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Empirical Evidence of a Changing Operating Cost Structure and Its Impact on Banks' Operating Profit: The Case of Germany

Florian Diener

Department of Entrepreneurship, Faculty of Business Administration, Prague University of Economics and Business, Churchillovo nám. 4, 137 00 Praha 31, Czech Republic; florian.diener@vse.cz;
Tel.: +49-(0)151-4053-2978

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Abstract: The financial sector is undergoing extensive changes and challenges that affect the entire market and infrastructure of financial service providers. Technological development leads to increased digitalisation and allows new business models to emerge. With regard to the banking sector, it is evident that this sector is characterized by employees and associated services. However, due to changing conditions, a decline in personnel has been recorded for many years. This raises the question as to what extent—based on contrary assumptions of the principle agency theory and the expense preference hypothesis—personnel changes influence the operational success of banks. On this basis, six hypotheses were formulated and tested. The principal component analysis method was applied to prepare the data. Afterwards, the actual analysis was carried out using a mixed method approach. The results on the basis of the years 2013–2017 showed a negative personnel development, which contributed to the improvement of the operating results of banks. Hereby it becomes evident that the business model design of savings and cooperative banks is of secondary importance.

Keywords: banking; cost structure; digitalisation; human resources; operating profit

JEL Classification: G10; G21; M1; M12; M54

1. Introduction

Technological development is leading to ever stronger software and hardware performance. Banks have to adapt to new technologies, increased competition with new competitors, and ever stronger regulation (Vives 2019), as well as human behaviour that has become increasingly digital in recent years (Omarini 2019). As a result, more and more digital offerings are being implemented by traditional bank institutions and anchored as an integral part of their business models[1] (Mohan 2015; Maiya 2017). In this process, transformation and operating costs can be saved through technological development (Mirković et al. 2019). This can be done on a procedural as well as on an administrative level. In recent years, for example, there has been an increasing reduction in the number of staff at financial institutions (banks); however, the actual reasons for this development have not yet been fully investigated. Nevertheless, it can be assumed that digitalisation has a fundamental influence on the positioning and management of a bank (Diener and Špaček 2020).

[1] 'A business model [. . .] consists of four interlocking elements that, taken together, create and deliver value. The most important [. . .], by far, is the first (Johnson et al. 2008).' Elements: Customer value proposition, profit formula, key resources, and key processes.

The bank we know from the past has always been characterised by employee–customer contact. Today, digitalisation is changing this relationship. Customers are increasingly taking advantage of digital services, thereby encouraging branch closures and staff reductions due to the increasing irrelevance of personal contact. It can be assumed that operating expenses, especially of a bank, are influenced by this digital development. These expenses, in turn, have a direct influence on the overall profitability of a bank and are also used as an indicator for the efficiency of corporate management and for cost control. The concepts of costs and expenses are often used interchangeably in everyday usage, as they are in this paper[2] To maintain past and present levels of bank customer service that has been built up over many years, sufficient staff must still be appropriately qualified and motivated on the one hand, and the processes and services offered must be adapted to customer requirements on the other, to maintain loyalty (Barari and Furrer 2018). It is, however, questionable how long this will be the case. Nevertheless, despite rapid digital development, human capital still plays an important role in banking (Fernandes and Pinto 2019), which is why employee motivation and satisfaction are still particularly important and must be maintained. Adequate remuneration is of crucial importance for employee motivation, although the level of service is not driven solely by monetary motivation, but rather by the overall satisfaction and appropriate qualification of employees (Mphil et al. 2014), which can be actively controlled by management. Low-level satisfaction—for example, due to job insecurity caused by the increasing digitalisation and staff reductions in banking—creates the risk of emigration and reduced willingness to perform, which affects not only the qualitative but also the quantitative outcome of work performance. Then, in turn, this influences the bank's operating profits (Chai et al. 2016). Not only the motivation of employees, but also automation or rather technology (can) improve the internal performance of a bank institution. In the past, this required appropriately qualified personnel and appropriate hardware and software. However, with the further development and omnipresence of continuous digitalisation, the issue is increasingly becoming the focus of customers, entrepreneurs, and educational institutions, making qualified personnel and technology more easily available today than they were a few years ago. Additionally, this favours and accelerates digital development (Ortaköy and Özsürünç 2019). In the meantime, customers can also receive precisely tailored product and service offers on a purely technological level, while being provided with a wide range of information and while their needs are increasingly being met digitally.

A holistic view of operational finances and current development shows that the potential of banks can be exploited through further technological development (Phan et al. 2020; Lee et al. 2020). This leads to the question as to whether the operating results of banks in the current economic environment can still be influenced by operational structuring—for example, by regulation of operating expenses. Other questions raised include whether increasing technological development will lead to higher profits and whether personnel reductions will further promote this development, or whether the banks will rather be forced to reduce staff or no longer fill positions to remain competitive. The former, in turn, leads to the assumption that bank employees of the past are increasingly redundant (Ortaköy and Özsürünç 2019). This gives rise to the overall question of to what extent personnel is needed in banking in the future. In addition, it must be questioned whether the theoretical assumptions made in the past about the influence of personnel on the banking business are still valid today (Chen and Strange 2005; Grigore and Ştefan-Duicu 2013; Ojeleye 2017; Ress 1974; Williamson 1963).

Following this thematic issue, this article will contribute to the development of a methodology for the analysis of highly multicollinearity data, which will provide the basis for further analysis of directly related financial values and analysis of personnel costs and their effects. In addition, existing assumptions on personnel costs and their impact on operating profit are reviewed on the basis of a

[2] In accounting, differences exist between these terms. When an enterprise purchases a service or product, it incurs an expense. As soon as the company receives a vendor invoice, it is posted and becomes an expense. An expense is a payment or cash outflow. Costs are associated with expenses, but they're associated with a specific period. Accountants use the word *expense* when costs are spent on a company's revenue-generating activities.

specific industry, namely banking. The paper contributes to combine existing statistical methods and to enhance the assumptions on this at the scientific level in order to create transparency about human resource development and its influences in a changing industry.

