BANK OF FINLAND DISCUSSION PAPERS

12 • 2002

Leena Mörttinen
Research Department
17.6.2002

Banking sector output and labour productivity in six European countries

Suomen Pankin keskustelualoitteita
Finlands Banks diskussionsunderlag

Suomen Pankki
Bank of Finland
P.O.Box 160
FIN-00101 HELSINKI
Finland
☎ + 358 9 1831

http://www.bof.fi

BANK OF FINLAND
DISCUSSION PAPERS

12 • 2002

Leena Mörttinen
Research Department
17.6.2002

Banking sector output and labour productivity in six European countries

Suomen Pankin keskustelualoitteita
Finlands Banks diskussionsunderlag

http://www.bof.fi

ISBN 951-686-785-5
ISSN 0785-3572
(print)

ISBN 951-686-786-3
ISSN 1456-6184
(online)

Suomen Pankin monistuskeskus
Helsinki 2002

Banking sector output and labour productivity in six European countries

Bank of Finland Discussion Papers 12/2002

Leena Mörttinen
Research Department

Abstract

This paper contributes to the discussion on the measurement of banking sector output. It is also a prelude to discussion on possible causes of productivity change in banking. We demonstrate how the banking sector's service production can be measured using aggregate financial statement and payment transactions data. We compute banking sector labour productivity Tornqvist indices for six countries (Finland, Sweden, United Kingdom, Germany, France and Italy) over a period varying from 11 to 20 years. According to the results, Finnish banking sector productivity has improved via a substantial reduction size of labour force, whereas output growth has been rather modest. Although in most of the other countries the restructuring process has been less intense, most of the sectors studied have improved in terms of overall output and labour productivity, especially since the mid-1990s.

Key words: banks, service production, productivity

JEL classification numbers: D24, G21

Pankkisektorin palvelutuotanto ja työn tuottavuus kuudessa Euroopan maassa

Suomen Pankin keskustelualoitteita 12/2002

Leena Mörttinen
Tutkimusosasto

Tiivistelmä

Pankkien palvelutuotannon mittaamista pidetään yleisesti varsin hankalana tehtävänä. Tässä selvityksessä osoitetaan, kuinka pankkisektorille voidaan laskea erilaisia tuottavuuslukuja yksinkertaisen laskentakehikon avulla. Samalla tutkimus pohjustaa keskustelua syistä, joiden vuoksi pankkipalvelujen tuotanto on muuttunut. Pankkisektorin tarjoamat palvelut jaotellaan työssä kolmeen pääluokkaan: maksupalvelut, rahoituksenvälityspalvelut ja muut palvelut. Näiden avulla lasketaan kokonaistuotantoindeksit kuuden eurooppalaisen maan (Suomi, Ruotsi, Iso-Britannia, Saksa, Ranska ja Italia) pankkisektoreille 11–20 vuoden aikana. Tulosten mukaan suomalaisen pankkisektorin kriisiä seurannut kapasiteetin supistaminen on parantanut sektorin tuottavuutta merkittävästi. Sen sijaan itse palvelujen kokonaistuotanto on kasvanut 1980-luvun lopun tilanteesta vain hieman. Vaikka useimmissa muissa maissa rakennemuutos on ollut vähemmän raju, suurin osa tarkastelluista sektoreista on pystynyt kasvattamaan kokonaistuotantoa ja kohottamaan työvoiman tuottavuutta erityisesti 90-luvun puolivälin jälkeen.

Asiasanat: pankit, palvelujen tuotanto, tuottavuus

JEL-luokittelu: D24, G21

Contents

1 Introduction

Banking is in turmoil. The fast information and communication technology advances together with rapid deregulation and market integration has forced banks to rethink their role in the economy. The fear of increased competition in the banking markets due to lowering of barriers to entry has caused already visible changes in market structure and banking activities. Mergers cross-border, cross-sector, and between competitors together with fast adoption of new technology has been the answer of many banks to the shaking foundation.

Many Nordic banks have reorganised after severe banking crisis in the beginning of the 90s. They have been active both in cross-border mergers and adoption of new technology. In the past few years Finnish banks have been particularly profitable. Their ROE has exceeded 15% (it exceeded 20% in 1998 and 2000) in four consecutive years. This is very good performance even if we control for the favourable economic environment.

How has the new technology changed the production of consumption smoothing, financing and payment services? If the increasingly competitive environment leads to diminishing importance of traditional banking services the natural response of banks is to change the scale and scope of their operations and dispose of the inefficiencies. Is the observed improvement in Finnish banks' profitability due to this development and does it eventually contribute to economic growth?

This paper aims at taking the first step on a road to answering these questions by looking at the changes in bank productivity over a period varying from 21 to 11 years in 6 EU countries: Finland, Sweden, Germany, United Kingdom, France and Italy. We compute the volume indices for three different classes of bank products, namely payment services, financial intermediation services and other services. From these indices we compute the labour productivity indices by combining the three output indices into Tornqvist overall output index and comparing this to the size of the labour force.

The method adopted proved to be quite straightforward, though we faced numerous problems when collecting and evaluating the quality of data for the chosen set of countries. It became quite clear that even though data reporting requirements have converged there still remains large differences between countries.

Output indices point to almost stagnant or modestly growing overall banking sector output in Finland during the past few years. This has been especially true in the financial intermediation business and other services. However, according to the computed productivity indices labour productivity has grown almost 4,8-fold and total factor productivity by 4,5-fold in Finnish banks from 1981 to the end of year 2000. Other countries have experienced less drastic improvements. This is

mainly due to relatively more modest restructuring of the sector. However, after mid-1990s the labour productivity in banking has improved at somewhat faster speed in all countries. This has been achieved by keeping the labour force steady or slowly decreasing and by increasing the overall output. It is possible that the increase in efficiency is a result of adoption of new technology. This hypothesis should be tested with proper econometric methods.

The paper is organised as follows. In section 2 we discuss the general problem of measuring the output of a financial firm and introduce previous literature. In section 3 we present the more conventional measures of bank efficiency used in the every day banking sector analysis, namely that of cost to income and real assets to employees ratios. These ratios are used as a starting point to the discussion on productivity and possible errors introduced when using these measures of efficiency. In section 4 the methods adopted in computing the bank output indices are discussed. Section 5 presents the output indices and section 6 the labour productivity indices. In the section 7 we present the total factor productivity measure for the Finnish banking sector. Section 8 concludes the paper. The data questions are discussed in the Appendices 1–3. The nominal value series of various services are presented in the Appendix 4. The indices used and computed in the paper can be found in the Appendix 5.

2 Banking sector output and productivity

If we believe the financial intermediation literature banks' task in the economy is to intermediate funds from agents with financial surplus (usually households) to agents with financial deficit (usually firms). The service offered to depositors is safety. To borrowers it is risk sharing and availability of funds.

According to this simplified view, deposits are inputs since they are used to make loans. However, this is not the whole truth. Deposits have a number of qualities appreciated by customers: in addition to being safe they are liquid and enable consumption smoothing. Liquidity varies depending on the terms of the deposit agreement. The most liquid funds are demand deposits, which are mainly held for transaction purposes. Irrespective of the degree of liquidity all deposits give access to other services, either explicitly or implicitly.[1] Hefty deposit account balance enhances customer's position in negotiations but it is not only the size of the balance that counts. Banks are eager to collect information. At the same time they want to lock-in the customer to hinder competition. They try to achieve all this by cross-subsidisation ie by building complicated multi-service contracts and

[1] Among other things, the are protected by deposit insurance, though this is not a value added service provided by banks.

offering some services free of charge. These include both deposit account related payment services, as well as other services.

Banks' physical service production is complicated enough business. However, banks' engagement with granting loans merits more attention. After all, this is a service for which compensation is paid in the future. To maximise the profits with minimum risk banks have to produce information ie screen and monitor their customers.[2] Due to this the number of physical services produced is inadequate measure of bank output since it does not accurately describe how efficiently banks have produced information. For large part, customers pay for information collected and analysed with loan risk premiums. Banks price loans and set charges on physical services to achieve long term strategic objectives in imperfect capital markets under imperfect competition.[3] This is why customers do not pay the marginal cost of services they use but some pay more and some pay less.

2.1 Previous literature

Much of the debate on financial service production is caused by the difficulty to measure prices and outputs. Many of the financial services are jointly produced. This is why prices are often signed to a bundle of services. The complicate multiproduct nature of banks has caused problems to researchers for many years. Many papers have tried to categorise measurement approaches adopted.[4] However, clear consensus has not yet emerged. In Suominen and Tarkka (1991) and Berger and Humphrey (1992) there are lengthy discussions about the problems involved in measuring the value of production and separating quantity and price from this information. We can roughly divide the various definitions into four categories: *production or value-added* approach (sometimes also called the activity approach), the *intermediation* approach, the *user-cost* approach and less discussed *transactions-cost approach*.[5] To give some idea of the complicated nature of the issue we will briefly list the varying methodologies adopted and discussed in the above mentioned and other papers.

The *production* or *value added* approach focuses on operating costs and ignores interest expenses.[6] This approach considers any activity that absorbs real resources to be bank output. According to this line of thinking output is

[2] Banks engage in information production at various points in time (cross sectional) and over time (information accumulated during a long-term customer relationship).

[3] Levitt (1993).

[4] See for example Berger and Humphrey (1992), Colwell and Davis (1992), Freixas and Rochet (1997).

[5] Wykoff's comment in Berger and Humphrey (1992).

[6] Benston (1965), Sherman and Gold (1985), Vassiloglou and Giolias (1990).

production of physical services to depositors and borrowers. It is measured in terms of what banks do that cause operating expenses to incur (opening new deposit accounts, transactions on these accounts, other fee income generating operations, operations on loan accounts etc.). This approach suits well studies on bank branch activities since local branches are "financially transparent". Often funds collected from depositors are transferred to main branch. In this case the only branch output are the services to depositors and borrowers and its only inputs are labour and physical capital.[7] Berger and Humphrey (1992) modify this definition by incorporating aspects of deposits as both outputs and inputs. The categories having substantial value added are employed as important outputs. Depending on their nature the other categories are treated as representing mainly unimportant outputs, intermediate products, or inputs.

The payment systems transaction data have generally been used in studies, which are said to represent production approach. There are benefits to measuring transactions instead of currency amounts. Transactions are a flow concept and their use removes the inflation bias. They can also, to a certain extent, take into account the free of charge or reduced fee services offered by a bank (eg payment services related to multi-dimensional long-term customer relationships).

However, production approach ignores many important aspects of banking activities. This is particularly problematic when the number of transaction can not capture the quality of these services. Bank that generates large transaction flows and makes large short term profits by granting loans to bad quality customers or to customers with questionable motives who are ready to pay high rate of interest is not as productive in the long term as a bank that makes less short term profits but more rigorously screens its customers. Adoption of information technologies is at the heart of this since new technology should benefit the bank by allowing it to process information on its customers more efficiently.

The *intermediation* or asset approach considers only bank assets to be outputs. Bank deposits are regarded as financial inputs. Asset approach implies that banks buy and sell funds ie act as intermediaries between liability holders and those who receive funds. It is equivalent to the services approach in the national accounts literature.[8]

User-cost approach defines financial product of a bank as output or input on the basis of its contribution to bank revenue. The operating costs are not explicitly considered. However, they are included implicitly. According to Berger and Humphrey (1992) an optimising bank earns (in financial revenue less operating costs) exactly its opportunity cost of funds at the margin on each asset and pays (in financial cost plus operating costs) exactly its opportunity cost at the margin on every liability. In other words, user-cost approach treats bank assets as outputs

[7] Colwell and Davis (1992), Freixas and Rochet (1997).

[8] Triplett's Comment in Berger and Humphrey (1992).

if the financial return on the asset exceeds the opportunity cost of funds. Correspondingly, the liability is considered to be an output if the financial cost of a liability is less than its opportunity cost. An important difference between user-cost and value-added approaches is that value-added approach explicitly uses operating cost data rather than determining these costs implicitly as the part of the return or cost not accounted for by the difference between measured financial flows and marginal opportunity cost.[9]

According to Wykoff[10] deposits are neither outputs nor inputs but they are "financial instruments associated with a flow of a wide variety of complex and subtle services received by deposit customers" (p. 285). They are also intermediated goods, which are produced to partly provide these services and partly to generate other financial instruments that generate final product services. In other words according to Wykoff we have to think of a bank as a service sector firm. It is also important to realise that financial instruments are not services. Wykoff suggests adopting a *transaction-cost* approach that focuses on differences among and unique features of various markets that cause these markets to organise in different ways[11].

We believe that truth lies in the amalgam of the numerous different approaches sited in the literature. This is why in here we adopt a hybrid methodology combining something from all the above. We divide bank production into three rough categories: financial intermediation services, payment services, and other services. Formulation of disaggregated indices is justified since using service data for estimating banking technology there is a danger of imposing bias by using inconsistent aggregate output measures.[12] Above discussed User-cost approach is applied to financial intermediation services. We try to capture the user-cost of financial products by taking into account the opportunity cost of loans and deposits[13], production approach methodology is put to use in collecting info on the number of payment transactions. Unfortunately direct volume information is not available for other services so we are forced to rely on the cash flow generated by these services.

After calculating output indices for each of these categories we combine them and calculate one banking services output index since the inputs, ie labour, capital, and computer services, can not be divided between the outputs in a meaningful way.

---

[9] Berger and Humphrey (1992).

[10] Comment in Berger and Humphrey (1992).

[11] Based on the idea of Ronald Coase in the 1930s and 1940s.

[12] Kim (1986).

[13] See also Fixler (1993).

3 The conventional measures of productivity in the banking sector

Before we proceed to discussing the methodology behind the computation of output indices, lets first take a look at the conventional efficiency and productivity measures in banking. Below we present the cost to income and real assets to labour (measured by the number of employees) ratios for each banking sector. Ratios are computed using OECD's Bank Profitability statistics.[14] The validity of cost to income ratio as a measure of efficiency over time relies on the assumption that the prices of inputs and outputs move together. However, if input prices rise faster than output prices the curve will be an inadequate measure since the ratio may remain flatter than the actual input/output volume ratio which decreases due to improvements in productivity. It is likely that this is the case since output prices decrease as productivity improves and quantity of goods supplied increases. As such cost to income ratio should be considered an inadquate measure of efficiency. The real assets to labour ratio should be closer to the labour productivity index we are computing later in the paper. How good of a measure of efficiency assets to labour is, is of course also debatable since public companies have an incentive to try to decrease the size of their balance sheet since this improves earnings per share. Instead of using value series of inputs and outputs and hence inducing error to real assets to labour series through relative prices, we use volume series for labour input. By using assets as a proxy for outputs we can eliminate some of the incidental income accruing from price changes in the revenue series. The largest error is now caused by asset prices to the extent that their movements differ from changes in the volume of output. We deflate the nominal assets with consumer price index to counter balance this at least to a certain extent.[15] Also the off-balance sheet services are left out. This productivity ratio, even if not clouded by relative price changes, is, of course, only a partial measure of productivity. However, it is not trivial since in many countries labour is still the largest single expense category for banks.

It is possible that the data contains some errors at least for Finland and Sweden (see below appendices). We can see that the cost to income ratio is rather flat for most of the countries. The only exceptions are the large jumps experienced by the Finnish and Swedish banking sectors in the beginning of the 1990s. These

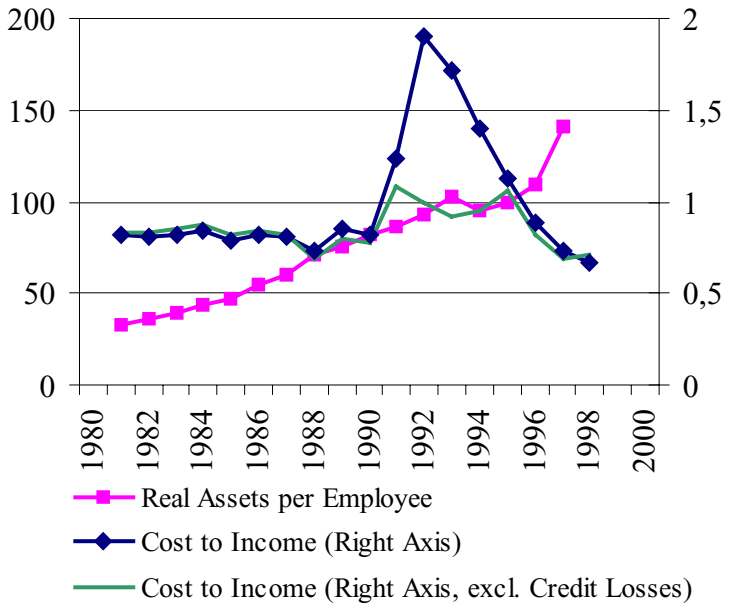
[14] OECD data includes foreign branches operating in the country for all countries excluding UK. For more imformation on Banking Sector definitions see Bank Profitability – Methodological Country Notes 2000.

[15] CPI, though far from optimal, is used while no better candidate was available for the chosen set of countries.

increases are due to sharp rise in operating expenses.[16] As expected, picture reflected through real assets to labour ratio is somewhat different. Here all of the curves exhibit an upward trend. Banks increased their assets with respect to labour on average from 3% (Sweden, Italy) to 10% (Finland) per year. The results will be discussed in more detail below.

Finnish banks cost to income ratio was approximately 80% in the 1980s. This is much higher than in other banking sectors (the average is between 60% and 70%). The severe banking crisis in the beginning of 1990s caused the ratio to jump close to 200%. If we subtract the loan losses from operating expenses we can see that the ratio increases to approximately 100% until 1995 after which it decreased steadily close to 60% by 1998. According to this measure Finnish banks have been able to improve their income with respect to costs from their pre crisis level. Whether this is a sign of improved efficiency and/or further market concentration is unclear. The assets to labour ratio of Finnish banking sector has grown over fourfold in 1981–2000. This has mainly been the result of large scale restructuring in the 1990s, which led the labour force to decrease to less than half of the size it was in the end of 1980s.

