0.32	13.88

Note: (1) Profit after tax as a percentage of capital and reserves. - (2) 1982-1992. - (3) 1984-1992.

Source: Authors' calculations based on data from OCSE, Bank Profitability. Data for the period 2002-2003 have been reconstructed using data from Deutsche Bundesbank for Germany, Banco de Espana for Spain, Banca d'Italia for Italy, Dutch National Bank for the Netherlands, Banco de Portugal for Portugal, FDIC for the US and the BankScope database (Fitch-Ibca) for the remaining countries.

Table 3

Regressions Results (1)

	(i) Net interest income			(ii) Other income (2)			(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. $_{jt-1}$	0,966	***	0,075	0,501	***	0,061	0,782	***	0,090	0,365	***	0,080	0,282	***	0,085
Endogenous var. $_{jt-2}$	-0,187	**	0,074				-0,206	***	0,068	0,119	*	0,076	0,266	***	0,083
log of real GDP $_{jt}$	0,436	**	0,184	0,064		0,432	0,131		0,184	-1,999	*	1,091	2,897	**	1,391
Inflation rate$_{jt}$	-0,003		0,005	0,009		0,010	0,005	*	0,003	0,041		0,028	0,006		0,035
Money market rate $_{jt}$	-0,002		0,004	0,010		0,010	-0,001		0,003	0,044	*	0,025	-0,089	***	0,031
Long term rate $_{jt}$	0,013	**	0,005	-0,019	*	0,012	0,003		0,004	-0,066	**	0,032	0,082	**	0,040
Log of total assets $_{jt}$	0,038		0,044	-0,111		0,102	0,135	***	0,049	0,397	*	0,229	-0,285		0,281
Lending /GDP $_{jt}$	0,114	**	0,058	0,086		0,133	0,130	***	0,044	-0,063		0,337	-0,075		0,417
Stock Mark. Cap. /GDP $_{jt}$	0,095	***	0,030	0,078		0,076	0,137	**	0,029	0,010		0,171	0,355		0,221
Stock Mark. Volatility $_{jt}$	-0,001		0,001	0,005	*	0,003	0,000		0,001	0,036	***	0,008	-0,033	***	0,010
Corporate Income Tax Rate$_{jt}$	1,967	**	0,802	-4,656	**	2,038	-0,162	*	0,091	-0,533		0,739	2,501	***	0,928
(Corporate Income Tax Rate$_{jt}$)^2	-2,058	**	0,838	4,344	**	2,140									
Sargan test (2nd step; p-value)			0,15			0,16			0,16			0,54			0,38
MA(1), MA(2) (p-value)	0,00		0,41	0,00		0,82	0,00		0,63	0,00		0,15	0,00		0,53
No of countries, no of observations	10		184	10		192	10		184	10		176	10		176

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, except where indicated. - (2) Inflation rate is one period lagged.

Table 4

**Regressions results for the spread (1)**

	(i) Mark-up= short term interests 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

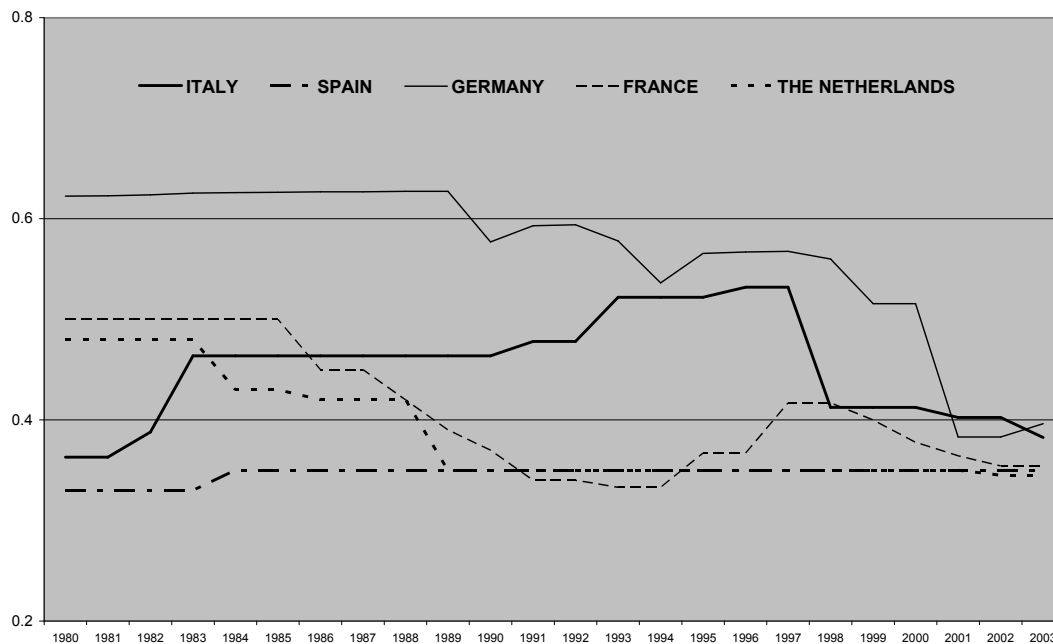**Cross-sectional dispersion of bank profitability**