2. Thematic Classification and Hypothesis Development

In the following section, the research area is presented and examined with regard to the German banking market and the overall human resources development, as the statistical data indicate a continuous change in the German banking market and therefore should be analysed in more detail. In addition, the position of the paper in the context of finance and management of scientific research is explained with regard to existing literature, whereby the hypotheses are derived from existing assumptions and theories.

2.1. The German Banking Market

The German savings and cooperative banks that account for most of the regional and supra-regional branch coverage in retail banking (see Table 1) differ significantly in their business model on an organisational and structural level. Due to the omnipresence of these two sectors and the data accessibility for this analysis, this paper focusses on exactly these two banking models, which are described in more detail below for better classification.

Table 1. Bank branches by bank groups 1997–2017 in thousands.

Bank Branches	1997	2009	2010	2011	2012	2013	2014	2015	2016	2017	CAGR [3]
Savings bank sector [1]	19.8	14.2	13.9	13.7	13.5	13.2	12.8	12.3	11.4	10.6	−3.09%
Cooperative sector [2]	19.2	13.3	13.2	13.1	12.9	12.6	12.3	11.9	11.1	10.4	−3.04%
Private banks and building societies	27.2	13.2	12.8	12.7	11.6	12.1	11.9	11.6	11.1	10.7	−4.56%
Other banks	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	−3.03%
∑	66.8	41	40.2	39.8	38.3	38.2	37.3	36	33.9	32	−3.62%

Note: Constant decline of bank branches in the German banking market to almost the same extent in all sectors. [1] Savings banks and state banks. [2] Credit cooperatives and cooperative central banks. [3] Compound Annual Growth Rate (CAGR) 1997–2017. Source: Deutsche Bundesbank (2000, 2009, 2011, 2015, 2016b, 2016a, 2018, 2019).

Gabler Business Dictionary (2019) describes savings banks as follows: In general, they are characterised by their regional affiliation and the associated ownership and sponsorship. In Germany, they are mostly defined by their name; for example, the name provides information about the administrative district in which the bank is located. The shareholders are mostly the city and the district themselves. Often, the name already points to the municipal owner—for example, Stadtsparkasse, Kreissparkasse, or Bezirkssparkasse. Following this, the public-sector savings banks are governed by local authorities—such as cities, municipalities, or administrative districts—or a municipal savings and loan association as a merger of several local authorities. The banks are organised into the following institutions: The board of directors, administrative council, and loan committee. The Sparkassen Finance Group is the main organisation of all savings banks in Germany; thus, regional savings banks are also members of this cross-guarantee system. This main organisation secures the existence of the institutions and ensures that the banks can fulfil their obligations in case of insolvency. By becoming a member of one of the 12 regional savings banks and giro associations, the public-sector savings banks and their respective owners are indirectly members of the *Deutscher Sparkassen- und Giroverband e. V.* (DSGV) based in Berlin, the umbrella organisation of all German savings banks, Landesbanks, and regional building societies.

In its main line of business, the goal of savings banks is the legal task of offering investment opportunities to broad segments of the population, to carry out payment transactions, to satisfy the local credit needs of their customers, to tend to the population's economisation, and to promote

cashless payments (Sparkassengesetz 2015). In further detail, their objective is the placement of building loan contracts of regional building societies, mutual funds of *Deka Investment*, and insurance products of, for example, *Versicherungskammer Bayern*. The savings banks cooperate with the company *Deutschen-Leasing* in the leasing sector.

Raiffeisen and Volksbanken, simply known as cooperative banks, define themselves through their regionality and presence, as do savings banks. According to §1 of the Cooperative Act, the basic idea is to promote the acquisition or the business of its members by means of joint business operations. The acquisition of shares in a cooperative bank usually requires that you be a client of this bank. Some cooperative banks also allow non-clients to acquire shares. The practices permitted are defined in the relevant statutes. Members of a cooperative may participate in the cooperative shares that are governed by the cooperative's statutes. Shares can be acquired by both natural and legal persons. They are assigned to the respective person and are withdrawn when this cooperative member resigns. Depending on the statute, a minimum amount per business share of at least 10% must be paid. This sum corresponds to the business balance. Shares and credits do not necessarily match. Unlike a corporation, each member does not have multiple votes, regardless of their number of shares; rather, the cooperative adheres to the principle of 'one person, one vote'. The amount of the annual dividend of each cooperative bank usually depends on the annual net profit and is approved and resolved by the general meeting or representative assembly. The dividend is usually above the current interest rate level to make the shares attractive to clients and non-clients. The *National Association of German Cooperative Banks* (BVR) is the umbrella organisation of all cooperative banks in Germany. It does the following:

1. Represents the interests of the cooperative financial network at both national and international levels;
2. Coordinates and develops the joint strategy within the network;
3. Advises and supports their members on legal, taxation, and business management issues;
4. Informs their members about the latest developments in the economy, politics, and banking;
5. Provides the cooperative financial network protection scheme, Germany's oldest deposit guarantee fund for banks that is run by the BVR (National Association of German Cooperative Banks 2019).

As an example of the regional level bank, the *Bank1Saar*, in the eponymous German state *Saarland*, is a member of the *Saarlandischer Genossenschaftsverband e.V*. To date, the cooperative banks have the same business lines as the previously mentioned savings banks; however, they have different business partners—for example, the insurance company *R+V Allgemeine Versicherung* and the investment company *Union Investment Privatfonds*. Past mergers of various cooperative banks have led to cross-regional cooperation, while bank branches and personnel reduce at the same time to maintain cost-effective and more competitive business structures (see Table 1).