Figure 1. **Finland: Productivity Measures**

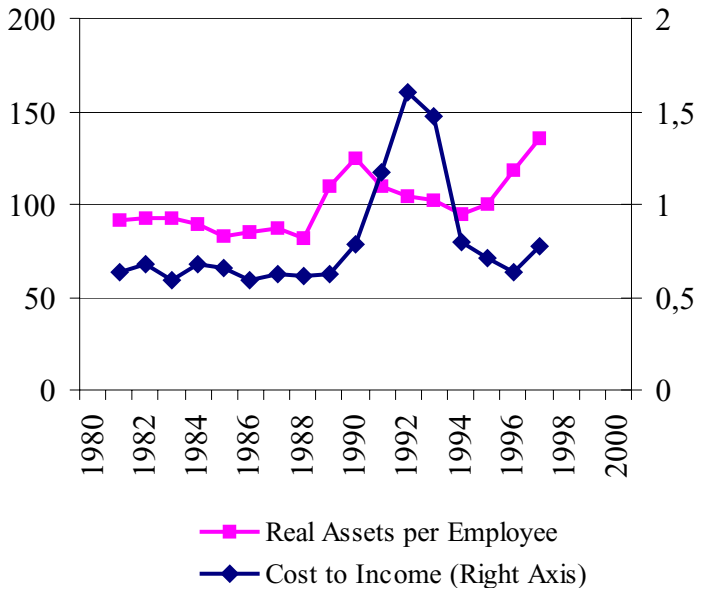


Swedish banks seem to have had lower cost to income ratio than Finnish banks until 1996. Before the banking crisis the ratio was approximately 60%. Loan losses increased the ratio to 160%. By 1996 the ratio had decreased close to

[16] Operating expenses of Finnish and Swedish banks include loan losses. These were generated by the severe banking crisis experienced by both countries.

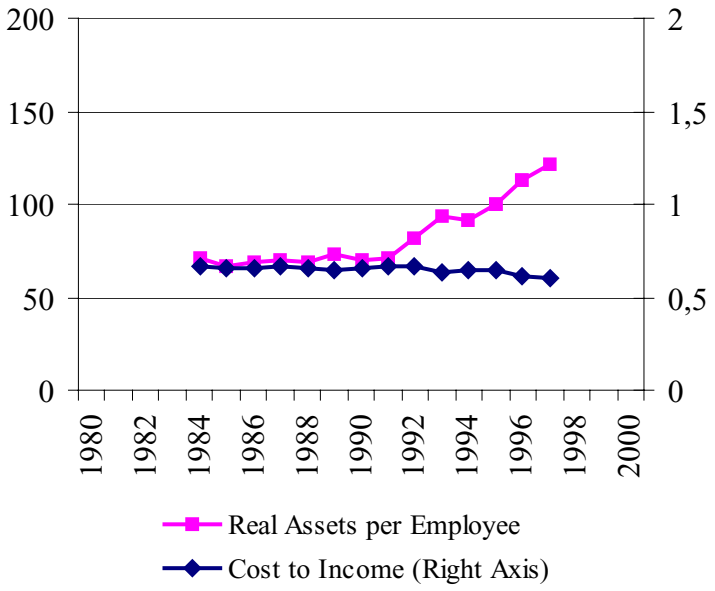
before crisis levels. Between 1981 and 1999 the assets to labour ratio has grown 1,5 -fold in Sweden. The annual growth rate has been 3,1% (Stdev 11,8%).

Figure 2. **Sweden: Productivity measures**



The cost to income ratio of UK banks has been quite steady with slight downward trend. By the end of 1999 UK's banking sector has increased the assets with respect to labour by nearly twice that of the ratio in 1984. The average annual growth rate has been quite steady 4,4% (Stdev. 7,3).

Figure 3. **UK: Productivity measures**



German banks' cost to income ratio has remained between 60% and 70% on average with slightly more variation than the ratio of UK banks. In the case of assets to labour ratio the time period covered is only 9 years: 1989–1997. During this period assets have grown 1,5 times with respect to the labour force. Though there seems to be a slight decrease in the ratio in the beginning of the period, the average growth rate has been 5,1% with standard deviation of 6,3%.

Figure 4. **Germany: Productivity measures**

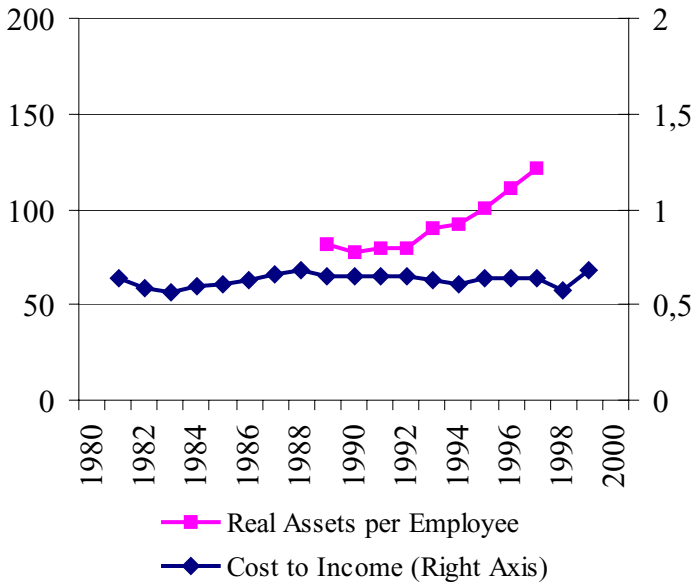
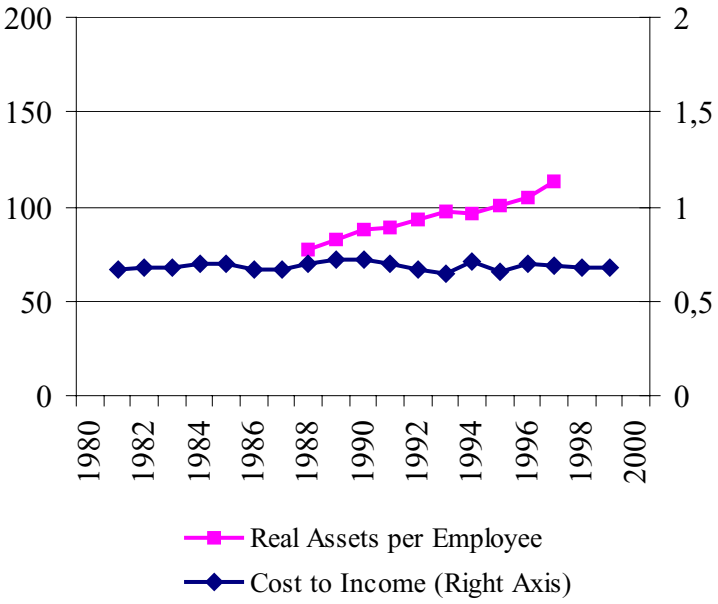


Figure 5. **France: Productivity measures**



The cost to income ratio in both France and Italy is again quite steady, about 65–75%. The assets to labour ratio has grown almost 1,5 fold in France between 1988 and 1997 and in Italy between 1984 and 1997. According to the OECD data the respective average annual growth rates have been 4,4% (Stdev. 2,9%) and 3,2% (Stdev 3,9%).

Figure 6. **Italy: Productivity measures**

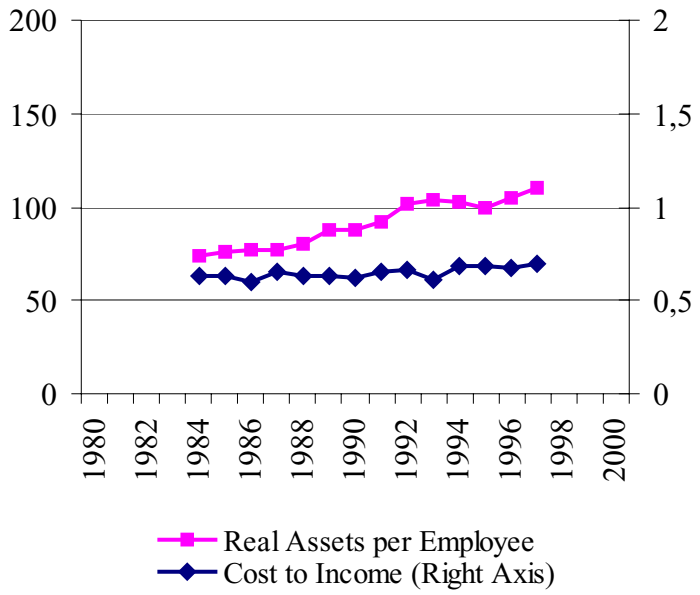


Table 1. **Assets to labour ratio in the banking sector**

Country, Time period	Growth Whole period	Average annual growth, (standard deviation) Whole period
Finland 1981–1997	330%	9,8 (7,4)
Sweden 1981–1997	48%	3,1 (11,8)
UK 1984–1997	71%	4,4 (7,3)
Germany 1989–1997	47%	5,1 (6,3)
France 1988–1997	47%	4,4 (2,9)
Italy 1984–1997	48%	3,2 (3,9)

4 Measuring banking sector output

We have decided to adopt the following approach, which is also outlined in Suominen and Tarkka (1991). We start to analyse the measurement problem by asking the question from what sources banks generate their income. Easiest way to approach this is to see what is the distribution of income in banks' income statement. The bank income function can roughly be expressed as follows

$$\begin{aligned}&\text{Income} = \\ &\text{Fees}_P + (R_T - R_D)D \\ &+ (R_M - R_T)(D + T) + (R_L - R_M)L \\ &+ \text{Fees}_O,\end{aligned}$$

where Fees_P represent the fee income generated by payment services, D is the stock of demand deposits, T is the stock of time deposits, L is the stock of loans and Fees_O represents the fees generated by other services provided by the bank. R_T is the time deposit rate, R_D is demand deposit rate, R_M is the market rate and R_L the loan rate.

According to this definition income is composed of revenue generated by payment services that consists of fees (Fees_P) plus the interest rate differential that the customer is ready to forgo[17] to obtain cheap or free of charge liquidity services from transaction or demand (D) deposits. It also includes income from consumption smoothing and financing (ie Financial Intermediation services).[18] The last income component is formed by fees from other services such as asset management, off-balance sheet activities, securities and FX-trading activities etc.

Next we proceed to finding adequate data that capture the volume of the three categories of services. Ideally we would like to have data on physical service production of payment and other services. Financial intermediation services can best be measured by taking into account the price of risk conveyed by the interest rates differentials. However, it has to be recognised that in addition to the complex nature of bank production lack of data constraints the measurement further. It seems that very seldom there exists detailed information on physical service production of other services. Usually there only exist payment services data in the form of number of transactions. This implies that most of the time we have to rely on financial statement information containing, at best, information on the value of other services rendered. This in turn has to be deflated with

[17] $R_T - R_D$ is the margin that customer pays for transaction services.

[18] $R_M - R_T$ is the interest rate differential that customer is ready to pay in order to get the consumption smoothing services from demand and time deposits and $R_L - R_M$ is the differential that customer pays for finance.

appropriate price index, which is quite difficult to define. This adds another possible source of error to the measurement process.

After computing the three separate output indices we proceed to combining them into output volume index.[19] This is achieved by calculating annual weights for each income category and computing the Tornqvist index. We prefer to use Tornqvist index due to its strong link to economic theory.[20] Binary comparisons of consecutive periods s and t (=s+1) can be defined as

$$\ln Q_{st} = \ln \text{OutputIndex}_{st} = \frac{1}{2}\sum_{i=1}^{3}(\omega_{is} + \omega_{it})(\ln y_{it} - \ln y_{is}),$$

where Q is the change in output between periods s and t, w_i refers to weight and y_i refers to output of ith services category (in this study 3 categories in total). Weights are generated using the information on bank income structure: the weight is calculated by dividing the income from each output category by gross income.

The index measures the difference between two consecutive periods. These differences are then chained to form an index covering at best 20-year period.

4.1 Payment services

Payment services have been banks' essential value added in the economy. Banks' exclusive right to deposits has so far effectively limited competition also in payment services. It is possible that this changes as new institutions start competing with transaction deposits by issuing e-money. However, banks are maintaining dense and reliable payment system network, which is quite an obstacle to overcome for the potential competition. In addition to strong infrastructure they also have government safety net to protect them from new market entrants.

The bank income structure in the form presented above underlines the duality of compensations for payment services: there exist both direct fees and implicit charges. The implicitly priced payment services (ie liquidity) are essential from customer's point of view.[21] However, since it is extremely difficult to find an adequate price index to deflate the value series (this applies also to fee income from payment services) we use payment transaction volume data instead as a

[19] A general discussion on index numbers and productivity measurement can be found in Coelli et al (1998).

[20] See eg Caves et al (1982) and Hulten (2000).

[21] In reality banks have monopoly power. This results in customers paying more for the services and perhaps consuming less services than they would like.

proxy for each country.[22] However, it should be kept in mind that the changes in the quality of payment services are not captured by this volume index. Appendix 1 gives a detailed description of the data and in Appendix 5 we present the transaction volume indices for each country.

When we are computing the complete Tornqvist production index we need weights for each output category for each year. We do this by separating from net-interest income the liquidity margin (LM) on demand deposits and from fee income the fees from payment services.[23] The liquidity margin can be defined as

$$LM = (R_T - R_D)D.$$

Weights are derived by adding the nominal liquidity margin and the payment services fee income to get the total income from payment services[24] and finally dividing this by the gross income.

4.2 Financial intermediation services

Financial intermediation volume index is composed of two important elements: services provided through deposits (consumption smoothing) and those provided through loans (financing).

Bank earns the opportunity cost that the deposit customer bears from not investing directly to a project or to other instruments. Customer must feel that he is better compensated by the bank than by the market if he chooses to deposit the funds at the bank. The margin between opportunity cost of deposits and the deposit rate is the compensation received by the bank for providing safety and liquidity for the customer.[25] Consumption smoothing using long term deposits effectively insures the depositor from macroeconomic shocks. Depositor avoids the inter-temporal fluctuations in the value of his assets since he holds claims on intermediaries that are fixed in nominal terms. Structure of financial markets affects the distribution of financial assets in the economy. In bank based economies deposits are often the most common asset held by households, whereas in market based economies the larger portion of household assets is in the form of equity. Technological advancement usually increases the number of available financial assets to households. Competition from other players in the financial

[22] More on the analytical issues involved in the choice between direct and indirect (ie quantity is the value divided by price) quantity comparisons can be found in Allen and Diewert (1981).

[23] In practice, this liquidity margin compensates the bank not only for payment services offered but also for the deposit insurance scheme. This, of course, is not part of banks' output.

[24] See Appendix 1 for more information on data.

[25] As well as the government safety net.

markets can lead to diminishing role of inter-temporal smoothing provided by financial intermediaries, in particular banks.[26] Technological advancement can result in increased volatility in the stock of deposits.

Another important element is the financing services provided by the bank. In many situations markets would not be willing to finance the projects due to lack of information on the quality of the project and the type of the borrower. Banks collect and process information in order to finance good projects. They have the means to collect information through numerous other contracts with the customer. The pricing of risk is assumed to be banks' advantage compared with other financial intermediaries.

If customer could directly borrow from (and invest in) the financial markets then the interest rate paid as a compensation for these funds would effectively be just a direct transfer of income from one agent to another. Since we only want the value added from the financial intermediation services provided by the banking sector we have to purge the income by subtracting the benchmark market rate from the loan rate. The value of bank deposit and bank loan services can be expressed in a following way. We denote loans by L, demand deposits D, and time deposits by T. Loan rate is R_L, time deposit rate is R_T, and market rate is R_M. The value of financial Intermediation services (FI) is

$$FI = (R_M - R_T)(D + T) + (R_L - R_M)L.$$

On the right hand side the first component is the opportunity cost the deposit customer is ready to pay to get the services related to deposits at the bank. The latter component is the interest revenue from loans.

The appropriate price index for financial intermediation services is rather simple. We have to take into account both the general price level and the market power of banks. Price index is formulated by multiplying the Consumer Price Index by interest margin index (ie the difference between average loan rate and average time deposit rate at periods t and s; base period value=1). This will lead to following Laspeyres price index for financial intermediation

$$P(t) = \frac{CPI * (R_L(t) - R_D(t))}{R_L(0) - R_D(0)}.$$

We assume then that as the difference between loan and deposit rate increases (decreases), bank is using its market power (facing stronger competition). It is not producing more or less services. However, it should be kept in mind that this assumption ignores the changes in the structure of deposits or in the amount of implicitly priced services provided. Even though different time deposit accounts

[26] Allen and Gale (2000).

offer fairly comparable set of services, their liquidity differs depending on their maturity.

The weight for financial intermediation services in the overall output index is computed by subtracting the implicitly priced payment services income (nominal value) from the net-interest income and dividing this by gross income.

4.3 Other services

The non-interest income generating services have steadily increased their role as a source of income to banks in most European countries. Non-interest income generating services can be divided into capital gains, income from securities and fee income. Here we want to concentrate only on fee income since capital gains and income from securities are rather incidental. Trading income should be thought of as pure interest, which is distributed from one agent to the other in the economy. Fee income generating services provided by a bank include various underwriting activities, securitisation, advisory activities, asset management, accounts administration, safe custody and administration of securities etc.

If there has been a transition from traditional banking operations to other operations we should observe an increase in the fee income stream. Since direct volume information is not readily available, we have to rely on the value of services deflated by appropriate price index. Though it is fairly safe to assume that the severity of problems caused by cross-subsidisation by deposits is limited, changes in the quality of fee income services can create more serious problems. It is likely that technological advances improve the quality of fee income services in addition to the amount services produced. Another major problem is the price index. There does not exist an appropriate index computed using various fees of different banks. On the whole, this side of banks' income is quite inadequately disaggregated and, as mentioned before, no data on the number of various transactions exists.