(a) Euro area
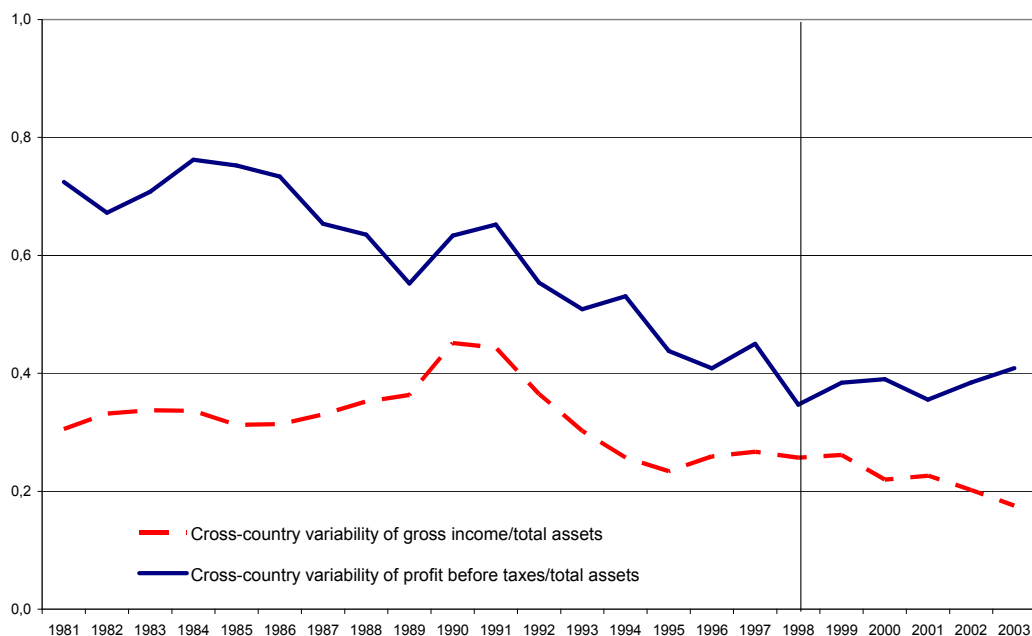
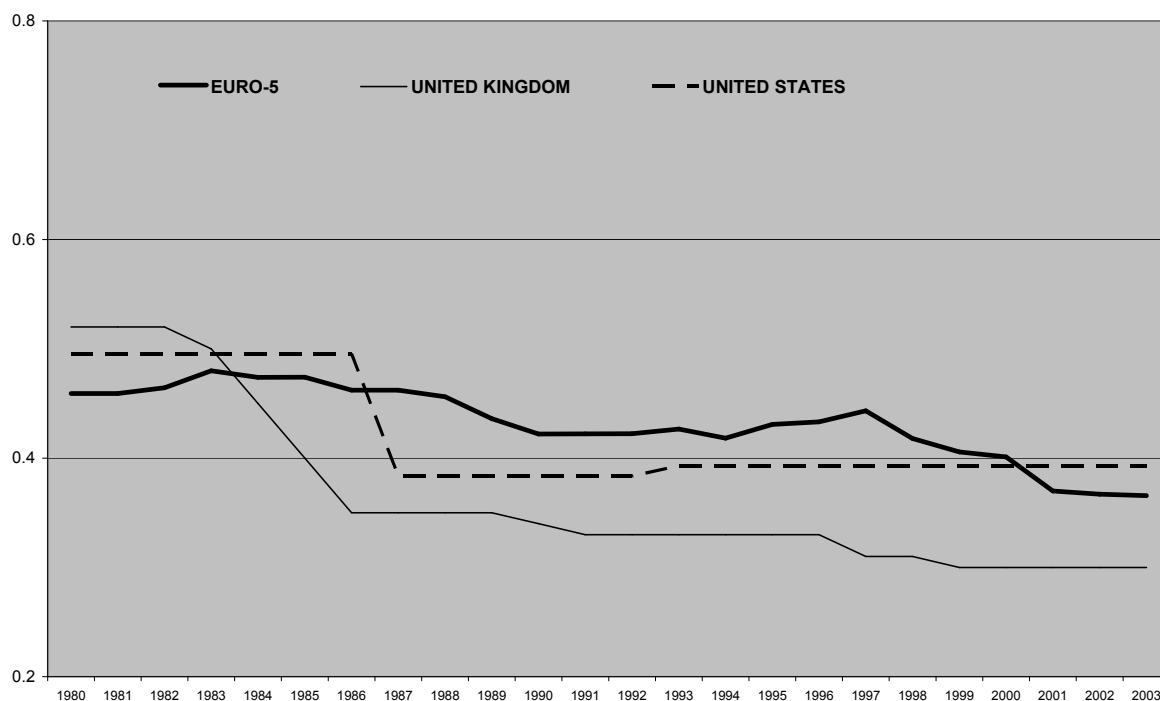
(b) Euro area, UK and US
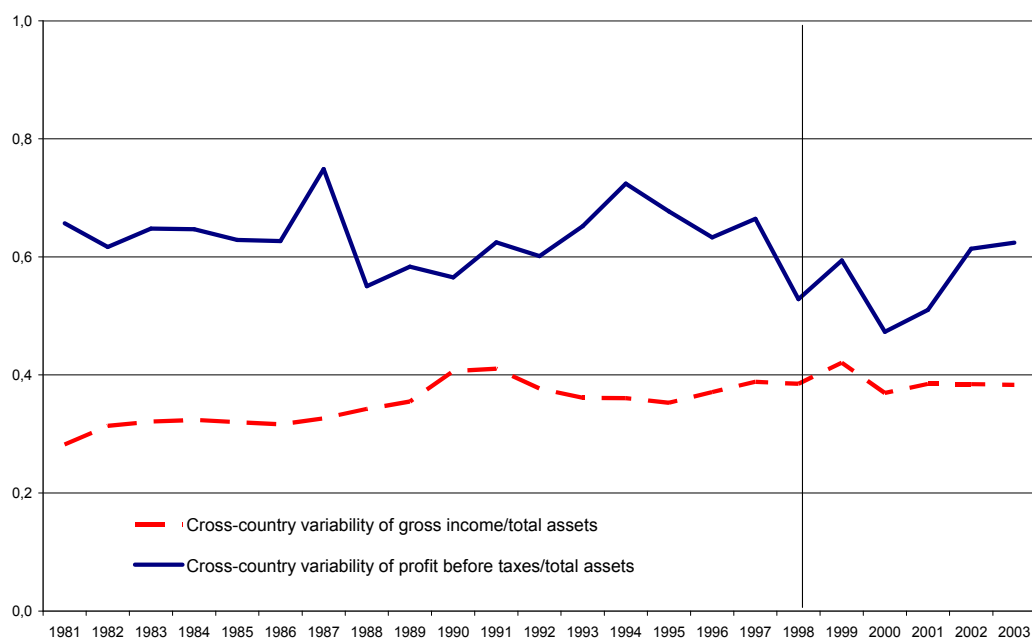
Source: Coefficients of variation (ratio of cross-country standard deviation to simple mean). Authors' calculations based on data from OCSE, Bank Profitability. Data for the period 2002-2003 have been reconstructed using data from Deutsche Bundesbank for Germany, Banco de Espana for Spain, Banca d'Italia for Italy, Dutch National Bank for the Netherlands, Banco de Portugal for Portugal, FDIC for the US and the BankScope database (Fitch-Ibca) for the remaining countries.