Historical data show that volatile market developments and technological advances lead to changes in sectors and individual companies (Musikindustrie Bundesverband 2017; Christensen and Bower 1996; Dolata 2008). Accordingly, banking institutions are exposed to and affected by these developments just like any other economic entity. A closer look at the German banking market reveals a negative development of branches. This does not apply only to specifically long-established institutions and/or sectors; rather, it points to a universally valid developmental nature (see Table 1). In all banking sub-sectors, the decentralised regional branch network is steadily declining, indicating a negative trend in terms of regional attractiveness. As a result, customers have less physical access to their bank.

2.2. Personnel Development in German Banking

Key resources are important factors for a company; they are necessary to create and/or deliver products and services (Clark et al. 2012; Osterwalder and Pigneur 2010). Clark et al. (2012) and Osterwalder and Pigneur (2010) defined four different types of key resources that are closely linked

and taken into account in a tool often used in practice today: Human, Physical, Intellectual Property, and Financial.

From a scientific point of view, the assumption that personnel is a generally important resource in a company is confirmed. Some sectors are more personnel-intensive, others less. For the banking industry, human resources are considered an essential component (Pillai et al. 2019), which in turn has an impact on the quality of the services provided and the bank's overall performance (Mukherjee et al. 2003). Information technology modernises the functionalities of the business to a significant level in terms of the workforce and its sustainability. In this context, personnel resource management is crucial to achieve significant changes in business operations (Blount et al. 2003).

Financial institutions need staff to exist. Due to today's very strong focus on digital banking solutions, the emerging modern FinTech business models involve less personnel. Instead, highly qualified employees are required to enable the (further) development of the IT infrastructure and the strategic orientation of the business model in the long term. Nevertheless, material resources are still of great importance for financial companies. FinTechs, however, concentrate mainly on the IT infrastructure (or the computer centre, if not outsourced) and the maintenance of an efficient working environment (e.g., office and business equipment). There is no physical presence—for example, in the form of branches, as is the case with traditional banks. Intellectual property also plays an important role since it includes patents, copyrights, internally developed methods and systems, and intangible assets such as the value of a brand. FinTechs often have limited tangible assets; but due to their business model design, intellectual values are of special importance. They are often supported and promoted by investors to establish themselves within the market. Without financial support, it is (often) difficult to establish an innovative business approach on the financial market; therefore, the financial aspect is crucial for a start-up or FinTech.

In accordance to this, human capital can be understood as an essential component of a bank's key resources (Abosede et al. 2018; Blount et al. 2003; Dhar 2011; Mukherjee et al. 2003; Pillai et al. 2019). Thus, it is important to take a closer look at today's human resources development, particularly in industries with frequent customer contact which, in turn, is an important pillar for sales and the entire existence of financial institutions. As banking in Germany experiences a continuous reduction in workforce, this paper focusses on this essential development.

With almost 290,000 employees, the *savings bank sector* was—along with all *private banks' and building societies'* employees (approximately 246,000 employees)—the banking sector that had more than 50% of the employees in 1997. Similarly, the *cooperative sector* experienced high staffing needs in 1997. Further historical examination revealed that the need for employees in the *savings and cooperative banking sector* persisted until 1997. As a result, the number of employees increased, but since then the beginnings of a continuous reduction in the number of persons have been evident in both sectors (AGVBanken 2018).

Apart from *other banks*, where demand in direct comparisons between sectors has hardly changed over time, the negative development observed in the present study cannot be downplayed by temporary positive counter developments or interpreted as a periodic peak (see Table 2).

Table 2. Employees by bank groups 1997–2017 in thousands.

Employees	1997	2009	2010	2011	2012	2013	2014	2015	2016	2017	CAGR [3]
Savings bank sector	288.4	249.6	248.2	246	245	244	240.1	233.7	224.7	216.1	−1.43%
Cooperative sector	182.1	164	163.4	163.9	165.6	166.1	165.1	161.8	157.3	152.3	−0.89%
Private banks and building societies	246	192.9	189.7	187.2	183.1	180.8	180.9	178.6	175.5	167.5	−1.90%
Other banks	51.7	56.6	56.5	56.6	55.4	54.7	54	53.1	51.6	50.4	−0.13%
∑	768.2	663	675.7	653.6	649	645.6	640.1	627.2	609.1	586.3	−1.34%

Note: Constant decline of bank employees in the German banking market to almost the same extent in all sectors.
[3] Compound Annual Growth Rate (CAGR) 1997–2017. Source: AGVBanken (2018).

2.3. Hypotheses Development

On the basis of different assumptions about the influence of personnel costs on bank performance, this paper attempts to contribute to the effects of staff reductions and the associated costs for the banking sector. Since a high degree of multicollinearity was already expected at the very beginning of the analysis based on the calculation basis of the bank income statement, the results of the Principal Component Analysis (PCA) have to be taken into account in the hypothesis formulation. Thus, the following hypotheses are generated on the basis of the respective assigned variables. The two factors are calculated as follow Table 3.

Table 3. Factor combination *.

	Factor 1	Factor 2
Staff expenses	x	
Other administrative expenses	x	
Other operating expenses		x

* Table 6 provides a detailed explanation of the derivation of each factor.

Practice generally assumes that there is a negative correlation between net income and personnel costs. Therefore, the goal of the management is often to reduce these costs and thus increase the profit of the company. The agency theory explained that higher salaries and other benefits increase the agent expenses of the company; it is natural that the employer tries to minimise them (Chen and Strange 2005; Grigore and Ştefan-Duicu 2013).