The nominal value data on other services (excl. payment services) is from banks' income statements. Even though we tried to clean the series from the incidental income we have been forced to approximate the value of fee income by making the assumption that in earlier years the share of fee income has been the same as the average share observed in later years.[27] Also with price index we are forced to make an unsatisfactory compromise. With lack of a better alternative, we have decided to deflate fee income from other services with Consumer Price Index. The weight is calculated by dividing the fee income by gross income.

[27] See Appendix 1 for more information on the assumptions that were necessary in order to derive the value series.

5 Comparison of output indices

The three banking services output indices give quite an interesting picture of the banking sectors in the six countries under study.[28] Unfortunately a detailed description of each country's economic and financial conditions is outside the scope of this paper. Rather, the discussion here should be seen as a prelude to a more detailed country analysis.

GDP (at 1995 market prices) volume growth rates can be seen in the table below.[29] As a general rule bank services growth has surpassed that of GDP growth. However, certain interesting exceptions remain. These are reported below. The exceptional periods are marked with grey in the output tables below.

Table 2. **GDP Growth, %**

Country, time period	Whole period	–1985	1985–1990	1990–1995	1995–
Finland 1980–2000	68,1	15,4	17,7	–3,3	28,1
Sweden 1980–1999	37,2	9,5	12,1	1,6	10,1
UK 1980–2000	62,1	10,9	17,6	8,3	14,8
Germany 1980–2000	62,3	6	17,8	19,2	9
France 1980–2000	50,9	7,8	17,2	5,2	13,5
Italy 1980–2000	45,6	8,1	15,1	6,5	9,8

5.1 Payment services output

The length of the available data on payment transactions performed by banks varies somewhat between countries: in Finland and Sweden it is 20 years, in UK, Germany and Italy it is 17 years and in France 16 years. All banking sectors have been able to increase their payment services production at least 2,3 fold over the period. However, no matter what the period, the growth rate of payment services output has been remarkable in the Finnish banking sector. Output is over 6 times larger in the year 2000 compared to the beginning of the 1980s. The growth has been the fastest in the 1980s (1981–1989 average annual growth 18% (standard

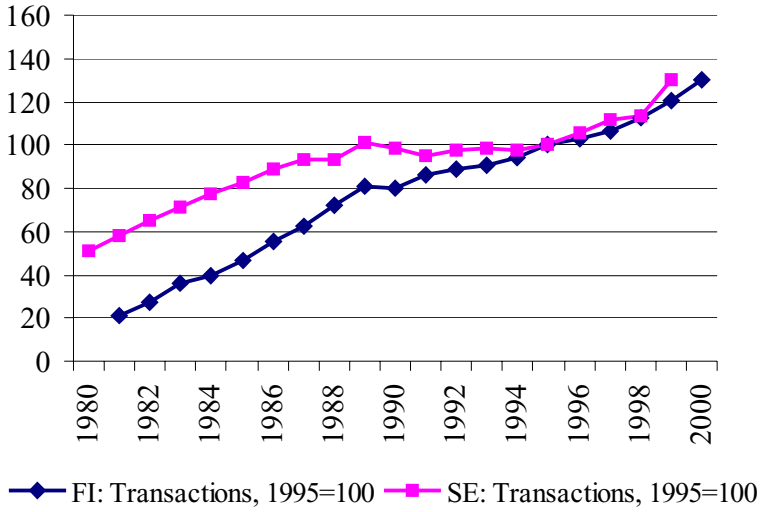
[28] The nominal values of output series are presented in the Appendix 4.

[29] Data from IMF.

deviation 8,5%)). Between 1990 and 2000 it slowed down to 4,5% per annum (Stdev. 3,5%). Interestingly the depression in Finland does not show up in the payment services output. Whereas GDP volume decreased in 1990–1995 by 3,3% the payment services output continued to grow over that period by 24,5%. This is partly the result of increasing popularity of easy access and relatively cheap electronic payment services in Finland.

In Sweden we can see three distinct periods forming. Period 1980–1987 the Swedish banking sector experienced relatively rapid payment services output growth (annual mean: 10,3% Stdev. 4,7%). Growth slowed down in 1987 and remained modest (88–94: annual mean 0,7%, Stdev. 4,3%) until 1995 when it picked up the pace again (95–99: annual mean 6%, Stdev. 5%) accelerating towards the end of the period. In Sweden the overall growth in GDP volume and payment services volume practically matched each other during the difficult period of 1990–1995. In other periods payment services volume has clearly grown faster than GDP.

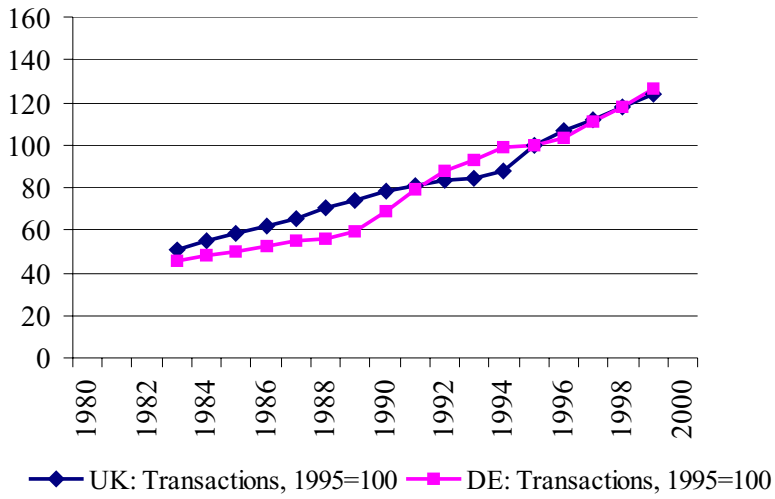
Figure 7. **Finland and Sweden: Payment services output**



Payment services output growth in UK and German banking sectors surpassed that of respective GDP growth rates during the whole period. For UK annual growth of payment services was quite rapid in 1983–1990 (Mean 6,4%, Stdev. 0,9%). It slowed down slightly during the period 1991–1994 (Mean 2,8, Stdev. 1,1%) speeding up for the period 1995–1999 (Mean 7,2%, Stdev. 3,8%).

In the German banks the beginning of 1980s was a period of rapid growth (Mean 4,5% per annum, Stdev. 1,3%). Payment services output accelerated even more after 1989 continuing approximately at the speed of 11,8% (Stdev. 4,7%) and from 1993 onwards slowing down on average to a speed of 5,3% per annum (Stdev. 2,3).

Figure 8. **UK and Germany: Payment services output**



Also in the case of French and Italian banks the payment services output growth can be divided into distinct periods. In France 1984–1988 was a period of very rapid annual growth (Mean 8,9%, Stdev. 0,89%) after which the growth slowed down some but was still quite rapid (Mean 4,1%, Stdev. 1,5).

In the Italian banking sector the difference between periods is clearer. From 1983 to 1989 the payment services output grew by 12,5% annually (Stdev. 4,5%). After this extremely rapid growth it slowed down to meagre 2,4% per annum (Stdev. 3,1%) picking up the pace again in 1996 (Mean 9,3%, Stdev. 4,6%). In Italy the period 1990–1995 led to exceptionally slow overall growth in payment services: whereas GDP grew by 6,5%, payment services grew only by 5,9%.

Figure 9. **France and Italy: Payment services output**

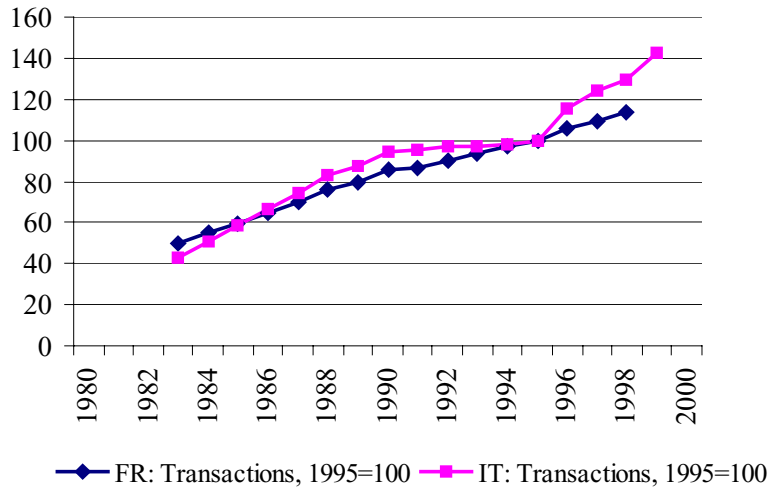


Table 3. **Payment services output growth, %**

Country, time period	Whole period	–1985	1985–1990	1990–1995	1995–
Finland 1981–2000	516,5	121,3	71,5	24,5	30,5
Sweden 1980–1999	156,0	63,5	19,2	1,2	29,7
UK 1983–1999	143,1	14,3	34,9	27,1	24,1
Germany 1983–1999	176,2	9,8	36,5	45,9	26,3
France 1983–1998	128,9	20,3	42,8	17	13,8
Italy 1983–1999	229,2	36,6	60,2	5,9	42,1

5.2 Financial intermediation services output

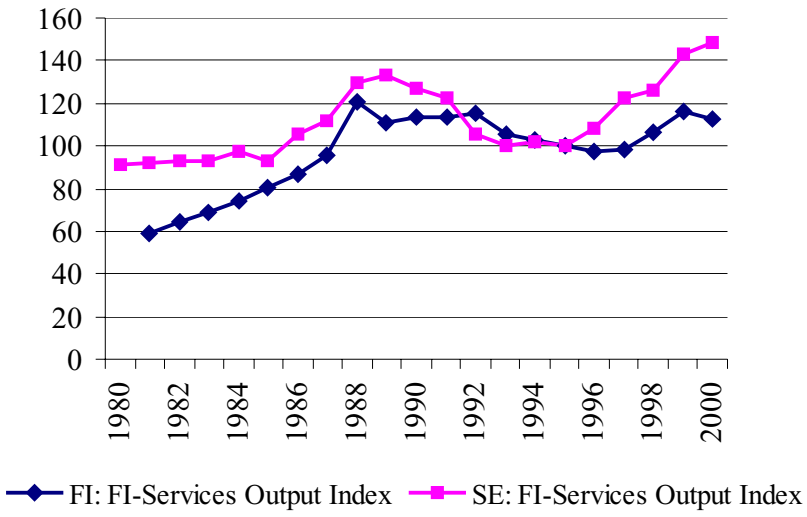
The various shocks to the economy can be seen in the financial intermediation output index. This is particularly true in the case of Finnish and Swedish banks. Both of these sectors experienced severe banking crisis in the beginning of the 90s after a heating of the economy in the end of 80s. In Finland financial liberalisation together with strong economic growth started to accelerate the intermediation business from the beginning of the 80s. As a result financial intermediation services output grew by 36% between 1981 and 1985. The Finnish financial markets were liberalised by the beginning of 1990s, whereas in Sweden liberalisation had been achieved by the mid-1980s. The growth rate of financial intermediation services remained at meagre 2% (GDP grew by 9,5%) in Sweden. However, between 1985–1990 both countries picked up the pace. Financial intermediation services output grew by 41% in Finland and by 37% in Sweden.

In the beginning of 90s economic climate started to cool down quickly. Following this the demand for new credit slowed down while credit standards became stricter. The output growth rate for banking sectors in Finland and Sweden between 1990 and 1995 were –12% (GDP: –3,3%) and –21% respectively. During this period the GDP in Sweden continued to grow, even though at the modest speed of 1,6%.

The reduction in intermediation output came to a halt in 1995 in Sweden. However, unlike the Swedish banking sector, which seems to have recovered well from the shock, in Finland the financial intermediation services output produced by banks has been left behind by GDP growth. Between 1995 and 2000 the growth was 12,9% whereas GDP grew by staggering 28%.

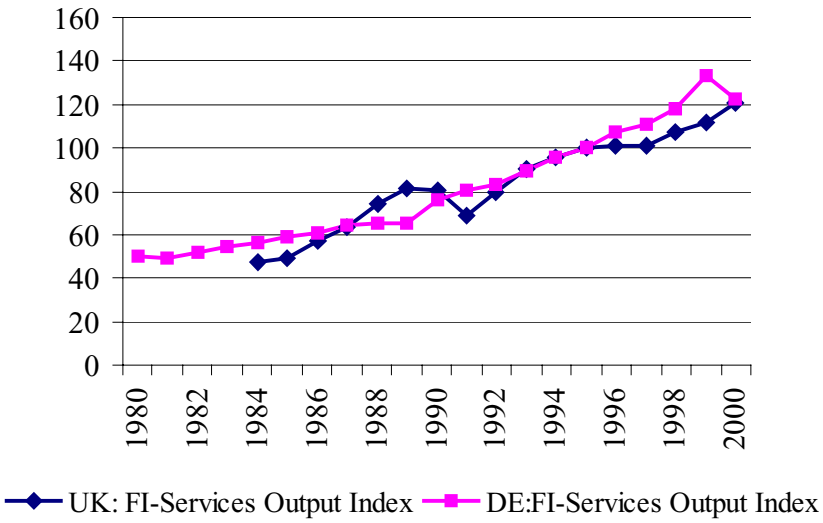
The average annual growth rate has been 3,8% (Stdev. 8,1%, period 1981–2000) in the Finnish banking sector and 2,8% (Stdev. 7,6%, period 1980–1999) in the Swedish banking sector.

Figure 10. **Finland and Sweden: FI-services output index**



In UK and German banking sectors financial intermediation services output has grown steadily and rather quickly over the past 17 to 21 years. In UK the output has grown over 2,6 times of that in 1984 ie in 17 years. By comparison the German banks' financial intermediation services output has grown 2,5 times in 21 years. Between 1984 and 2000 it grew 2,16-fold. In Germany the annual growth has been on average 4,7%, standard deviation 5,1%. In UK it has been 6,4%, standard deviation 8,1%.

Figure 11. **UK and Germany: FI-services output index**



Financial intermediation output of French banks has accelerated during the most recent years: in 1990–1995 it grew by 26% and the following two-year period 1995–1997 by 15%. The average annual growth rate has been 3,4% (Stdev. 10,1%).

During the 18-year period (1980–1997) according to the data the slowest financial intermediaton output growth of the group of countries under study was experienced by Italian and Swedish banks. While the output grew over the period by 64% in France (84–97: UK 115%, 81–97: Finland 66%, 80–97: Germany 123%), it grew by only 33% in Italy (and 35% in Sweden). Italy experienced only one six-year period of more rapid output growth: between 1985 and 1990 the growth rate was 24%. After 1993 the financial intermediation output of Italian banks has not grown significantly. Financial intermediation output growth has surpassed GDP growth in two periods namely that of 1985–1990 and 1995–1997 (GDP grew during this period only 3,1%). Between 1980 and 1997 GDP grew by 37%. The annual growth of Financial intermediation services output has been on average 1,7% (Stdev. 3,5%).

Figure 12. **France and Italy: FI-services output index**

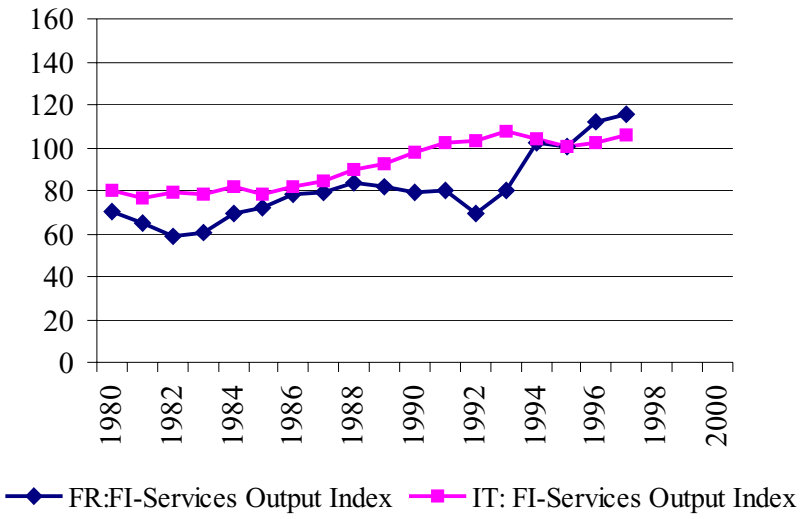


Table 4. **Financial intermediation services output growth, %**

Country, time period	Whole period	–1985	1985–1990	1990–1995	1995–
Finland 1981–2000	90,8	36,3	41,1	–12,1	12,9
Sweden 1980–2000	63,2	2,1	36,7	–21,2	48,3
UK 1984–2000	158		71,2	24,2	21,1
Germany 1980–2000	145,2	18,2	29,6	31,2	22
France 1980–1997	63,8	2,4	9,9	26,3	15,2
Italy 1980–1997	32,5	–1,2	24	2,5	5,5

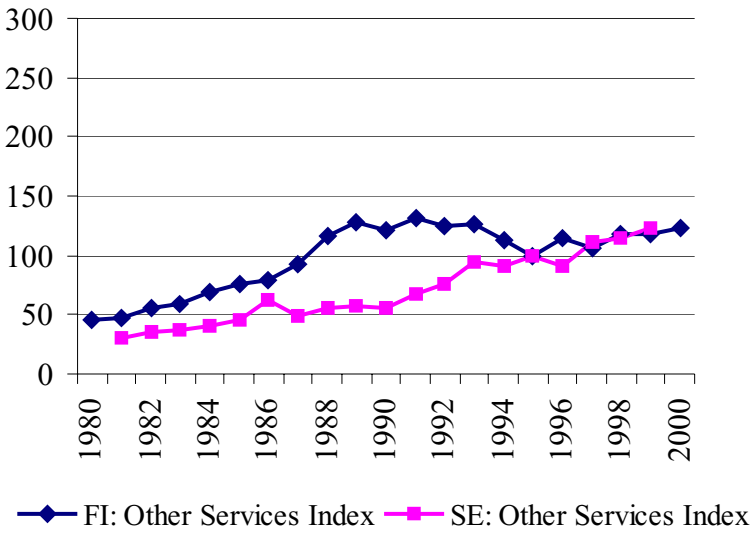
5.3 Other services output

Whereas financial intermediation and payment services output indices are quite well behaving, a more extreme behaviour can be seen in some cases with other services output. The high volatility of the series is, probably due to inclusion of incidental income or data errors (see the discussion above in section 4.3). On the other hand the weight of these services is quite small for most of the periods under study (see Appendix 2).