Figure 2

Cross-sectional dispersion of corporate income tax rates
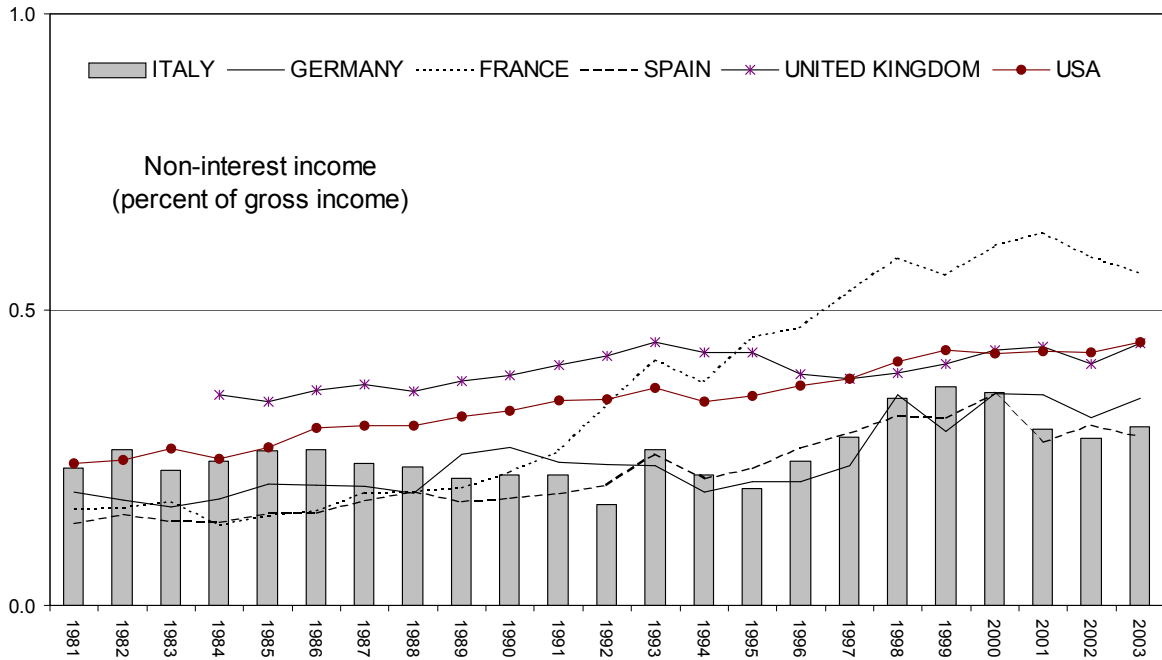
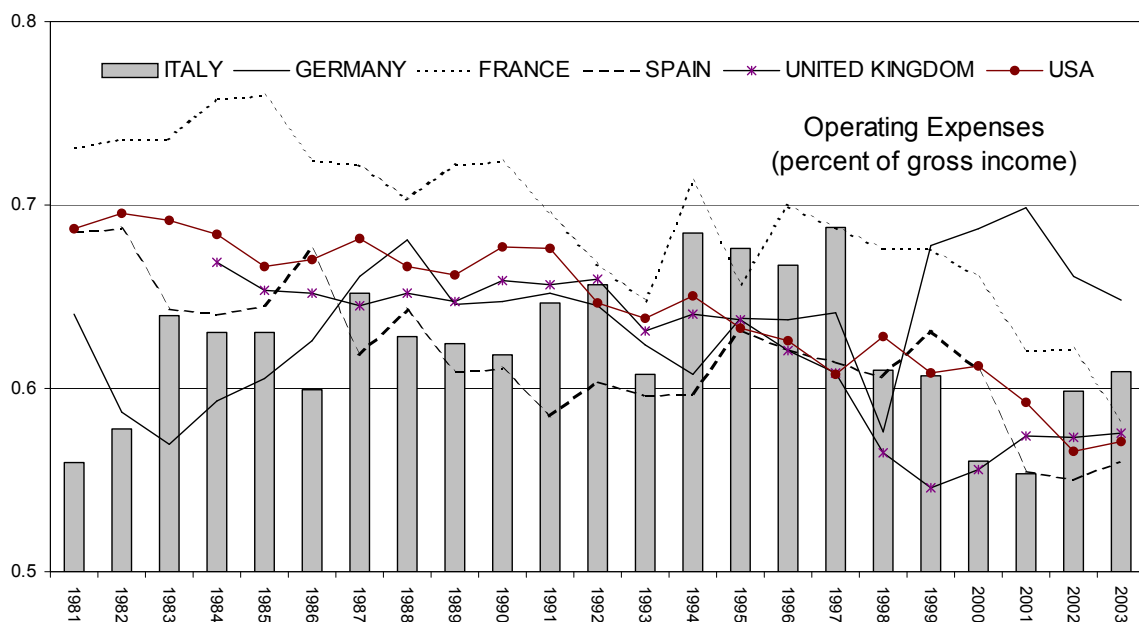**(a) Main euro area countries**

(b) Euro area, UK and US

Source: Coefficients of variation (ratio of cross-country standard deviation to simple mean).