Hypothesis 1 (H1). *The reduction of factor 1 has a positive effect on operating profit.*

The expense preference hypothesis, in turn, assumes that the company will achieve its objectives by increasing salaries and other benefits (Ress 1974; Williamson 1963). A study by Ojeleye (2017) has also shown that there is a positive correlation between personnel costs and the bank's profit. One reason is that profit is the output of employee planning ability, the introduction of new technologies and personal development. Another reason is that salaries and wages, as well as bonuses and incentives, serve as a form of motivation. This leads to H2:

Hypothesis 2 (H2). *The reduction of factor 1 has a negative effect on the operating profit of a bank.*

In the researchers' understanding, due to the low interest rate phase in recent years (Chang and Talley 2017; Kozak 2016, 2018), the increasing regulation and ever stronger competition (Vives 2019), and further technological development on the financial market (Omarini 2019), it can also be assumed that banks will adjust their personnel and associated expenses on the basis of the current market situation in order to remain profitable and viable in the long term. This means not only staff reductions, but also the closure of branches, whereby cost reductions are equally realised and could have the same effect on the operating result of a bank. This leads to the following hypothesis:

Hypothesis 3 (H3). *Factor 1 and factor 2 have equal effects on operating profit.*

There is the question of whether staff and branch reductions (Tables 1 and 2) will also have an impact on other operating expenses, as these include, for example, IT (software services) and all other fixed costs and expenses for property, plant and equipment, as well as related depreciation and amortisation that are important for future business. Since, to the best of my knowledge, no further scientific evidence could be found in this area and, therefore, no assumptions about the effects could be made, two more hypotheses arise. They are intended to test the relationship of factor 2 on operating profit.

Hypothesis 4 (H4). *Factor 2 has a positive effect on operating profit.*

Hypothesis 5 (H5). *Factor 2 has a negative effect on operating profit.*

This paper focusses on cooperative and savings banks, which are structured differently according to their business model (see Section 2.1). However, both are regionally omnipresent for customers, address the same target group with an almost identical product portfolio, show negative personnel and branch developments, and are exposed to the same market conditions and technological developments. Given this background of an almost identical business model design, the following hypothesis arises:

Hypothesis 6 (H6). *Operating profit is not affected by the fact of different business model influences, namely cooperative and savings banks.*

3. Theoretical Framework—Interlinkages of Personnel Costs in Bank's Income Statement

3.1. Bank Income Statement

Credit institutions may derive the breakdown and the items to be included in the annual accounts essentially from (1) International Accounting Standards (IAS) (Kessler 2019), (2) International Financial Reporting Standards (IFRS) (Kessler 2019), and (3) German Accounting Regulation for Banks (RechKredV) (Sollanek and Hansen 2012):

(1) IAS 1–Presentation of Financial Statements,
(2) IFRS 7–Financial Instruments: Disclosures, and
(3) RechKredV–Ordinance on the Accounting of Credit Institutions and Financial Services Institutions.

IAS 1 sets out basic guidelines for the presentation and structure of financial statements as well as minimum requirements for their content. In this way, a formally uniform starting basis for the inter-period and inter-company comparability described above is to be guaranteed. In contrast to the German Commercial Code (HGB), the requirements are not dependent on legal form, size, and sector, but apply equally to all companies.

IFRS 7 is of fundamental importance for credit institutions in particular, as this standard specifies the quite comprehensive disclosure requirements for all financial instruments. IFRS 7 refers not only to the balance sheet financial instruments, but also to off-balance sheet financial instruments (e.g., loan commitments). The unutilised part of a guaranteed credit line (so-called overdraft facility) is an example of an off-balance-sheet financial instrument in the form of a loan commitment.

The *Ordinance on the Accounting of Credit Institutions and Financial Services Institutions* regulates the structure and the items to be shown in the balance sheet and income statement. In practice, the income statement is primarily structured according to business management criteria, which in Germany is based on the RechKredV (Lüdenbach et al. 2019, p. 132). The application of the RechKredV for banks results from the supplementary regulations for credit institutions in the German Commercial Code (§ 340 Abs. 1 HGB).

The data source of the paper, Bureau van Dijk/BankFocus (2019), takes advantage of these approaches and presents the banks' income statements in compressed form (see Appendix A). Based on these approaches, the analysis focusses on the positions of *net operating revenues*, *staff expenses*, *other administrative expenses*, *other operating expenses*, *total operating expenses*, and *operating profit*.

Within the income statement, there is income, which encompasses both revenue and gains. Some arise in the ordinary course of business and have various designations, such as revenue, service charges, interest, rent, dividends, and royalties. Banks particularly focus on interest, fee, and commission income. Gains are, for example, income from the sale of non-current assets. The definition of *income* also includes unrealised income, such as income from the revaluation of marketable securities and income from the increase in the carrying amount of non-current assets.

On the other hand, expenses in companies include both expenses incurred in the ordinary course of business as well as other expenses. Expenses incurred in the ordinary course of business include, for example, cost of sales, wages and salaries, and depreciation. They usually occur as an outflow or decrease of assets, such as cash.

Both can be found in the income statement and form the basis for calculating the income statement. Income and expenses represent the company's financial situation for a specific period, in particular a financial year, and thus show the nature, amount, and sources of entrepreneurial success from a financial perspective.

3.2. Mathematical Calculation of Operating Profit

Administrative expenses of a bank, which include personnel costs, and operating profit are directly linked. The calculation of operating profit is based on the following variables[3], which are partially derived from the bank's income statement. They form the basis for this analysis and illustrate the interconnections.

$$OP = \quad TOP \quad + NOR$$

$$OP = (SE + OAE + OOE) + NOR$$

where

OP is operating profit,
SE is staff expenses,
OAE is other administrative expenses,
OOE is other operating expenses,
NOR is net operating revenues, and
TOE is total operating expenses with $SE + OAE + OOE$.