In Finland the series resembles that of financial intermediation services output. We can see the rather rapid growth in the beginning of 1980s and the hump shape between 1987 and 1995 (in the case of financial intermediation output this hump covers the period approximately from 1987 to 1994). Output started to recover after 1995. The growth for the 6-year period 1995–2000 was 23%. Both financial intermediation services output and other services have grown slower than GDP in the past 10 years (1990–2000). For the observed period the annual growth rate of other services output has been on average 5,6% (Stdev. 10,4%)

Unlike in Finland, the other services output index for Swedish banks does not resemble that of financial intermediation services index. It has grown quite steadily over the observed period of 1981–1999. The annual growth rate is remarkable 9,1% (Stdev. 13,9%).

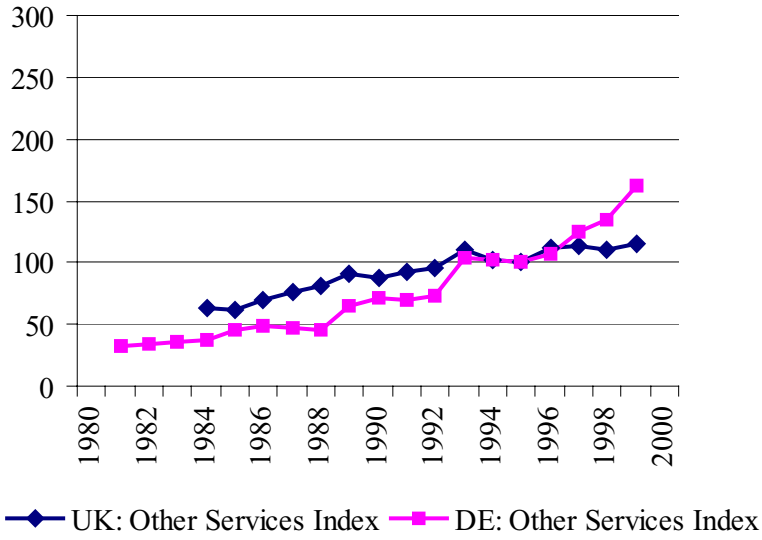
Figure 13. **Finland and Sweden: Other services index**



Other services growth rate of UK banks under the observed period of 16 years was 82%. The annual average growth has been rather steady 4,3% with standard deviation of 6,8%. GDP grew faster in 1984 and 1985 (3,8%) than other services (–2,9%).

In German banks the growth has also been quite steady, though odd jumps seem to appear every four years. Other services output of German banks grew by almost 4 fold (386%) during the 19-year period. The average annual growth rate has been 10% (Stdev. 14,2%).

Figure 14. **UK and Germany: Other services index**



French banks have rather well behaving and fast growing other services output. The growth rate has been a magnificent 625% over the 19 years under study. After a slow period 1981–1987 (1981–1985: –4,1%, GDP 6,6%) the growth has been remarkable. The annual growth rate has been 12,7% with standard deviation of 16,3%.

Italian banks have a peculiarly behaving other services index. After two years of even growth of approximately 13% the index starts to decline rapidly reaching the bottom in 1992 (Mean –13,2, Stdev. 8,3). From here on it grows very fast, dipping slightly in 1995 and 1996, accelerating into a staggering speed of 38,6% per annum (Stdev. 19,5%) between 1997 and 1999. Clearly this is very erratic behaviour and would call for more thorough investigation of the quality of data.

Figure 15. **France and Italy: Other services index**

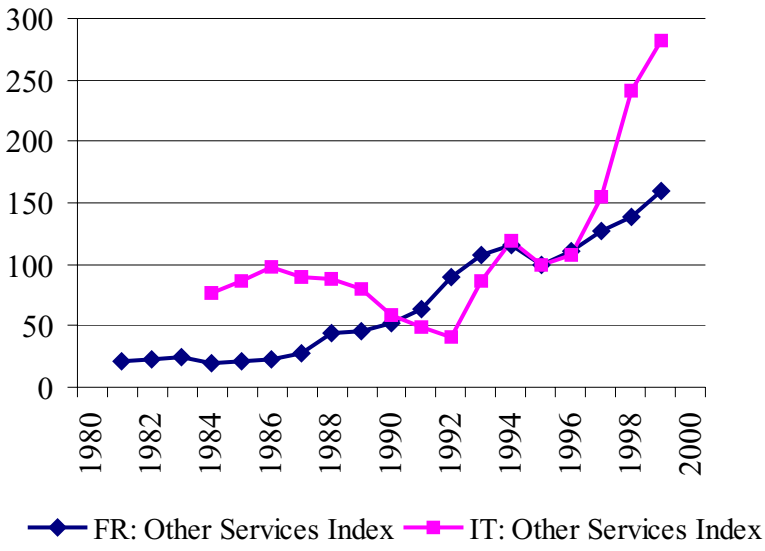


Table 5. **Other services output growth, %**

Country, time period	Whole period	–1985	1985–1990	1990–1995	1995–
Finland 1980–2000	172	67,7	61	–18	23
Sweden 1981–1999	312,4	55,3	20	80,6	22,6
UK 1984–1999	81,5	–2,9	42	13,8	15,7
Germany 1981–1999	386	37,2	56,9	39,8	61,5
France 1981–1999	625,2	–4,1	149,7	90	59,4
Italy 1984–1999	268,3	12,5	–31,8	69,6	182,8

6 Labour productivity of the banking sector in the six EU countries

After calculating the three output indices and the weights for each country we can proceed to computing the overall output indices and the labour productivity indices for the six banking sectors. These differ to a varying extent from the more conventional measures such as assets to labour ratio presented in section 3. The real assets to labour ratio and labour productivity index are quite close to one another in all sectors except the French banking sector when comparing the average annual growth rates.

For all countries the more radical improvements in labour productivity of the banking sector have been realised in the end of the 90s. Even though banks in other countries have also experienced improved productivity in the last few years, this has not been achieved through as exensive restructuring as in Finland.

It is clear that labour productivity analysis tells only a part of the story. To get a clearer view of how the productivity of banking sector has developed we need total factor productivity (TFP) measure.[30] We will discuss these results for Finnish banks below in section 7.

[30] More discussion on total factor productivity can be found for example in Hulten (2000).

Table 6. **Overall output of the banking sector**

Country, time period	Growth, whole period	Average annual growth (standard deviation)		
		Whole period	–1992	1993–
Finland 1981–2000	169%	5,6 (7,2)	8,8 (7,3)	1,2 (4,4)
Sweden 1981–1999	104%	4,2 (5,7)	3,7 (5,9)	5 (5,8)
UK 1984–1999	120%	5,5 (5,4)	6,3 (6,9)	4,6 (3,3)
Germany 1984–1999	176%	6,6 (3,8)	5,8 (4)	7,6 (3,6)
France 1983–1997	107%	5,6 (7,7)	3,3 (6)	9,8 (9,4)
Italy 1984–1997	43%	2,9 (3,5)	2,7 (2,4)	3,2 (5,2)

Interestingly only Finnish and French banking sectors seem to have cut labour force when we compare the beginning and end of the period figures. In Swedish, UK and German banking sectors number of employees has grown, whereas in Italy it has remained relatively stable (see table 7). However, it should be noted that most of the banking sectors have stopped increasing (UK, Germany) or actually reduced (Finland, Sweden, France, Italy) labour after the peak years in the end of 1980s and beginning of 1990s. The labour force in the Finnish banking sector reached its peak in 1989 after which it started to decrease fast. Between 1989 and 2000 it diminished by 55%.

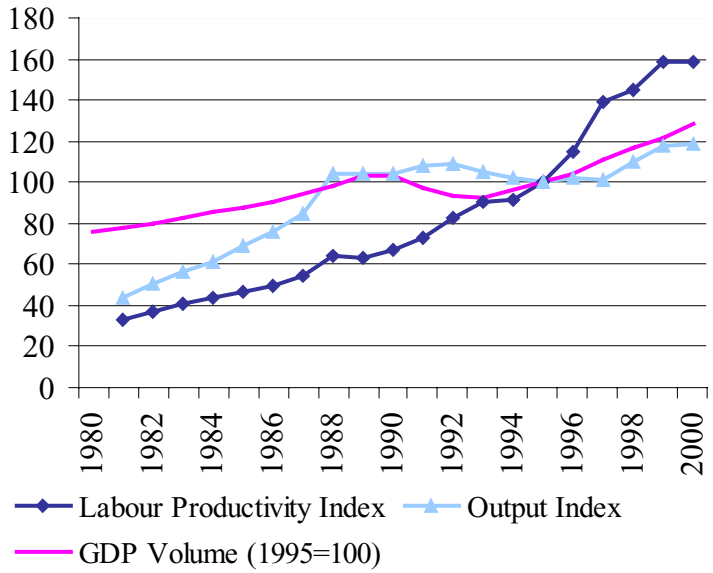
Table 7. **Employees in the banking sector**

Country, time period	Growth	Average annual Growth, (standard deviation)
	Whole period	Whole period
Finland 1980–2000	–41%	–2,3 (6,9)
Sweden 1981–1999	21%	1,3 (7)
UK 1984–1999	22%	1,4 (4,5)
Germany 1989–1999	25%	2,4 (4,6)
France 1982–1997	–12,5%	–0,8 (1,4)
Italy 1981–1999	3,9%	0,2 (1,5)

Though Finnish banking sector has been very profitable in recent years, financial intermediation and other services output has not been increasing at the rate preceding the banking crisis according to our calculations. In fact, it has been left behind by the GDP growth rates in past few years (see earlier section). Though the nominal value of financial intermediation output grew approximately fourfold between 1980 and 1988 up to nearly fivefold by 1993, the financial intermediation services and overall output indices show increase of 104% and 136% respectively by 1988 and then decrease of 18,7% and 2,8% between 1988–1997. This is supported by the facts since after the rapid nominal output growth the loose credit standards resulted in huge loan losses. In retrospective it is clear that the growth was not there in real terms. The overall output has recovered some in recent years. Between 1997 and 2000 it grew by 17,3%.

It seems that in the Finnish banking sector the strong decrease in number of employees has led to rather slowly growing output but much more efficient production of services.[31] Labour productivity has grown on average remarkable 8,8% per year with standard deviation of 5,9%. After even more rapid improvement in productivity between 1995–1999 (growth per annum 11,8%, Stdev. 6,5%) the labour productivity growth slowed to a standstill in 2000.

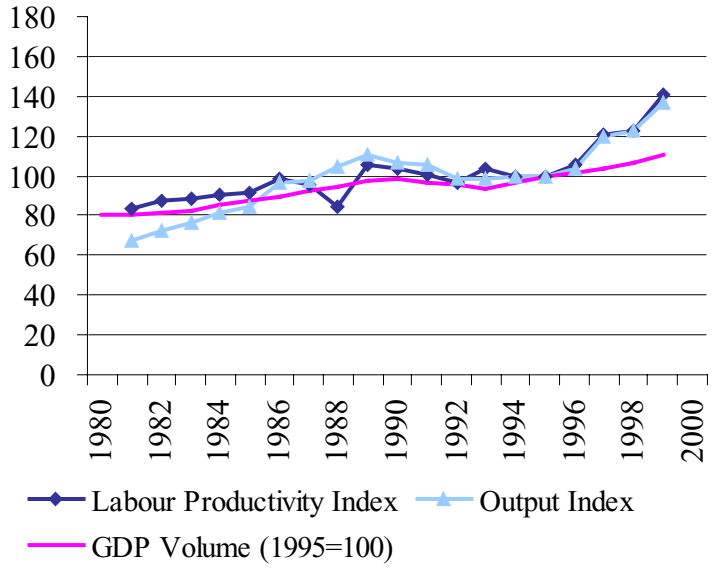
Figure 16. **Finland: Banks' service production**



[31] However, It should be kept in mind that the data problems discussed in the appendix can greatly diminish the reliability of output indices calculated.

Interestingly output and productivity of the Swedish banking sector seem to differ from Finnish banking sector.[32] The labour force has decreased quite slowly: after 1989 on average 2% per year (Stdev. 5%). There seems to be small dip in the labour productivity in 1985. This is probably caused by error in the data on number of employees.[33] For most part of the period banking services output and labour productivity have grown faster (productivity growth 1981–1999: 3,3% and Stdev. 8,6%) than the GDP, which slowed down in 1991–1993 after which it has grown at a pace of 2,8% with standard deviation of 1,1%. After 1995 labour productivity growth of the Swedish banking sector has accelerated to impressive 9% per year (Stdev. 6,7%) while output has grown by 8% (Stdev. 5,7%). According to our calculations this remarkable speed has lead to nearly 37% increase in output in 5 (1995–1999) years.

Figure 17. **Sweden: Banks' service production**



UK banks' service production has increased at a pace of approximately 5,5% per annum (Stdev 5,4%). In 1993–1999 output grew quite smoothly, on average 4,6% annually with standard deviation of 3,3%. Output has grown faster than GDP on average. In 1993–1999 the GDP growth was steady 2,9 % per year (Stdev 0,8%). The average GDP growth for the whole period is 2,5% with standard deviation of 1,8%.

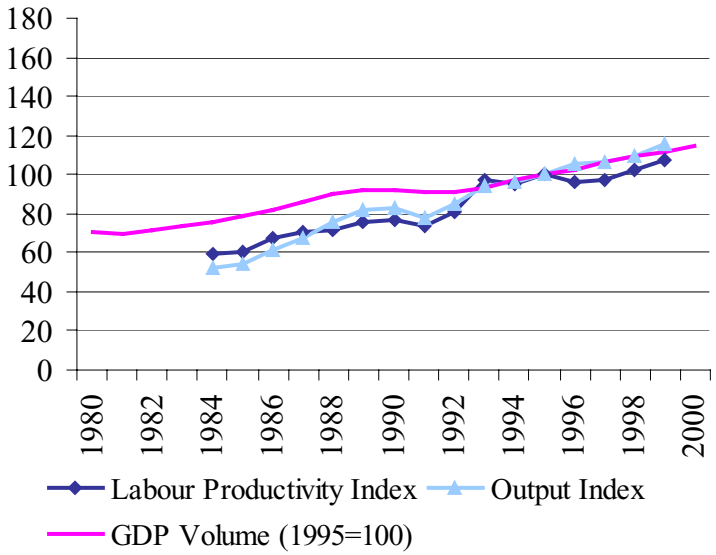
The labour productivity has grown on average with a speed of 4,2% annually with standard deviation of 6,1%. All and all, labour productivity has improved

[32] See the cautionary remarks on Swedish data in the Appendix 2.

[33] In the OECD data the number of co-operative banks jumps from 3 900 in 1987 to 12 500 in 1988 and then to 4 000 in 1989.

80% from 1984 to 1999. This has been achieved by output growth without reducing the labour force. In fact between 1984 and 1999 the labour force has increased by 22%. After 1990 it has decreased by meagre 0,4%.

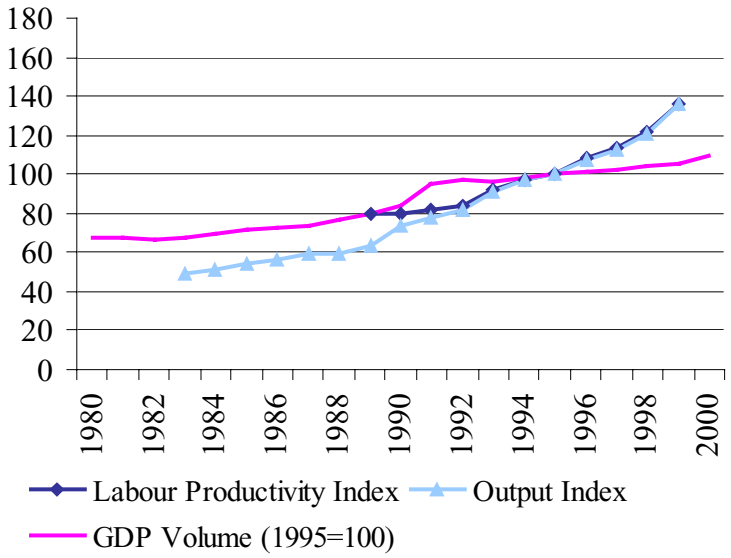
Figure 18. **UK: Banks' service production**



As with UK, the banking sector output weights are available for Germany only for a relatively short period, 1984–1999. It is impressive, though, how fast the banking sector output has grown in Germany during the period covered. According to our data the growth for the whole period is 176%. Output has grown at an average speed of 6,6% annually with a standard deviation of 3,8%. The growth was somewhat slower in the beginning of the period. Between 1984 and 1989 the average annual output growth was 4,2% (Stdev. 1,9%). This is an interesting result. Lately there has been discussions on the inefficiency of the German banking sector. However, the indices computed here do not reveal it. The results should be checked with alternative data covering also the present.

Unfortunately, we were able to find only a short series on number of bank employees for Germany. The data cover the period of 1989–1997. Interestingly, unlike in Finland, where the productivity growth of banks has been achieved by reducing labour, in Germany the growth has resulted in more efficient use of the same labour force, at least after 1992. The annual labour productivity growth in 1993–1999 is 7,3% (Stdev. 3,3%). The growth for the whole 11-year period is 72%. It would be very illuminating the compute the total factor productivity index for German banks to see, how capital intensive the industry has become.