Figure 3

(a) Revenue diversification

Non-interest income
(percent of gross income)

Legend: ITALY, GERMANY, FRANCE, SPAIN, UNITED KINGDOM, USA

(b) Cost-to-income ratio

Operating Expenses
(percent of gross income)

Legend: ITALY, GERMANY, FRANCE, SPAIN, UNITED KINGDOM, USA

Source: Authors' calculations based on data from OECD, Bank Profitability. Data for the period 2002-2003 have been reconstructed using data from Deutsche Bundesbank for Germany, Banco de Espana for Spain, Banca d'Italia for Italy, FDIC for the US and the BankScope database (Fitch-Ibca) for France and the UK.
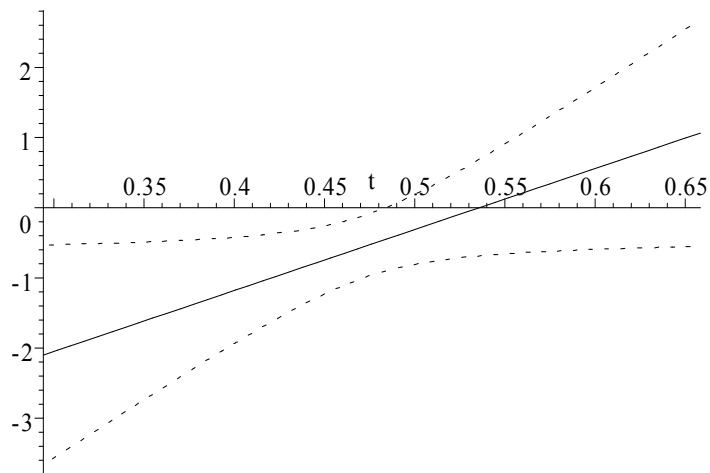
Figure 4

Marginal effect of the statutory tax rate (1)
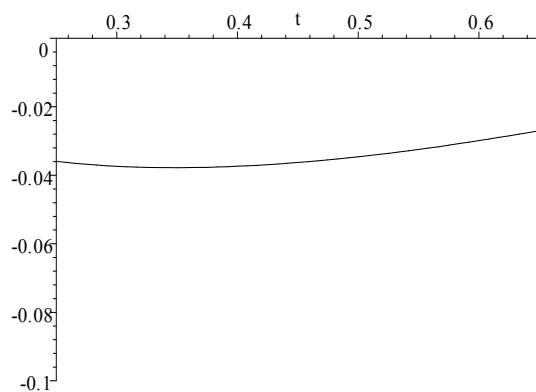
Net Interest Income
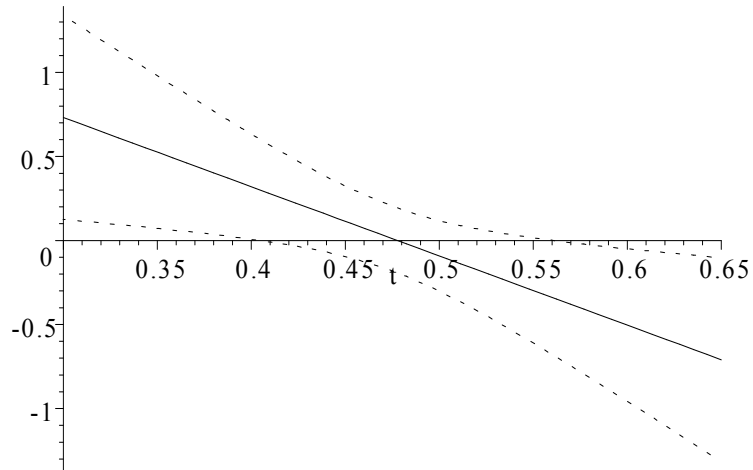
Non Interest Income

(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. The interval of τ chosen is the one included between the minimum and the maximum level of corporate income tax observed in the sample, which are respectively 30 and 63 per cent. Dotted lines denote confidence bands at 95 per cent level of significance.

Figure 5

Impact of an additional unit of currency of taxes on profits after tax (1)

(1) The interval of τ chosen is the one included between the minimum and the maximum level of corporate income tax observed in the sample, which are respectively 30 and 63 per cent.