4. Methodology

4.1. Data

Based on June 2019 data provided by Bureau van Dijk/BankFocus (2019), this research focusses on interlinkages of administrative costs—in particular, *staff expenses*, *other administrative*, and *other operating expenses*—to determine their overall impact on *operating profit*. Furthermore, *net operating revenues* will be included for the calculation, as it has impact on *operating profit*, too, and represents *operating revenue* streams of banks. Detailed financial data of each bank were prepared accordingly for the analysis. To provide not just a one-time result and highlight one-off effects, the analysis is based on the years 2013–2018; but due to missing data, and so that an analysis with holistic annual data is guaranteed, the year 2018 is not taken into account.

4.2. Mathematical Approach and Calculation

Due to the calculation basis of the OP and the associated data, a very high multicollinearity can be assumed, which was confirmed in a pre-test. This is a problem of regression analysis and occurs when two or more explanatory variables have a very strong correlation with each other. Since these effects would distort the results, the variables SE, OAE, and OOE are considered latent variables in the panel regression of the years 2013–2017. Principal Component Analysis (PCA) is used for latent variable calculation. For this method, no assumptions regarding content are necessary. Therefore, the exact assignment of the manifest variables to the factors and the number of factors themselves are often unknown (Bacher and Wolf 2010, p. 333). In general, it is based on the following approach: The value

[3] Further detailed explanations of the variables are given in Appendix B.

of a person on a variable (i.e., item/test value) can be described by a combination of weighted factor values and an error (Bühner 2010, p. 181). This paper prefers a two-factor solution due to the small number of explanatory variables. On this basis, the corresponding factor values are calculated for a subsequent regression analysis.

Mathematically, the following calculation results:

$$z_{im} = f_{i1} * a_{m1} + f_{i2} * a_{m2} + f_{i3} * a_{m3} \ldots + f_{ij} * a_{mj} \ldots f_{iq} * a_{mq} + e_i$$

where

z_{im} is the z-value of a person i on an item m,
f_{i1} factor value of person i to factor 1,
a_{m1} loading of items m to factor 1,
f_{ij} factor value of person i to factor j,
a_{mj} loading of items m to factor j,
q number of factors, and
e_i error component that cannot be explained by the extracted factors.

The PCA procedure described in the previous section can be explained mathematically as follows: (1) The communalities are inserted into the diagonal of the correlation matrix, and the column sums are then calculated. The column sums are mapped side by side in a new row, resulting in a row vector z with a certain number of elements i. For example, a 10×10 item correlation matrix yields 10 column sums. (2) By squaring the individual elements of the row vector (z_i) and (3) summing the elements ($\sum z_i^2$), the length of the row vector (z) results (Bühner 2010, p. 195). (4) Then, the root must be drawn from the squared sums of the row vector.

$$z_{length} = \sqrt{\sum_{row} z_i^2}$$

(5) All elements of the row vector must then be divided by the length of the row vector and normalised ($z_{i.norm}$).

$$z_{i.norm} = \frac{z_i}{\sqrt{\sum_{row} z_i^2}}$$

(6) Now the normalised row vector has to be multiplied by the correlation matrix to create a new row vector. (7) This vector has to be re-normalised by its length (Bühner 2010, p. 195). After each step, the differences between corresponding elements of the successive row vectors must be formed. These are then squared and summed up. As soon as the sum of the squared differences between two successively calculated row vectors is smaller than 0.00001, the process must be aborted. One speaks of a converged solution. By squaring and then summing the $z_{i.norm}$-values, the value 1 is obtained. The factor length is thus normalised to the vector length of 1. If the solution is converged, the last non-normalised line vector calculated represents the first eigenvector (Bühner 2010, p. 195; Null et al. 2003, p. 291). Its length gives or corresponds to the eigenvalue of the first main component. By multiplying each element of the eigenvector by the root of the eigenvalue, the loads of the items on the component are obtained.

Once the number of factors has been determined and the relevant factors for each year have been extracted, they must be interpreted in terms of content. For this, it is necessary to find suitable rotational processes. The rotation changes the way the extracted factors describe the items. The aim is to describe the items as unambiguously as possible using the factors obtained. For this purpose, a simple structure is to be achieved by orthogonal rotation. This leads to uncorrelated factors. The most frequently used method is the Varimax rotation used here (Bühner 2010, p. 205). This rotation is therefore used for the present work. It maximises the variance (s^2) of the squared charges (a^2) of the

items within the factors (column of the structure matrix) (Bühner 2010, p. 205). This rotation technique requires that for each factor, one part of the loading is higher and another part is lower in order to achieve a simple structure (Bühner 2010, p. 205; Nunnally and Bernstein 2017). The simple structure allows a clear interpretation of the two factors, since they have items that can be clearly assigned using the Varimax rotation method.

Following this, *NOR* is z-standardised for further analysis, so that through the transformation the resulting random variable (Z) has the expected value (μ) zero and the variance (σ^2) one.

$$Z = \frac{X - \mu}{\sigma}$$

In the next step, the Mixed Method approach is applied. The model with fixed effects and estimators based on it make it possible to consistently estimate the effects of the explanatory variables even if the individual, time-constant heterogeneity is correlated with the explanatory variables (Werwatz and Mangelsdorf 2019). The basic idea of the estimator for fixed effects is to remove the individual heterogeneity from it by a suitable transformation of the estimation equation. On the one hand, the panel or multi-level structure of the data is exploited; on the other hand, the assumption that the individual heterogeneity is fixed—that is, it is a specific constant for each individual (Werwatz and Mangelsdorf 2019).