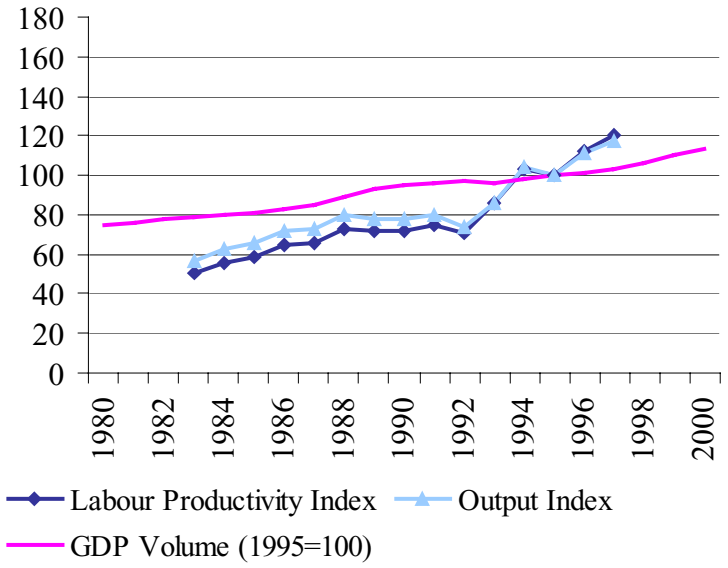
Figure 19. **Germany: Banks' service production**



As with Germany the shortness of the available time series hampers the computation of indices for French banking sector. The labour productivity growth follows that of banking sector's overall output growth even though French banking sector has been the only other sector in addition to Finnish sector that has actually reduced the labour force since the beginning of the period. Output index, which resembles that of financial intermediation index, has two distinct periods: 1983–1992 and 1993–1997. In 1983–1992 the output (and labour productivity) grew rather slowly: on average 3,3% per year (Stdev. 6%). After 1992 output grew remarkably faster, on average by 9,8% annually (Stdev. 9,4%). All and all, it grew by 36% during 1993–1997 according to our data.

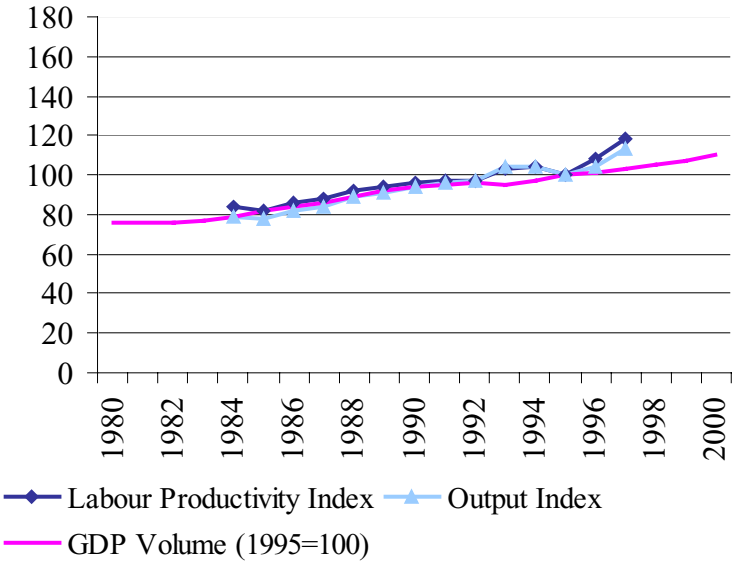
Between 1993–1997 the labour productivity improved by staggering 11,3% per year (Stdev 9,9%). This speed matches that of Finnish banks which for the identical period was 11,2%, though the volatility of French data is somewhat larger (Finland: Stdev. 7,6%). Even though the French banks have reduced the number of employees over the years by 13% (after 1988 by 11%) the improvement in productivity of banks seem to have been mainly achieved through output growth.

Figure 20. **France: Banks' service production**



The growth rates of overall output and labour productivity indices computed for Italian banks seem to differ remarkably little from the GDP growth. Unfortunately we have data on weights only until 1997. It would be interesting to see how the indices behaved in 1998–2000, since after 1995 the output growth seem to have accelerated. The average annual growth rate of GDP for the whole period is 1,9% (Stdev. 1,2%), of banking services overall output 2,9% (Stdev. 3,5%) and of labour productivity 2,8% (Stdev. 3,9%).

Figure 21. **Italy: Banks' service production**



Looking at the average annual growth rates across countries it seems that the productivity of banks has been improving especially after the beginning of 1990s. This could be a sign of integration and technological innovations causing the sector to become more efficient. However, the observation is, of course, quite preliminary since the time series are of varying length (some very short) and no statistical analysis of the significance of the differences have been made.[34]

Table 8. **Labour productivity of the banking sector**

Country, time period	Growth, whole period	Average annual growth (standard deviation)		
		Whole period	–1992	1993–
Finland 1981–2000	383%	8,8 (5,9)	8,9 (5,2)	8,7 (7,2)
Sweden 1981–1999	68%	3,3 (8,6)	1,7 (9,5)	5,7 (7)
UK 1984–1999	80%	4,2 (6,1)	3,9 (4,7)	4,4 (7,8)
Germany 1989–1997	72%	5,6 (3,9)	1,7 (0,9)	7,3 (3,3)
France 1984–1998	92%	6,6 (7,9)	4 (5,6)	11,3 (9,9)
Italy 1984–1997	41%	2,8 (3,9)	1,9 (2,2)	4,2 (5,7)

7 Total factor productivity of the Finnish banking sector

Since we have best availability of data for Finland we decided to compute the total factor productivity only for this country. We report the results here briefly.

In order to calculate the TFP for the banking sector we need both input and output indices and their respective weights. We decided to use the detailed statistics of Statistics Finland. We were able to obtain data on various bank expense categories (profit account information; period 1980–1999) as well as different categories of capital (balance sheet; period of 1980–2000).

We formulated three categories of inputs namely labour, real estate capital in own use (office space) and other fixed assets (machines, computers and other capital). The data is fairly uncomplicated, though better division would have been achieved if we had in our disposal for the whole period the data that has been

[34] A rather less attractive explanation for the observed increase in labour productivity in the end of the 1990s is a spurious correlation caused by changing definitions of data due to new EU standards. This would have to be checked country by country.

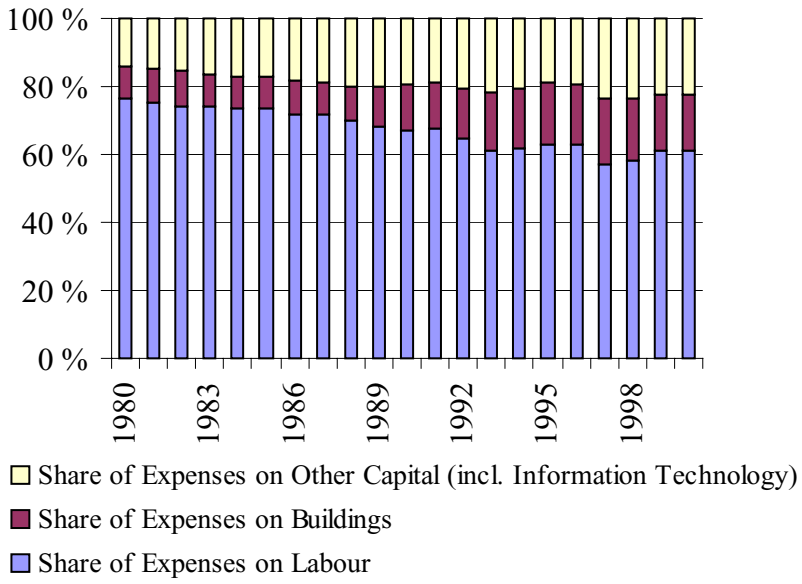
reported by banks since 1995.[35] Since between 1980–1994 it is impossible to disaggregate the share of real estate capital in own use we decided to use the number of branches as a proxy for real estate capital quantity. We used the number of employees as a proxy for labour input quantity.

The series *machines* and *other fixed capital* were combined to form the other fixed assets value series. This had to be deflated with appropriate price index. Since other fixed capital is a combination of different types of capital we decided to use the investment goods wholesale price index. Since it is likely that the structure of banks' other capital has changed over the 20 years under study towards information technology, this price index probably underestimates the drastic change in quality of high tech goods, as well as the decreasing price of computers. This will lead to underestimation of the quantity of other fixed assets.

The weights were computed using the information on expenses. Since the data on capital covers the whole period of 1980–2000, we decided to approximate the expense information for the year 2000 with the information from the year 1999.

The largest weight is that of labour: salaries are the largest single expense category with 68% on average. Rents and expenses from real estate form the weight for real estate capital and office expenses and it-expenses combined are used as a weight for other capital. The weight distribution has changed over the years. Whereas in 1980 the labour weight was 77%, real estate capital weight was 9% and other capital weight was 14%, in 1999 the respective weights were 61%, 16% and 23% ie capital has increased its share from 23% to 39%. Banking industry in Finland has clearly become more capital intensive over the years.

Figure 22. **Finland: Input weights**



[35] After this change in balance sheet definitions banks' capital structure is more transparent and it is easier to find out how much capital bank uses as input.

The total factor productivity comparison between two consecutive periods s and t is computed as follows:

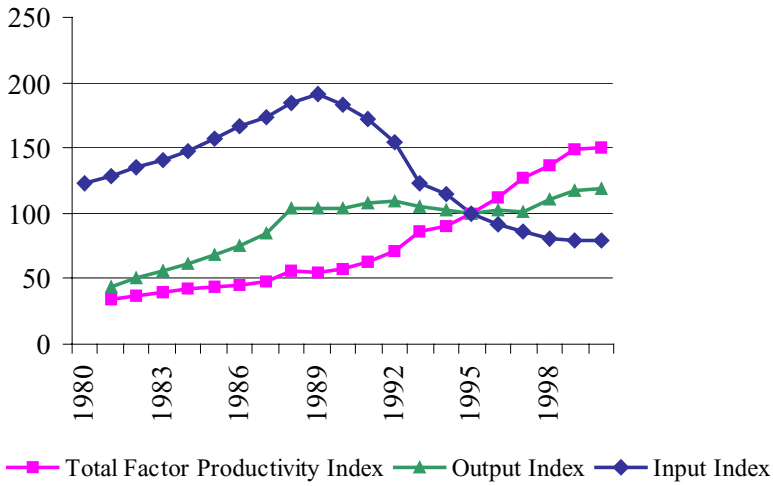
$$\ln TFP_{st} = \ln \frac{OutputIndex_{st}}{InputIndex_{st}} = \frac{1}{2}\sum_{i=1}^{3}(\omega_{is} + \omega_{it})(\ln y_{it} - \ln y_{is}) - \frac{1}{2}\sum_{j=1}^{3}(\upsilon_{js} + \upsilon_{jt})(\ln x_{jt} - \ln x_{js}),$$

where the first term on the right hand side is the output index discussed above and the latter part is the input index. Weights are υ_{js} and υ_{jt}, and there are 3 inputs x_j (j = 1,…,3). The Tornqvist index is computed by chaining the annual changes.

The total factor productivity of Finnish banking sector has been increasing steadily: 339% alltogether between 1981 and 2000. In the 1980s the growth was slower. It grew on average by 6% per year (Stdev. 2,4%) between 1981 and 1987. In the end of 1980s the heated economy shows up as a slight acceleration in the output and TFP indices.

It is interesting, however, that while the total output slowed down to nearly zero growth in the beginning of the 1990s and finally decreased in 1993–1997, TFP hit bottom in 1989 after which it has grown steadily until 1999, on average 10,7% annually (Stdev. 4,5%). Between 1989 and 2000 the total factor productivity of Finnish banks has increased by 177%. The massive banking crisis led to serious restructuring of the industry, which has since contributed remarkably to the productivity of the whole industry.

Figure 23. **Finland: Total factor productivity of the banking sector**



8 Conclusions

In this study we have computed the Tornqvist output and labour productivity indices for banking sectors in Finland, Sweden, UK, Germany, France and Italy. In addition to this we have also computed the total factor productivity for the Finnish banking sector. When we started the project we wanted to cover the period from 1980 to 2000 ie 21 years. However, this has not been possible to achieve for any of the countries, since the availability and reliability of data from the 1980s is far from good and some of the latest data has not yet been published in the statistics used here. The best coverage has been achieved with Finnish banking sector since we have access to data sources inside the Bank of Finland.

The quality of data unavoidably casts a shadow on the computed indices. Though they have improved remarkably during the process with the help of bits and pieces of information collected from different data sources there still remain a number of open questions that would require verification of the validity of data and acquisition of new data.

As a starting point we computed conventional measures of productivity namely cost to income and real assets to labour ratios. As expected they convey a slightly different picture. In actuality cost to income is a poor measure of productivity since the relative price changes of inputs and outputs blur the picture. Whereas cost to income ratio has remained almost unchanged for most countries the asset to labour ratio has increased steadily in all countries. According to our results real assets to labour is fair measure of banks' labour productivity. In all countries except France the average annual labour productivity growth comes close to average annual growth of real assets to labour ratio. Of course the actual annual rates can differ somewhat.

The output and productivity of the banking sector have improved in all countries during the period under study. It would seem that the largest improvement in labour productivity has been achieved by the banks in Finland. By reducing the number of employees they have managed to increase labour productivity by the end of the year 2000 from the 1981-level by 380%. At the same time the total factor productivity has improved nearly 340%. While labour has been reduced it has been replaced to a certain extent by capital and hence banking industry has become more capital intensive over the years.

The banking sectors in other countries differ from Finnish banking sector quite interestingly. This is true even for Sweden which is culturally closest to Finland and also experienced a banking crisis, though somewhat less severe one, in the beginning of 1990s. Banking sectors in all the countries in the data set have been able to improve labour productivity, though some more and some less. However, the difference lies in the extent of the structural reform carried out by the banks. Whereas Finnish banks cut labour by substantial amount while output

growth remained modest, the banks in the other countries increased output while labour force remained unchanged or decreased only modestly compared to Finland.

An interesting feature of the labour productivity (and overall output) growth is that the most remarkable improvements happened after the mid-1990s. What has caused this sudden improvement? There are number of candidates, among others European integration and technological innovations. It is clear that to answer this question requires econometric analysis.

References

Allen, R. – Diewert, W. (1981) **Direct versus Implicit Superlative Index Number Formulae.** Review of Economics and Statistics, 63, 430–435.

Allen, F. – Gale, D. (2000) **Comparing Financial Systems.** The MIT Press.

Benston, G.J. (1965) **Branch banking and economies of scale.** Journal of Finance, 20, 312–331.

Berger, A. – Humphrey, D. (1992) **Measurement and Efficiency Issues in Commercial Banking.** In Output Measurement in the Service Sectors, edited by Zvi Griliches, Chicago: NBER, University of Chicago Press, 245–300.

Caves, D.W. – Christensen, L.R. – Diewert, W.E. (1982) **The economic theory of index numbers and the measurement of input, output and productivity.** Econometrica, 50, 1393–1414.

Coelli, T. – Rao, P. – Battese, G. (1998) **An Introduction to efficiency and Productivity Analysis.** Kluwer Academic Publishers.

Colwell, R. – Davis, E. (1992) **Output and Productivity in Banking.** Scandinavian Journal of Economics, 94, Supplement.

Fixler, D. (1993) **Measuring financial service output and prices in commercial banking.** Applied Economics, 25, 983–993.

Freixas, X. – Rochet, J.-C. (1997) **Microeconomics of Banking.** The MIT Press.

Hulten, C. (2000) **Total factor productivity: A short biography.** NBER working papers 7471.

Levitt, M. (1993) **The Measurement of Banking Output.** Economic Notes by Monte dei Paschi di Siena, 22, No. 2.

Kim, M. (1986) **Banking Technology and the existence of a consistent output aggregate.** Journal of Monetary Economics, 18, 181–195.

Sherman, J.D. – Gold, F. (1985) **Bank branch operating efficiency: Evaluation with data envelopment analysis.** Journal of Banking and Finance, 9, 297–316.

Suominen, M. – Tarkka, J. (1991) **Rahoituspalveluiden markkinat ja tuotanto Suomessa.** Suomen Pankki, A:82.

Vassiloglou, M. – Giolias, D. (1990) **A study of the relative efficiency of bank branches: An application of data envelopment analysis.** Journal of Operational Research Society, 41, 591–597.

Appendix 1

Output data

As discussed above, thought the methodology for deriving the indices is quite simple, the errors are likely due to data problems. It would be useful to compare the results presented in this paper with results from alternative sources of data. Unfortunately it is not possible to double-check all the data in this way.

We use annual data on bank production aggregated on a country level. Since banks are multi-product firms that produce payment and other fee income generating services, liquidity and financing services, we need to formulate at least three services output indices for these separate sets of products.

As explained earlier, computation of financial intermediation output index, as well as the value of implicitly priced payment services, require information on four interest rate series: loan rate, time and demand deposit rates and market rate (average annual rate), and three series on stocks, namely loans, demand deposits, and time deposits (end of the year information). Most of the stock and interest rate data are acquired from IMF's International Financial Statistcis (IFS). IMF data are supplemented, and sometimes replaced, with OECD's Financial Statistics Monthly (Interest rate data) and OECD's Bank Profitability: Financial Statements of Banks (assets and liabilities stock data).

IMF's financial statistics database is an excellent source of data. Among other things it contains detailed information on the accounts of monetary and other financial institutions as well as information on interest rates. The data are available both monthly and annually. The only caveat concerns the differences between country specific definitions.

The majority of payment transaction data are from BIS and EMI/ECB statistics on payment systems. Weights are calculated by using the OECD's bank profitability information.

Below we list all data sources used:

- Bank of Finland database
- BIS: Payment systems in eleven developed countries (1980,1985,1989–1991)
- BIS: Statistics on payment systems in eleven developed countries (1988–1991)
- BIS: Statistics on Payment Systems in the Group of Ten Countries (1988–1999)
- Central Statistical Office (UK), Financial Statistics 1980–2000
- ECB: EU Banks' Income Structure, April 2000
- ECB: Payment and securities settlement systems in the European Union, June 2001

- EMI: Payment Systems in the European Union (1995–1996)
- IMF: International Financial Statistics
- OECD: Bank Profitability (see Methodological country Notes, 2000)
- OECD: Monthly Financial Statistics, Interest Rates
- Riksbank, Sweden
- Riksbank, Credit and Foreign Exchange statistics (1990–1991)
- Statistics Finland, Banks (1980–1998)

Payment services output

Payment transactions are used as a proxy for payment services output. The main data sources are the BIS data on eleven (or ten) countries and EMI/ECB payment systems statistics. The BIS data have been published in a book "Payment systems in eleven developed countries" in 1980, 1985 and 1989–1991. The book "Statistics on payment systems in eleven developed countries" is published in 1988–1991, and the book "Statistics on Payment Systems in the Group of Ten Countries" has been published in 1988–1999. The BIS statistics do not exist in electric form. The EMI statistics cover the period 1990–1994. The latest ECB Blue Book: Payment Systems in the European Union (June 2001) covers the period 1995–1999.

Since Finland is not among the G10 countries an alternative data source had to be found for the period before 1990. Finnish data are from The Finnish Bankers' Association for the period 1987–1999 due to some discrepancies with EMI data. The period 1981–1986 was covered with Bank of Finland's clearing data.

In the table below we list the length of the series, sources and notes on necessary data manipulations performed.

Table A1. **Payment services data**

	Time period	Source	Notes
Finland	1981–2000	BoF clearing data (1981–1985); Finnish Bankers Association	
Sweden	1980–1998	BIS (–77, –83, 88–93) and EMI/ECB (86–87 and 94–99)	Interpolated between 78–82 and 84–85
UK	1983–1999	BIS (–83) and EMI/ECB	84–86 interpolated
Germany	1983–1999	BIS (–83, 89–93) and ECB	84–86 interpolated
France	1983–1998	BIS (–83); ECB (87–98)	84-86 interpolated
Italy	1983–1999	BIS and ECB (95–99)	84–87 interpolated

Financial intermediation services output

We started to build the financial intermediation services (FIS) volume index by choosing the series from the IFS database. The interest rates selected are money market rate (60b), deposit rate (60l) and lending rate (60p). The assets and liability series were chosen under the heading "Deposit Money Banks". They consist of claims on private sector (22d), demand deposits (24) and time deposits (25). I describe the data country by country below.

Finland

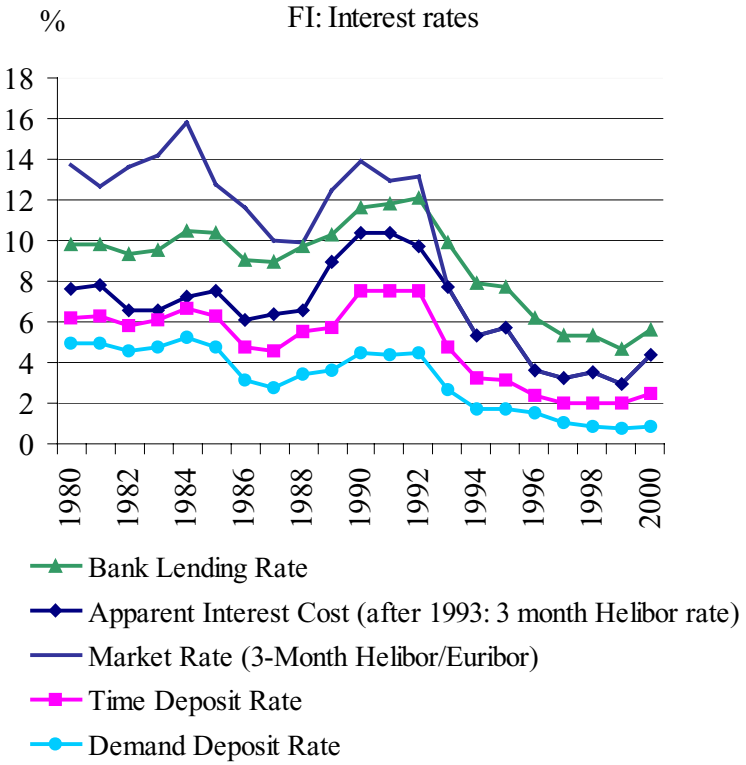
FIS-index turned out to be quite burdensome to compute for the Finnish banking sector. A major problem was posed by the interest rate data, namely market rates. Most of the 1980s were exceptional due liberalisation of previously highly regulated financial markets. This prevented formation of meaningful market rate. For large part of the period under study IFS reported market rate[36] is higher that the average bank leading rate. This leads to a bizarre situation where banks seem to make large losses with lending business. They also seem to have cross-subsidised this with revenue from time deposits (market rate-time deposit rate).

Since data on market rate is not reliable at least for the period 1980–1987 we decided to compute an *apparent market cost for funds*. To compute this we needed the OECD data on bank interest bearing liabilities. We subtracted interest expenses generated by deposits from all interest expenses and divided the remainder with interest bearing liabilities excluding deposits. In this way we managed to generate reasonably well behaving apparent market cost series. The price of funds to banks did not converge with market price until in 1993. The apparent market cost series ended in year 1998 due to shortness of OECD data series. We decided to use 3 month Helibor rate from 1993 onwards.

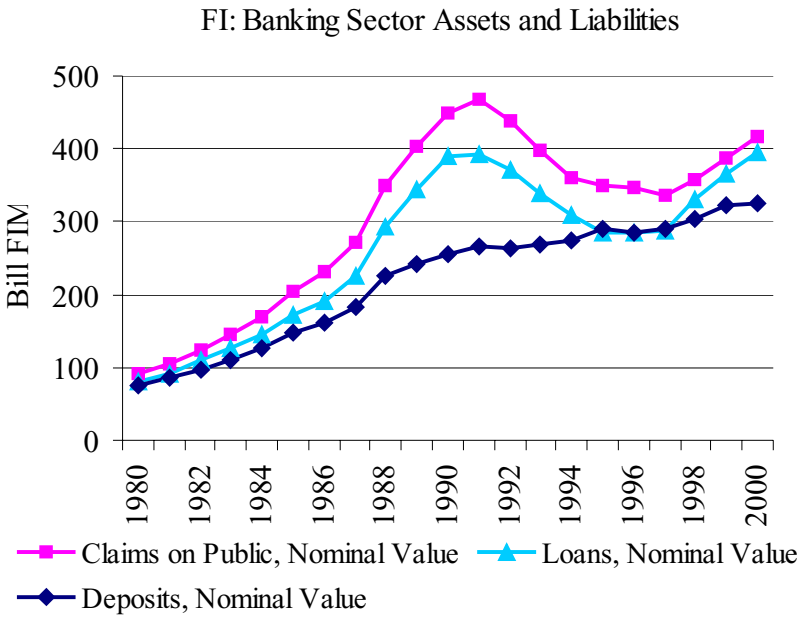
Since the IFS deposit rate is a weighted average of demand and time deposit rates, we had to use a different rate that would exclude demand deposits (these represent the largest share of all deposits in Finland). We experimented with numerous different time deposit rate series and in the end chose the average weighted time deposit rate for the period 1980–1988 (source: BoF; the series ended in 1988) and the 24 month time deposit rate for the period 1989–1997 and tax exempt time deposit rate for the period 1998–2000. Since weighted rate does not exist for the whole period the other interest rate series were chosen according to which time deposit type had the majority of funds.

The loan rate did not cause problems. We decided to use the average bank lending rate from IFS data base (series 17260p).

[36] Average cost of Central Bank Debt (or Feb. 2001 3-month helibor/euribor).



The Stock information from IFS showed some peculiarities. Even though the stock of aggregate deposits is quite close to BoF series, the sub-series on time and demand deposits differ quite remarkably. Though this was not critical for computation of FIS output index, we decided to use BoF data since the time period is longer (BoF: 1980–2000, IFS: 1980–1998). According to IFS data claims *claims on other resident sectors in the country* are much larger through the whole period than the Bank of Finland's bank loan (broad definition) series. This is why we chose the BoF series covering the period 1980–2000.

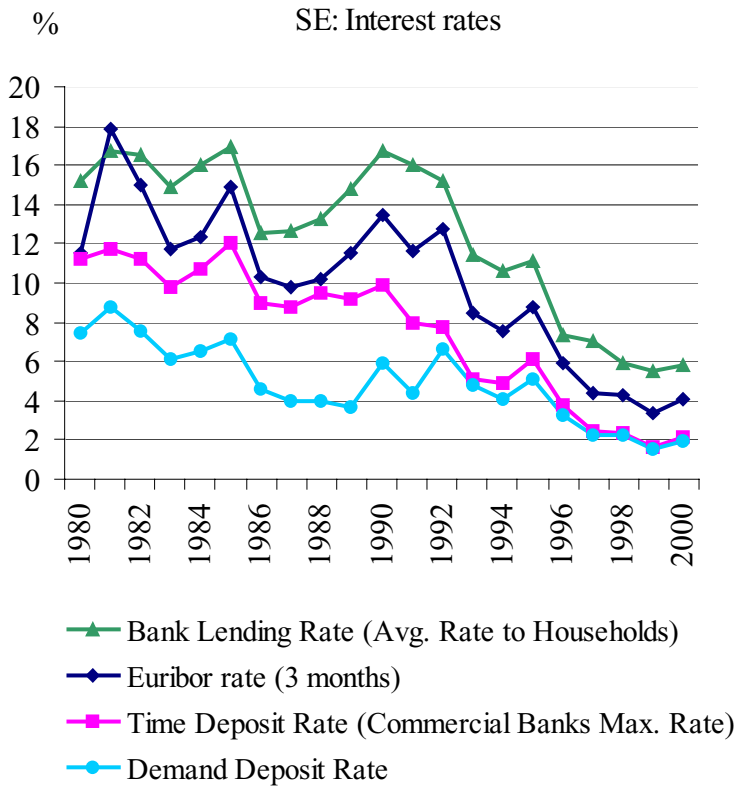


Sweden

With Sweden we had our share of difficulties. The IFS's interest rate information did not suit our purposes very well. Among other things the market rate posed problems. In the beginning of 1990s Sweden experienced a sharp interest rate hike while trying to prevent krona from being devalued. This showed up in the short term interest rates but was much less clear in the long term interest rates. Since the IFS market rate for Sweden is day-to-day interbank loan rate (monthly averages) we needed to find another longer maturity market rate series. Using BoF's database we were able to find 3-month euribor interest rate for Sweden.

Deposit rate was also quite problematic. The rate is for large part of the period a weghted average of different deposit rates which means that the demand deposit rate is again included in the series.

The loan rate did not pose any problems. The IFS loan rate series is before December 1992 the average rate on loans to households and after 1992 the average rate of total lending of 6 largest banks.



IFS data was used for loan and deposit stocks. However, the deposits are not disaggregated. This caused problems when calculating the implicitly priced payment services value.

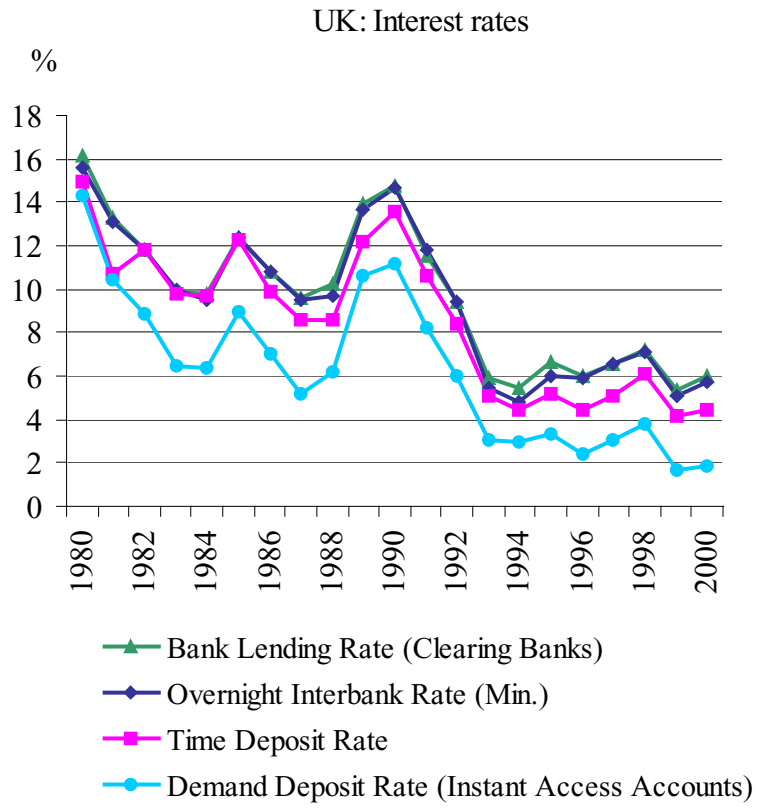
UK

From the point of view of this study IFS data on UK and Sweden have similar qualities. However, the market rate was not the root of the problem this time. Even though the IFS's UK market rate is the interbank offer rate for overnight deposits, it does not really seem to differ from interest rates with longer maturity.

The UK loan rate in IFS data is the loan rate for clearing banks. How good of a proxy this is for the whole banking sector is unclear since no alternative series was found. However, the time deposit rate series raised some suspicion since in more than one occasion the IFS time deposit rate[37] is higher than the loan rate. We felt that another data source was needed, also in order to obtain the demand deposit rate (see below discussion about payment services weight). We started to look for more suitable series from the Financial Statistics publication by UK's

[37] IFS time deposit rate is, according to its definition, the rate on instant access or seven-day notice accounts, which would mean that the rate is closer to being a demand deposit rate than time deposit rate.

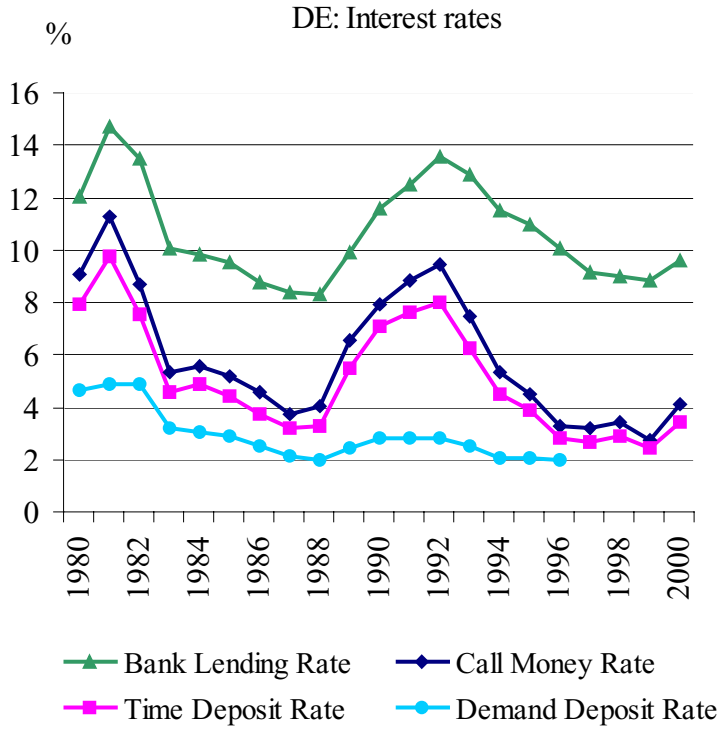
Central Statistical Office. This publication was found to include detailed, disaggregated series for all subsectors of UK's financial markets. However, the definitions have changed over time and so exactly suitable proxy for time or demand deposits was not found. Due to these difficulties we decided to drop the years 1980–1983 and for the rest of the period use a hybrid rate for time deposits. Years 1984–1988 it is the IFS deposit rate and 1989–2000 it is the CSO's 90 day account, medium balance (average money rate of selected retail banks).



CSO's Financial Statistics proved useful also in the case of deposit and loan stocks. Before 1987 IFS data does not include Building Societies in deposit money banks. After 1987 they are included. This leads to a large upward jump in the IFS's deposit and loan series in the 1987. We were able to correct this by adding the Building Society deposits (and shares) and loans into respective IFS series before 1987. As in Sweden also the UK demand deposits were not disaggregated. This created problems when computing the implicitly priced payment services value.

Germany

The IFS data seemed to be suitable for Germany. The market rate in the IFS data is the rate for overnight credit. The time deposit rate is the rate for 3-month deposits under 1 million, which is quite suitable for our purposes. Loan rate is the current account credit under 1 mill.

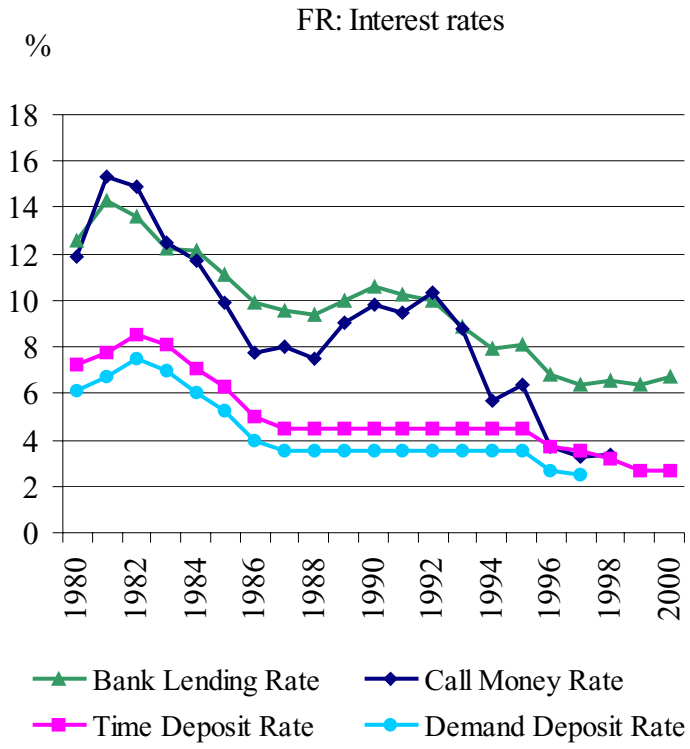


For Germany we utilised the IFS data also for loans and deposits. All and all, the data seems to behave quite well.