The underlying model is based on the typical equation of a linear panel data model for a panel with $i = 1, \ldots, N$ individuals and $t = 1, \ldots, T$ time periods. It has this form:

$$y_{it} = x'_{it}\beta + \alpha_i + u_{it}$$

Here, y represents the expression of the declared/dependent variable for individual i and time period t. x is a vector that contains the expressions of the explanatory/independent variable. The characteristics of the model can correlate with each other. *Fixed effect* means that correlations between α_i and x_{it} are allowed.

$$E(u_{it}|x_i, \alpha_i) = 0, \; t = 1, \ldots, T$$

$$\text{with } x_i = (x_{i1}, x_{i2}, \ldots, x_{it})$$

That is, any relationship between x_{it} and α_i; but given α_i, there is no relation between u_{it} and the x_{it} of all periods.

5. Results

5.1. Statistical Interpretation

The results presented in this section first illustrate the reduction of highly multicollinear variables performed by PCA (see Tables 4–6).

In Table 4, the column 'Total' indicates the eigenvalue or variance of the original variable attributable to each component. The '% of Variance' column represents the percentage ratio of the variance of each component to the total variance of all variables. The 'Cumulative %' column indicates the percentage of the variance attributable to the first components. The results show that variables 1_ and 2_ of each year explain almost 100% of the variability of the original three parameters, so the complexity of the dataset could be reduced by using a two-factor solution. A desired information loss of 0% in factor simplification is favoured. By means of the varimax rotation, two latent variables are thus formed, which fulfil this criterion and are used for further analysis.

Table 5 confirms this approach by showing two factors after Varimax rotation, which represents the totality of the variables SE, OAE, and OOE. For the years 2013–2017, SE and OAE consistently form factor 1 (Fac1) and OOE is represented by factor 2 (Fac2).

Table 4. Total variance explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1_2013	2.337	77.888	77.888	2.337	77.888	77.888	1.921	64.03	64.03
2_2013	0.647	21.581	99.469	0.647	21.581	99.469	1.063	35.439	99.469
3_2013	0.016	0.531	100						
1_2014	2.493	83.106	83.106	2.493	83.106	83.106	1.874	62.456	62.456
2_2014	0.487	16.228	99.334	0.487	16.228	99.334	1.106	36.878	99.334
3_2014	0.02	0.666	100						
1_2015	2.468	82.263	82.263	2.468	82.263	82.263	1.885	62.825	62.825
2_2015	0.515	17.164	99.427	0.515	17.164	99.427	1.098	36.602	99.427
3_2015	0.017	0.573	100						
1_2016	2.582	86.053	86.053	2.582	86.053	86.053	1.845	61.511	61.511
2_2016	0.401	13.382	99.435	0.401	13.382	99.435	1.138	37.923	99.435
3_2016	0.017	0.565	100						
1_2017	2.651	88.373	88.373	2.651	88.373	88.373	1.815	60.498	60.498
2_2017	0.333	11.097	99.47	0.333	11.097	99.47	1.169	38.973	99.47
3_2017	0.016	0.53	100						

Extraction Method: Principal Component Analysis.

Note: This table describes the variance result, based on the years 2013–2017, for the extracted factors.

Table 5. Rotated component matrix [a].

	Component									
	F1_2013	F2_2013	F1_2014	F2_2014	F1_2015	F2_2015	F1_2016	F2_2016	F1_2017	F2_2017
SE	0.96	0.265	0.939	0.328	0.944	0.318	0.918	0.386	0.897	0.433
OAE	0.967	0.237	0.94	0.327	0.946	0.311	0.93	0.357	0.919	0.384
OOE	0.252	0.968	0.329	0.944	0.316	0.949	0.372	0.928	0.407	0.913

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation.

Note: This table describes the factor loadings based on Varimax rotation for each year. High values represent high loadings. [a] Rotation converged in 3 iterations.

Based on the PCA results, the relevant variables for the analysis are shown in Table 6. This also leads due to the exclusion of the year 2018, to a data population of 6400 cases without missing cases for the analysis carried out.

Table 6. Frequencies.

		NOR	OP	Fac1	Fac2
N	Valid	6400	6400	6400	6400
	Missing	0	0	0	0
Mean		46,574.82	10,631.80	0.00	0.00
Median		211,86.50	4809.5	0.10234	0.28
Mode		1506.00 [a]	1235.00 [a]	0.000 [a]	0.000 [a]
Std. Deviation		147,731.16	43,147.22	0.999531	0.999531
Minimum		374.00	−15,723.00	−33.150	−18.02
Maximum		4,753,000.00	1,601,000.00	5.462	3.706

[a.] Multiple modes exist. The smallest value is shown.

Since the variables NOR and OP differ significantly from the figures calculated by the PCA, they are also z-standardised for further analysis to ensure comparability. The standardisation leads to the following variable adjustments:

$$NOR \rightarrow zNOR$$

$$OP \rightarrow zOP$$

Table 7 illustrates the model composition holistically and presents the number of subjects for the years 2013–2017 (IndexY). The standardised dependent variable (operating profit) of the model is zOP. In total, the analysis results in nine dimensions.

Table 7. Model dimension [a].

		Number of Levels	Covariance Structure	Number of Parameters	Subject Variables	Number of Subjects
Fixed Effects	Intercept	1		1		
	Fac1	1		1		
	Fac2	1		1		
	zNOR	1		1		
Repeated Effects	IndexY	5	Identity	1	ID	1298
Total		9		5		

[a] Dependent Variable: zOP.

The tests of fixed effects (see Table 8) provide *F*-tests for each of the effects specified in the model. The significance values indicate that the effect contributes to the model. Thus, highly significant values are consistently considered in the analysis with regard to each dimension.

Table 8. Type III tests of fixed effects [a].

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	6400	67.89	0.000
Type	1	6400	392.03	0.000
Fac1	1	6400	15,589.62	0.000
Fac2	1	6400	22,660.30	0.000
zNOR	1	6400	42,247.69	0.000

[a.] Dependent Variable: zOP.

The calculations of fixed effects of dimensions are shown in Table 9. Here, Fac1, Fac2, bank types savings banks (SB) and cooperative banks (CB), as well as zNOR are taken into consideration. Based on

the General Linear Model (GLM) method, the model calculation could be performed. Since there is no column in the MIXED table 'Type III tests of fixed effects' for sum of the squares, the one calculated from GLM can be considered. Taking all variables into account, the model explains the variance of the constants at a very high significant level of 98.9%.

Table 9. Estimates of fixed effects [a,c].

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	−0.044130	0.0026	6400	−16.971	0.000	−0.049227	−0.039032
[Type = CB]	0.063985	0.003232	6400	19.8	0.000	0.05765	0.070321
[Type = SB]	0 [b]	0					
Fac1	1.465189	0.011735	6400	124.858	0.000	1.442185	1.488193
Fac2	0.832222	0.005528	6400	150.533	0.000	0.821384	0.84306
zNOR	2.636094	0.012825	6400	205.542	0.000	2.610953	2.661236

Note: This table describes the effects of the model variables and provides information on their effect parameters. The higher the estimated value for each parameter, the greater the effect. Signs provide information about the direction of action. [a] Dependent Variable: zOP. [b] This parameter is set to zero because it is redundant. [c] Model Adjusted R Squared = 0.989 based on 'Tests of Between-Subjects Effects' within General Linear Model.

The covariance estimate of the repeated measurement shows a very low value. Table 10 provides the estimated value of the residual, which is 0.011482 and stands for high accuracy.

Table 10. Estimates of Covariance Parameters [a].

Parameter		Estimate	Std. Error
Repeated Measures	Variance	0.011482	203

[a] Dependent Variable: zOP.

5.2. Hypothesis Verification

The results of the study indicate clearly that operating profit is positively influenced by decreasing personnel development.

H1 confirms the general agency theory expectation that lower salaries and other benefits increase a company's profit, and thus the findings of Chen and Strange (2005) and Grigore and Ştefan-Duicu (2013) regarding minimisation of agent expenses of the company.

In contrast, the assumptions of expense preference hypothesis made by Ress (1974), Ojeleye (2017), and Williamson (1963) are rejected (H2). Consequently, the preferential hypothesis that the company achieves its objectives by increasing salaries and other benefits is rejected; it is no longer valid for the current banking system.

The hypothesis that banks adjust their personnel and associated expenses on the basis of the current market situation in order to remain profitable and viable in the long term is rejected (H3). Nevertheless, both factors have positive effects. However, Fac1 has a stronger effect on zOP than does Fac2. This means that the reduction in staff and associated costs have greater impact within the administrative cost structure of banks.

Findings confirm H4. In contrast, H5 is rejected. Fac2 has a positive effect on zOP. This confirms that the reduction of associated costs at this administrative level contributes to the optimisation of zOP through other effects. For example, it can be assumed that process acceleration or optimisation is realised and has positive effects. However, this cannot be determined by the analysis and therefore requires further research.

From a statistical point of view, it can be confirmed that the design of the bank's business model (SB/CB) influences the zOP, but the associated impact (0.063985) is negligible. This indicates that their corporate structure and management approach, as well as changes in the markets, have almost the same importance and impact on zOP. Thus, H6 is confirmed.

Based on previous calculations, interpretations for H1–H6 are summarised in Table 11.

Table 11. Hypothesis Verification.

	Hypothesis	
H1	The reduction of Factor 1 has a positive effect on operating profit. *Fac1 = 1.465189*	Confirmed
H2	The reduction of Factor 1 has a negative effect on operating profit. *Fac1 = 1.465189*	Rejected
H3	Factor 1 and Factor 2 have equal effects on operating profit. *Fac1 = 1.465189*/Fac2 = 0.832222	Rejected
H4	Factor 2 has a positive effect on operating profit. Fac2 = 0.832222	Confirmed
H5	Factor 2 has a negative effect on operating profit. Fac2 = 0.832222	Rejected
H6	Operating profit is not affected by the fact of different business model influences, namely cooperative and savings banks. [Type = CB] = 0.063985 (negligible estimate value)/[Type = SB] = 0	Confirmed

6. Conclusions

This paper analysed the effects of human resources development on the total operating costs of savings and cooperative banks. In this context, various assumptions regarding the effects of labour development—with a focus on personnel expenses, other administrative expenses, and other operating expenses on operating profit—were analysed. Overall, this leads to the conclusion that the expense preference hypothesis for the banking sector is no longer valid today and is therefore inappropriate even in economically difficult times.

In contrast, the assumptions of the agency theory that lower expenditures (i.e., salaries and other benefits) increase a company's profits are still valid. They point out that these reactions of a company or its management are indispensable. According to the best available information, it has been shown that the analysis of highly multicollinear data within the income statement is quite possible. This methodical approach creates the basis for further possibilities of detailed financial analysis. In summary, it can be concluded that a negative personnel development (the reduction of personnel) in recent years has contributed to improved operating results of banking institutions and has thus enabled them to strengthen their market position and operating profits. The current market and competitive developments within the financial market suggest that staff reductions will intensify; whether this is simply a reaction to changing customer requirements or a reaction to a changing market environment remains unanswered and requires further research.

The extent to which cost reductions can be realised to optimise corporate results must be viewed critically and carefully. Cost reduction strategy will eventually reach a certain saturation point. It requires an individual analysis, given that a certain level of personnel costs will continue to exist in the future, which may vary from company to company. The group of employees still present in a company at this time can also be referred to in this context as the core workforce that the company needs to survive in order to deliver a desired performance. In this study, a foundation is laid for future research in the field of cost structure analysis and its influence on companies and their performance. Methodologically, a first-time analytical approach is presented, which is suitable for several companies from different industries.