France

With France we had difficulties with deposit rates. However, the choice of loan rate and market rate was rather straight forward. We decided to use the 3- month euro rate as the market rate since if had a longer maturity than the call money rate that was available from the IFS. We obtained the euro rate from BoF database. The IFS's loan rate for France was the rate on short term bank loans. It followed the market rate quite nicely, except that the market rate was higher than loan rate for four consecutive years 1981–1984 and again in 1992. The Deposit rate available from IFS for France is called *rate on tax-exempt passbook deposits* at

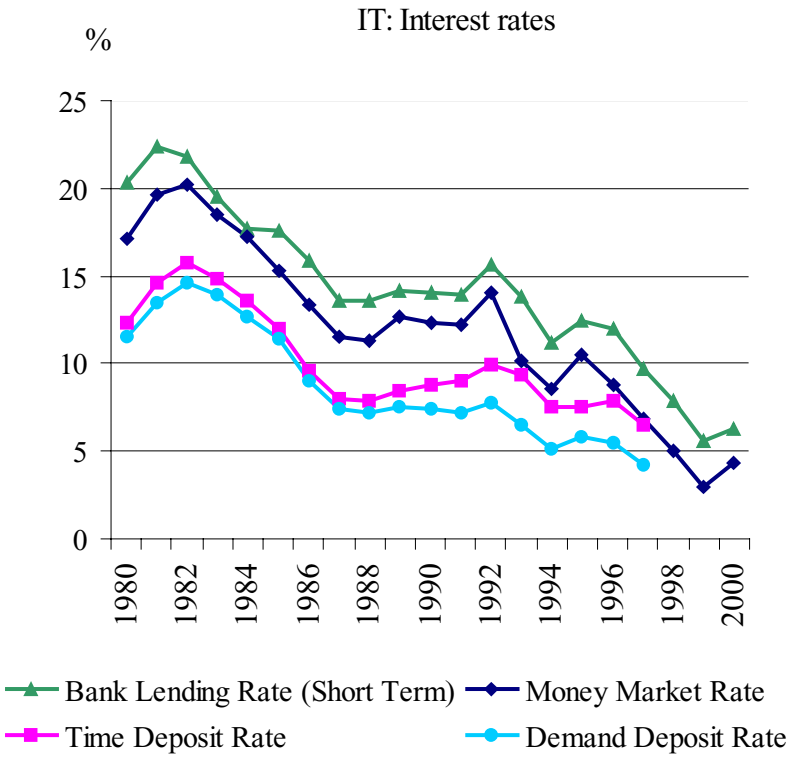
savings banks. We decided to use this since we did not have any good alternatives. Stock information is also from the IFS database.



Italy

In the IFS data the market rate for Italy is the 3-month interbank rate and the deposit rate is average rate paid on current accounts, savings accounts and certificates of deposits. Lending rate was not clearly specified. The IFS lending rate exhibited some peculiarities in the beginning of the 1980s. We decided to look for an alternative interest rate series. We found from the OECD data short term lending rate that matched that of IFS almost one to one except for the beginning of 80s. During this period the lending rate reported by OECD followed nicely the IFS reported market rate.

IFS deposit rate is a combination of demand and time deposit rates. Again, OECD data came to our rescue. We found two suitable series: rates paid on demand deposits and rates paid on savings deposits. The only handicap is shortness of these series. They end in 1997.



According to the IFS series on claims and deposits it seems that between 1980 and 1991 deposits were larger than loans to other resident sectors (excl. interbank). OECD data verifies this though there are small differences between the series from these two sources. It would seem that the deposit inflow was significantly larger than lending of funds to public. The overflow went to interbank market, securities and other assets.

Other services output

Originally we were hoping to be able to rely on OECD bank profitability data in computing the other services volume. This task turned out to be not quite as simple as that. In order to calculate the value of other services we had to subtract fee income from payment services from fee income from other services (including payment services). Even though OECD data on bank profitability does contain information on non-interest income most often for the period 1981–1999 (some countries 1984–1999; see table below), info on fee income from other services (including payment services) is available after the year 1993 at the earliest (exception: Italy has an excellent series covering the period 1984–1999). This meant that we had to approximate fee income using its average share of non-interest income (period 1981–1992).

Approximation of fee income was not necessary for Finland and Italy. Most of the data for Finland was obtained from the report on Finnish banks financial statements published by Statistics Finland. The fee income data on Italy covered the period 1984–1999.

For Sweden we supplemented the OECD data with ECB data on EU Banks' Income Structure (period 1993–1998). Sweden exhibited strange jump in the OECD's non-interest income series in 1992 and 1993. Since this series is used to derive the other services output we had to try to find another data source in order to validate the accuracy of observations in question. Riksbank came to our rescue. It turned out that the OECD series had erroneous observations in these two years. We obtained the correct data from Riksbank for the year 1993 and were able to interpolate the year 1992. This improved the quality of other services output, total output and labour productivity indices remarkably.

In order to compute the other services index we need to subtract the payment services fee income from the fee income from other services to avoid double counting. Unfortunately, OECD data does not report the sub groups of non-interest income. However, we were able to remedy this by using again the ECB report on EU Banks' Income Structure. In this report we found detailed descriptions of EU countries' non-interest income structures usually for the period 1993–1998 (Finland and UK: 1995–1998).

Interestingly, some countries turned out to have conflicting fee income data in ECB and OECD statistics. Germany and France had the largest discrepancy: the ECB reported share of fee income of non-interest income was approximately 60% for Germany and 56% for France (1993-1998) whereas OECD reported share was 76% Germany and only 40% for France. We decided to use the OECD data since most of the other series were also taken from OECD.

Unfortunately also in the ECB report there are countries which do not report the fee income from payment services. These are Sweden, UK and Germany. For these countries fee income from payment services had to be approximated using the information on other countries. We made an assumption that 20% of all fee income originates from payment services.

Table A2. **Other services data**

Country	Time period and data source	Fee income: time period and avg. share of non-interest income	Fee income from payment services: time period and avg. share of fee income
Finland	1981–2000 OECD, ECB, Statistics Finland, FSA	1981–2000 50%	1995–2000 31,7%
Sweden	1981–1998, OECD, ECB, Riksbank	1993–1999 53%	no info available ad hoc 20%
UK	1984–1999, OECD, ECB	1994–1999 75%	no info available ad hoc 20%
Germany	1981–1999, OECD, ECB	1993–1999 76%	no info available ad hoc 20%
France	1981–1999, OECD, ECB	1993–1999 76%	1993–1998 21%
Italy	1984–1999, OECD, ECB	1984–1999 35%	1993–1998 13%

While collecting fee income data for Finland we ran into a strange discrepancy between OECD data and Statistics Finland data. The non-interest income reported in OECD statistics is on average 24% larger than the Statistics Finland series in 1990–1997. Both data sets claim to report data on same institutions operating in Finland. After comparing the data with BoF's supervisory information we decided that the Statistics Finland data was closest to the truth. The payment services fee income data was taken from the ECB's report on banks' income structure. However, we were able to continue the data all the way to year 2000 with the Financial Supervision Authority's data on bank income structure.

After computing the fee income from other services we needed a price index in order to deflated the series. However, there exists no appropriate index. This is why we finally decided to rely on CPI to avoid unnecessary confusion. However, it should be noted that other services volume can well be exaggerated in 1990s since the inflation in consumer goods has been modest, whereas other services demand has started to increase. It is quite possible that during the banking crisis in Finland and Sweden banks were trying to cover part of their loan losses with profits from payment and other services. On the other hand, a counter balancing force can well be the improved quality of other services achieved through the use of new techology.

Appendix 2

Output weights

As discussed earlier, calculation of Tornqvist index requires annual weights. A good candidate in the case of banking services total output is to use income shares of respective service categories. We used the OECD bank profitability statistics as the main source for data. In some cases we had to supplement or replace the OECD data with other data sources (see discussion on data used to compute the other services output index).

Payment services

Weight for payment services is formed by two parts: fee income from payment services and implicitly priced payment services value. The weight is computed by adding together these two value series for each of the years under study. However, both value series leave much to be desired. The problems faced with other services production (excluding payment services) was discussed above. There we also explained the difficulties we met in subtracting the fee income from payment services from other fee income. After using various data sources and making numerous more or less ad hoc assumptions we finally had an approximation of fee income generated by payment services. Next we faced the task of computing the value of implicitly priced payment services.

In order to calculate the implicitly priced payment services value we need information on demand deposits, as well as demand and time deposit rates. For most countries IFS database contains disaggregated deposits. However, UK and Sweden do not report these. The demand deposit rate caused problems since neither the IFS nor OECD databases seemed to have reliable enough time and demand deposit rate for neither of these countries. For the Swedish banking sector we decided to use a composite rate from OECD (1981–1989) and BoF (1992–2000) supplemented with data from Riksbank's Credit and Foreign Exchange statistics (1990–1991). The series for demand deposits was obtained from Riksbank (1989–2000). However, since data from the period 1980–1988 was missing we decided to use an assumption that demand deposits were an even 57% of all deposits, which was the average share between 1989–2000. The use of this data resulted in abnormally large weight for payment services in the 1980s and beginning of 1990s. It is likely that the overall output and labour productivity indices for the period 1981–1991 are far from reliable in the case of Swedish banks.

For UK banks we were not able to find appropriate series using the IFS or OECD sources. We had to rely on CSO's Financial Statistics, which proved to be a valuable source. For calculating the implicitly priced payment services value we needed stock information on demand deposits and interest rate information on demand and time deposits. From CSO statistics we chose the series *Sterling sight deposits to public* (firms, households and public sector) to represent demand deposits. We ended up leaving out possibly a large amount of foreign currency nominated liabilities, but we wanted to make sure that we were able to separate demand deposits and time deposits accurately. In CSO statistics foreign currency nominated deposits are included as an aggregate (sight and time deposits).

For demand deposit rate we used from a series *Selected retail banks: deposit account with 7 days' notice* CSO table *Average money rates*. In 1990s the table Average money rates changed. Interest rates closest to demand deposit account is from 1990s onwards the rate on *Instant access accounts (small balance)*. Table also included the rate for *90-day accounts (medium balance and large balance)* which could be used for time deposit rate. However, before 1990 there are no suitable time deposit rate series. This is why we decided to use the IFS interest rate data to cover the period between 1984 and 1988. It should also be noted that building societies rates were combined with other deposit bank rates only after 1999.

Germany faced a different problem. Since the demand deposit rate data were available only for the period 1980–1996, we were able to compute the implicitly priced payment services for this period only. Since the financial intermediation services weight is calculated by subtracting the implicitly priced payment services value from net-interest income we ended up with two weight series covering only the period 1980–1996. However, since the number of transactions is used as proxy for payment services volume our services output indices cover the period 1983–1999. We decided to copy the weights from 1996 to cover the period 1997–1999.

As discussed earlier the selection of interest rates available for France was very limited. However, we had to find a series that would be a proxy for demand or transaction deposits. Since the IFS data was only able to deliver the time deposit rate we decided to rely on OECD monthly interest rate data. However, non of the series seemed to correspond to what we needed. Finally we decided to use the series inappropriately (to our purposes) named *Time deposits up to 1 year*. This series clearly followed that of the above mentioned time deposit rate, being only approximately 1 percentage point lower than IFS time deposit rate. Due to time constrained the above results are based on this rather weak proxy for demand deposit rate. It is likely that the variation of the payment services weight for France is underestimated since, with reference to other countries, it is likely that the margin between time and demand deposit rates varies ±1%-point.

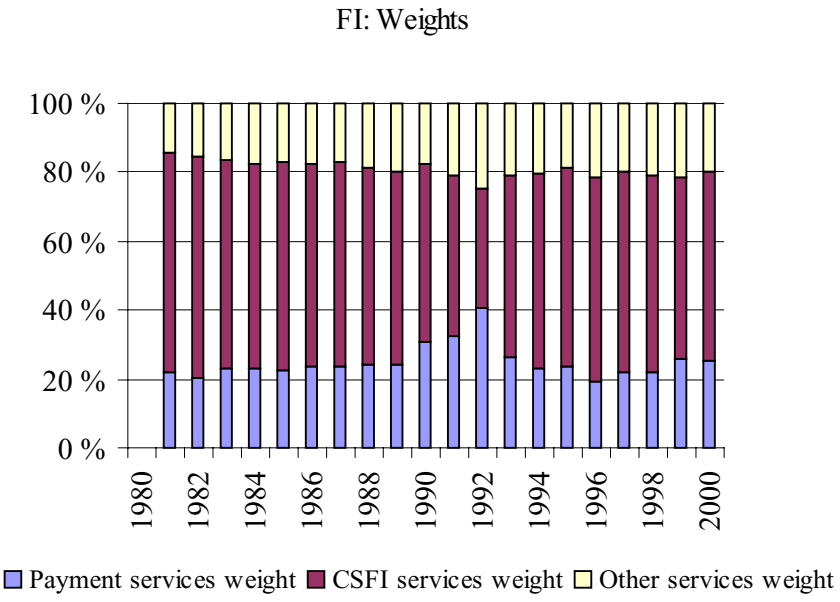
For Italy we used the OECD series for demand and time deposit rates. The demand deposit stock series is from IFS.

Financial intermediation services

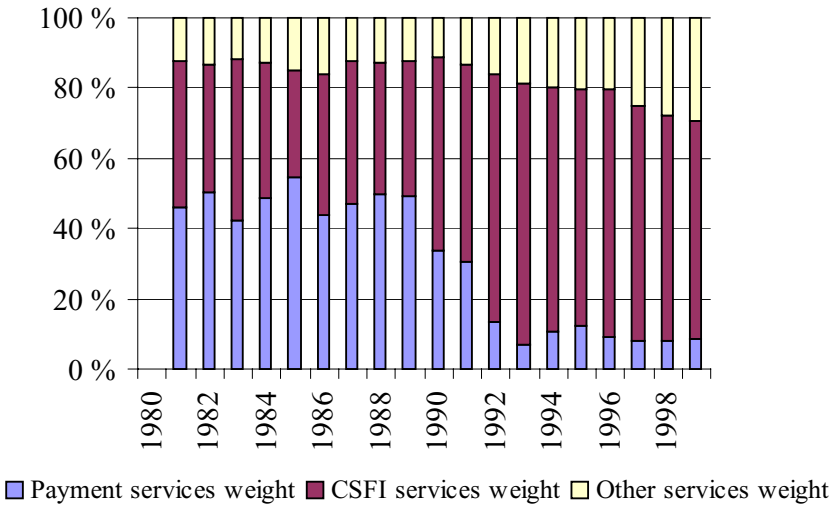
Since the framework used here is based on the assumption that part of the income from payment services is in the form of implicit payments ie interest income, we had to divide the net interest income into payment services and intermediation services income to obtain a weight for financial intermediation services. We achieved this by subtracting the implicitly priced payment services value from net interest income. After the difficulties mentioned above the computation in itself was very straight forward. We obtained the data on net interest income from the OECD bank profitability statistics. To our knowledge this series is well behaving even for Finland (ie it does not exhibit the same peculiarities as does the non-interest income series) the only problem being the shortness of the data for some countries.

Other services

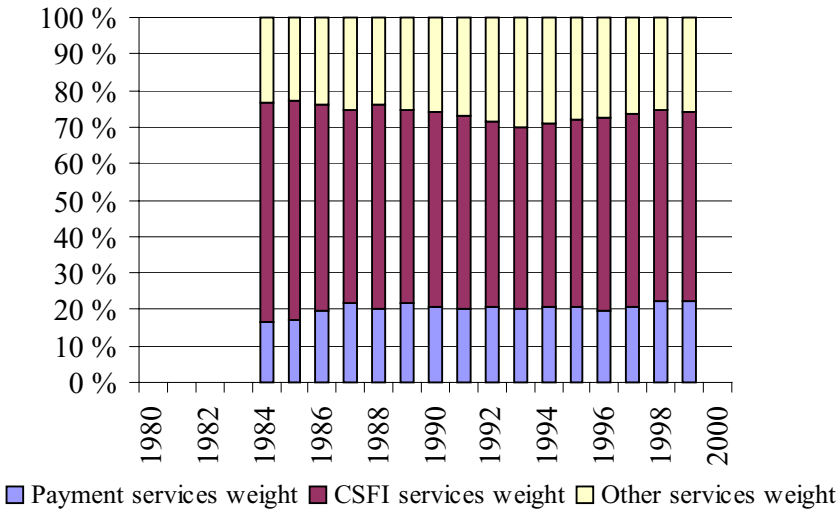
The natural choice for computing a weight for other services is the fee income value from these services. The problems inherent in this series are discussed above.



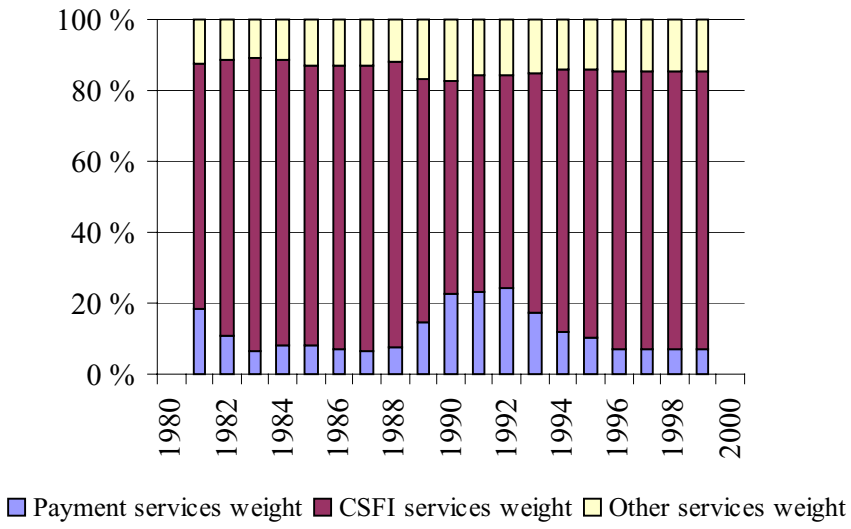
SE: Weights



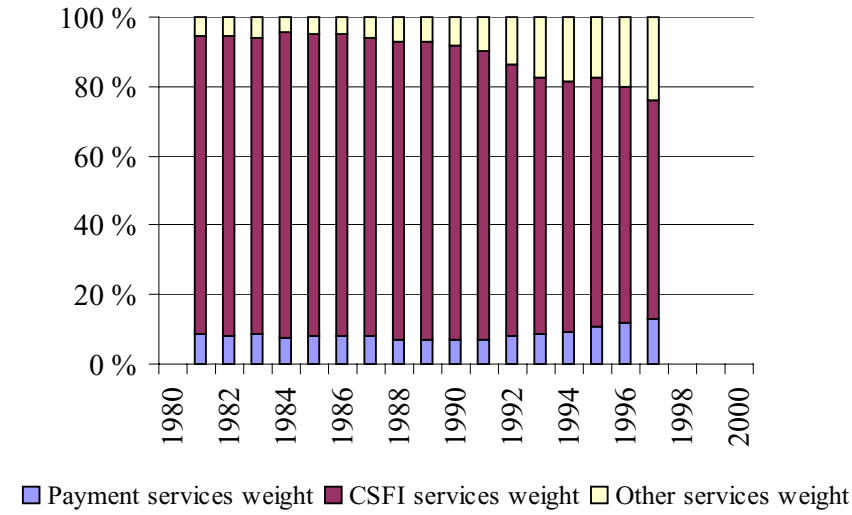
UK:Weights

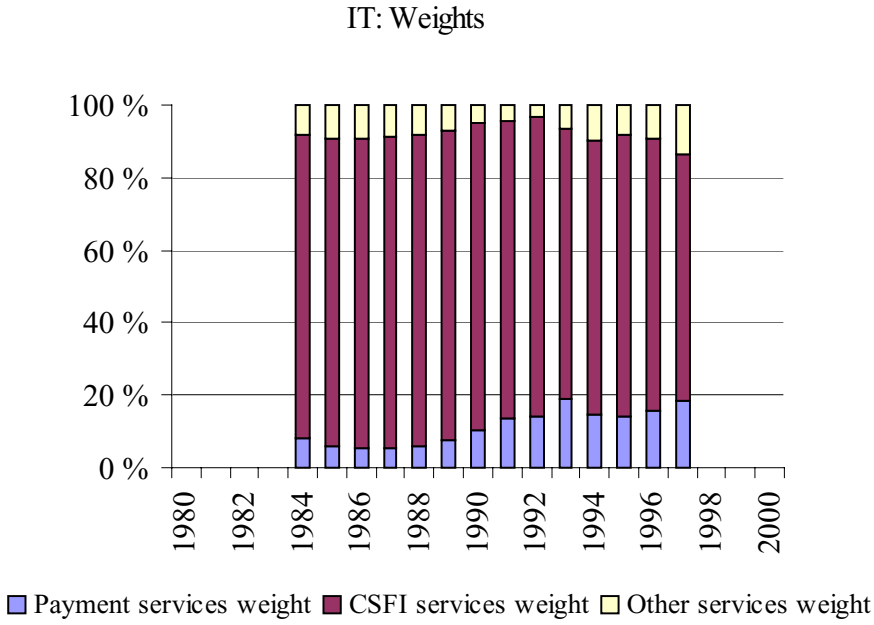


DE: Weights



FR: Weights




IT: Weights
100 %
80 %
60 %
40 %
20 %
0 %
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
Payment services weight
CSFI services weight
Other services weight

Appendix 3

Labour

Finland

For Finland the labour data was taken from the Statistics Finland's annual banking sector statistics (The Banks).

Sweden

OECD statistics report commercial and savings banks labour force for the period 1981–1999. Co-operative banks are reported only for 1981–1991 since they were transformed into limited company after 1991 and were included in the commercial bank figures.

UK

The figures for UK are available between 1984 and 1999 in the OECD statistics.

Germany

The figures for Germany are available only for a relatively short period of 1989–1999.

France

The OECD data on France included only commercial and credit co-operative banks between 1982 and 1989. The series containing all banks begun in 1988 ie there were two overlapping years (1988 and 1989). Using this information we calculated the difference between the two series and used the growth rate of the first series to approximate a series containing all banks for France for the period 1982–1999.

Italy

Italy reports commercial and savings banks from the period 1981–1989 and the group all banks from 1988–1999. As with France, there are two overlapping years and so we apply similar method as above. Using growth rates between 1981–1987 and the difference between all banks and commercial and savings banks in 1988 we approximate the growth rate of banks missing from the data before 1988.

Appendix 4

Nominal values of outputs

Table A3. **Payment services**
(fee income + implicitly priced services income)

	Billions of local currency					
	Finland FIM	Sweden SEK	UK GBP	Germany DEM	France FRF	Italy ITL
1980	0,984	5,757				
1981	1,120	5,577		9,019	9,034	
1982	1,240	7,440		6,204	9,911	
1983	1,516	7,889		4,145	12,221	
1984	1,807	9,841	2,034	5,523	12,203	2568,467
1985	2,122	11,793	2,273	5,669	13,189	2114,197
1986	2,295	12,586	2,819	5,248	15,001	2156,908
1987	2,822	13,955	3,384	5,120	15,432	2131,466
1988	3,513	17,351	3,713	5,767	17,608	2642,144
1989	3,961	19,085	4,508	12,244	18,832	3894,785
1990	5,651	15,595	4,536	20,740	20,415	5842,385
1991	5,681	15,452	4,728	23,278	21,212	8092,95
1992	5,815	6,449	4,931	27,209	24,413	9736,076
1993	4,654	3,730	5,261	23,179	25,528	13797,74
1994	3,824	5,661	5,438	17,166	27,074	10587,87
1995	3,767	7,077	5,672	14,979	30,141	10706,48
1996	3,003	4,635	6,191	10,871	32,315	12000,8
1997	3,508	4,055	7,130	10,871	34,654	13753,68
1998	3,804	3,922	7,892	10,871		
1999	4,346	4,059	8,457	10,871		
2000	4,982					

Table A4. **Nominal value of financial intermediation services**

	Billions of local currency					
	Finland FIM	Sweden SEK	UK GBP	Germany DEM	France FRF	Italy ITL
1980		10,630		47,085	103,522	19332,24
1981	3,184	15,353		59,990	133,780	21345,28
1982	3,804	17,699		79,956	105,987	20079,18
1983	4,298	18,950		79,926	97,737	17588,55
1984	5,389	21,734	5,323	76,814	146,078	18231,48
1985	6,709	20,760	1,280	83,747	153,540	25425,53
1986	7,897	17,990	2,807	85,534	173,133	31461,94
1987	8,950	21,702	3,555	92,842	187,091	30911,62
1988	11,686	25,903	7,105	93,327	198,137	34997,25
1989	12,483	42,230	8,244	84,232	221,893	38078,08
1990	12,169	53,023	6,237	103,104	246,148	39530,63
1991	13,228	67,098	3,371	118,030	240,903	40427,37
1992	14,827	53,870	5,564	147,623	206,677	50665,16
1993	15,449	45,522	5,702	196,089	195,520	42686,41
1994	13,675	43,307	7,301	229,426	194,277	35947,1
1995	13,184	37,524	11,829	247,582	207,040	48419,46
1996	10,811	30,000	12,325	273,296	202,421	42995,16
1997	9,512	42,290	12,078	257,666	193,193	35399,34
1998	10,646	34,165	9,891	264,122		
1999	9,524	42,661	10,891	310,964		
2000	11,093	42,227	16,784	283,928		

Table A5. **Nominal value of other services**

	Billions of local currency					
	Finland FIM	Sweden SEK	UK GBP	Germany DEM	France FRF	Italy ITL
1980	0,626					
1981	0,723	1,498		4,770	5,907	
1982	0,935	1,964		5,235	6,990	
1983	1,077	2,213		5,456	8,238	
1984	1,362	2,580	2,884	6,020	7,025	2568,240
1985	1,582	3,189	2,971	7,447	7,916	3156,360
1986	1,700	4,536	3,450	7,841	9,089	3794,940
1987	2,062	3,664	3,970	7,743	11,295	3605,280
1988	2,752	4,412	4,380	7,417	17,686	3730,560
1989	3,217	4,837	5,263	11,019	19,136	3587,880
1990	3,245	5,171	5,624	12,506	23,002	2837,940
1991	3,625	6,870	6,274	12,379	28,976	2528,220
1992	3,561	7,985	6,760	13,560	41,094	2213,280
1993	3,681	10,301	7,868	20,093	50,666	4893,450
1994	3,329	10,139	7,500	20,583	55,103	6990,060
1995	2,962	11,451	7,562	20,388	48,775	6147,420
1996	3,402	10,378	8,658	22,274	54,831	6929,020
1997	3,177	12,778	9,092	26,169	63,666	10148,550
1998	3,612	13,258	9,091	28,688	70,379	16053,820
1999	3,644	14,221	9,711	34,538	81,215	19118,250
2000	3,935					

Appendix 5

Input and output quantity indices

Table A6. **Indices for Finland**

Finland	Output indices				Input indices				Productivity indices	
	Payment services output	FI-services output	Other services output	Overall output	Labour	Real estate capital	Other capital	Overall input volume	Labour productivity	Total factor productivity
1980			45		126	202	69	123		
1981	21	59	47	44	135	197	70	129	33	34
1982	27	65	55	50	137	200	87	135	37	37
1983	36	69	58	57	139	202	106	141	41	40
1984	39	74	69	62	142	205	125	148	43	42
1985	47	81	76	69	146	203	156	156	47	44
1986	56	87	79	75	151	204	198	167	50	45
1987	63	95	92	84	155	203	225	174	55	48
1988	72	121	117	104	161	202	265	185	65	56
1989	81	111	128	104	165	189	305	192	63	54
1990	80	114	122	104	156	177	302	182	67	57
1991	86	114	131	108	147	161	284	172	73	63
1992	89	115	125	109	132	151	248	154	83	71
1993	90	106	127	105	116	123	150	124	91	85
1994	94	103	114	103	112	113	124	115	91	90
1995	100	100	100	100	100	100	100	100	100	100
1996	103	98	114	102	89	99	91	91	115	112
1997	107	98	105	101	73	93	92	86	139	126
1998	113	107	118	110	76	90	86	81	145	137
1999	121	116	118	117	74	87	85	79	158	150
2000	131	113	123	119	75	87	85	80	158	150

Table A7. **Indices for Sweden**

Sweden	**Output indices**				**Input indices**	**Productivity indices**
	Payment services output	FI-services output	Other services output	Overall output	Labour	Labour productivity
1980	51	91				
1981	58	92	30	67	81	83
1982	65	93	36	73	83	88
1983	71	93	37	76	86	89
1984	77	97	40	81	90	90
1985	83	93	46	85	92	92
1986	89	106	63	96	97	99
1987	93	112	49	97	101	96
1988	93	130	56	105	124	84
1989	101	134	57	111	105	105
1990	99	127	55	107	103	104
1991	95	123	67	106	105	101
1992	98	105	76	99	102	97
1993	99	100	94	98	95	103
1994	97	102	91	99	100	100
1995	100	100	100	100	100	100
1996	106	108	90	104	99	105
1997	112	122	110	119	98	121
1998	113	126	115	123	100	123
1999	130	143	123	137	98	140
2000		148				

Table A8. **Indices for United Kingdom**

UK	Output indices				Input indices	Productivity indices
	Payment services output	FI-services output	Other services output	Overall output	Labour	Labour productivity
1980						
1981						
1982						
1983	51					
1984	55	47	64	53	88	60
1985	58	49	62	54	89	61
1986	62	57	70	61	92	67
1987	66	64	77	68	95	71
1988	70	75	81	76	105	72
1989	74	81	90	82	108	76
1990	79	80	88	83	108	77
1991	81	68	93	77	105	74
1992	83	79	96	85	105	81
1993	84	90	110	94	97	97
1994	88	96	103	96	101	95
1995	100	100	100	100	100	100
1996	107	101	112	105	109	96
1997	112	101	114	107	110	97
1998	118	107	110	110	107	103
1999	124	112	116	115	107	108
2000		121				

Table A9. **Indices for Germany**

Germany	Output indices				Input indices	Productivity indices
	Payment services output	FI-services output	Other services output	Overall output	Labour	Labour productivity
1980		50				
1981		49	33			
1982		52	35			
1983	46	54	35	49		
1984	48	57	38	52		
1985	50	59	46	55		
1986	52	61	48	57		
1987	55	64	47	59		
1988	56	65	45	60		
1989	59	65	65	63	80	79
1990	69	76	72	73	92	80
1991	79	80	70	78	95	82
1992	88	83	73	82	98	83
1993	93	89	103	91	99	92
1994	99	95	103	97	100	97
1995	100	100	100	100	100	100
1996	104	107	108	107	99	108
1997	111	111	124	113	99	114
1998	118	118	135	120	99	121
1999	126	133	161	136	100	136
2000		122				

Table A10. **Indices for France**

France	**Output indices** Payment services output	FI-services output	Other services output	Overall output	**Input indices** Labour	**Productivity indices** Labour productivity
1980		70				
1981		65	22			
1982		59	23		111	
1983	50	61	25	56	111	51
1984	55	69	20	63	114	55
1985	60	72	21	66	113	58
1986	65	78	24	72	111	65
1987	70	79	28	73	110	66
1988	76	84	43	80	109	73
1989	80	81	45	78	109	72
1990	85	79	53	78	108	72
1991	87	80	64	80	106	75
1992	90	69	89	74	104	71
1993	93	80	107	86	100	86
1994	97	102	115	104	100	103
1995	100	100	100	100	100	100
1996	106	112	110	111	99	112
1997	109	115	126	117	97	120
1998	114		139		98	
1999			159		97	
2000						

Table A11. **Indices for Italy**

Italy	**Output indices** Payment services output	FI-services output	Other services output	Overall output	**Input indices** Labour	**Productivity indices** Labour productivity
1980		80				
1981		76			89	
1982		79			89	
1983	43	78			91	
1984	51	82	77	79	94	84
1985	59	79	86	78	94	82
1986	67	82	98	82	96	86
1987	75	85	89	84	96	88
1988	83	90	88	89	96	92
1989	87	93	79	91	97	94
1990	94	98	59	94	98	96
1991	95	102	49	96	100	97
1992	97	103	41	97	100	97
1993	97	107	87	104	101	103
1994	98	104	120	104	100	104
1995	100	100	100	100	100	100
1996	115	102	108	104	97	108
1997	124	105	156	113	95	118
1998	129		241		94	
1999	142		283		92	
2000						

BANK OF FINLAND DISCUSSION PAPERS

ISSN 0785-3572, print; ISSN 1456-6184, online

1/2002 Tuomas Välimäki **Bidding in fixed rate tenders: theory and experience with the ECB tenders.** 2002. 45 p. ISBN 951-686-763-4, print; ISBN 951-686-764-2, online. (TU)

2/2002 Juha Junttila **Forecasting the macroeconomy with current financial market information: Europe and the United States.** 2002. 70 p. ISBN 951-686-765-0, print; ISBN 951-686-766-9, online. (TU)

3/2002 Seppo Honkapohja – Kaushik Mitra **Performance of monetary policy with internal central bank forecasting.** 2002. 44 p. ISBN 951-686-767-7, print; ISBN 951-686-768-5, online. (TU)

4/2002 Iftekhar Hasan – Markku Malkamäki – Heiko Schmiedel **Technology, automation, and productivity of stock exchanges: International evidence.** 2002. 41 p. ISBN 951-686-769-3, print; ISBN 951-686-770-7, online. (TU)

5/2002 Vesa Kanniainen – Mikko Leppämäki **Financial institutions and the allocation of talent.** 2002. 23 p. ISBN 951-686-771-5, print; ISBN 951-686-772-3, online. (TU)

6/2002 Anne Brunila – Marco Buti – Jan in't Veld **Cyclical stabilisation under the Stability and Growth Pact: How effective are automatic stabilisers?** 2002. 33 p. ISBN 951-686-773-1 print; ISBN 951-686-774-X, online. (KT)

7/2002 Anne Brunila **Fiscal policy: Coordination, discipline and stabilisation.** 2002. 24 p. ISBN 951-686-775-8 print; ISBN 951-686-776-6, online. (KT)

8/2002 Ari Hyytinen – Iikka Kuosa – Tuomas Takalo **Law or finance: Evidence from Finland.** 2002. 57 p. ISBN 951-686-777-4, print; ISBN 951-686-778-2, online. (TU)

9/2002 Bill F. Francis – Iftekhar Hasan – Delroy M. Hunter **Returns and volatility linkages in the international equity and currency markets.** 2002. 36 p. ISBN 951-686-779-0, print; ISBN 951-686-780-4, online. (TU)

10/2002 Heli Paunonen – Hanna Jyrkönen **Cash usage in Finland – How much can be explained?** 2002. 33 p. ISBN 951-686-781-2, print; ISBN 951-686-782-0, online. (RM)

11/2002 Heiko Schmiedel **Total factor productivity growth in European stock exchanges: A non-parametric frontier approach.** 2002. 37 p. ISBN 951-686-783-9, print; ISBN 951-686-784-7, online. (TU)

12/2002 Leena Mörttinen **Banking sector output and labour productivity in six European countries.** 2002. 73 p. ISBN 951-686-785-5, print; ISBN 951-686-786-3, online. (TU)