The analysis of the reason behind personnel development was not the subject of the study and should be examined more precisely. Furthermore, the study is limited by the fact that only five years were considered for the examination. In the sense of a holistic approach, it is therefore advisable

to conduct a longer-term analysis. However, this approach was limited by the availability of data for the present study. In addition, it is recommended that future analyses also take into account the market situation—that is, stronger financial regulation and the low-interest phase—to ensure a holistic approach. The effects of digitalisation should also be taken into account in future analyses in banking; it is recommended to analyse the degree of digitalisation of financial institutions more closely so that this effect is also taken into account as a determining factor.

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Appendix A

	Income Statement
1.	+ Interest on loans
2.	+ Interest on bank deposits
3.	+ Interest and preferred stock dividends on securities (AFS and HtM)
4.	+ Other interest income
5.	= *Total interest received*
6.	− Interest on customer deposits
7.	− Interest on debt securities
8.	− Interest on bank deposits
9.	− Other interest expenses
10.	= *Total interest paid*
11.	= *Net interest income*
12.	+ Fee and commission income
13.	− Fee and commission expense
14.	= *Net fee and commission income*
15.	+ Net trading income on securities and derivatives
16	+/− Net gains and losses on assets & liabilities at fair value through P&L
17.	+/− Net gains and losses on other securities
18.	=*Total net trading income and fair value gains and losses*
19.	+ Net insurance income
20.	+ Dividend income: common stock
21.	+/− Net gains and losses on real estate
22.	+ Other operating income
23.	= *Operating revenues*
24.	− Impairment on loans and advances
25.	− Impairment on other assets
26.	= *Total Impairment charges*
27.	= *Net operating revenues*
28.	− Staff expenses
29.	− Other administrative expenses
30.	− Other operating expenses
31.	= *Total operating expenses*
32.	= *Operating profit*
33.	+/− Equity accounted share of profits of associates and joint ventures
34.	+ *Non-operating income*
35.	− *Non-operating expenses*
36.	+/− Profit/(loss) on acquisition and disposal of subsidiaries
37.	= *Profit before tax*
38.	− Income tax expense
39.	+/− Net profit/(loss) for the year from discontinued operations
40.	= *Net income*
41.	− Dividend paid
42.	= *Retained Income*

Source: Lüdenbach et al. (2019, p. 132).

Appendix B

Appendix B.1. Staff Expenses (Lüdenbach et al. 2019, p. 111)

Personnel expenses are an important component of total operating expenses. They include salaries, allowances, social security contributions, training costs and much more. The adjustment of personnel expenses has a direct positive or negative impact on a bank's operating profit.

A distinction has to be made between *fixed* and *variable* personnel costs, since employees can receive a fixed salary on the one hand and performance-oriented remuneration on the other. The latter case should be readily obvious to employees, since additional effort can lead to financial advantages. This financial benefit can be valuable to satisfy individual needs, which at the same time can lead to increased employee motivation. On the other hand, negative personnel development and lower earning opportunities can lead to deterioration in employee performance.

This can affect a bank's operating profit. Firstly, management can save costs and thus increase operating profit in the context of staff reductions. Secondly, there is a risk that there is not enough manpower available to realise sales and services, which can negatively impact operating profit. However, as a result of technological advances, fully automated processes, algorithms, and machines are increasingly taking over the work of bank personnel.

Appendix B.2. Other Administrative Expenses

Other administrative expenses are often also called (*other*) *general costs* and *administrative costs*. According to Bureau van Dijk/BankFocus, they can be categorised as one.

General and administrative expenses arise in the course of a company's day-to-day business activities. They are not directly linked or assigned to a specific function, department, or unit within the bank. General expenses are operating overheads that affect the entire bank. General administrative expenses include, for example, rent and ancillary rental costs, legal fees and certain salaries, and insurance costs. In particular, administrative costs are expenses that cannot be directly assigned to a specific function within the enterprise. Examples of this are manufacturing, production, or distribution/sale costs.

Other administrative expenses are all costs and expenses that a bank has to pay to a person or another entity in connection with the transactions contemplated in the business documents or underlying instruments. This includes fees and expenses of any third-party service provider, including an approved valuation company. They relate to all administrative costs but exclude fiduciary expenses, costs of the rating agency, and administrative costs of the collateral advisor. Items typically reported as other administrative expenses include, for example, all costs for the overall operation of the bank associated with the administration, and legal staff functions, including the costs of governing boards, executive wages and benefits, auxiliary costs for insurances, legal counsel and accounting, or the depreciation on office fixtures and equipment.

Part of the general administration costs is *fixed* because they are incurred in a certain period, regardless of the amount of the sales. Real estate costs are one example. As for *variable* general administrative costs, bank management will usually seek to reduce general and administrative costs as much as possible, as they do not directly impact the services provided to clients. It can be assumed that banks with centralised management typically experience higher administration expenses compared with institutions with decentralised or digitalised structures.

However, costs in the fixed-cost share can also be reduced—for example, by reducing the number of branches. However, even if no active service is offered by a bank, a part of the costs is still incurred. As a result, many general and administrative costs are fixed factors that cannot easily be influenced by cost-reduction strategies. Other administrative costs are not fixed, but semi-variable. For example, a company will always consume a certain minimum amount of electricity just to keep the lighting and the necessary machinery running. In addition, measures can be taken to reduce unnecessary expenditure on electricity.

Appendix B.3. Other Operating Expenses (Lüdenbach et al. 2019, p. 110)

This item includes all expenses related to ordinary and regular banking business other than those included in SE and OAE—in particular employee benefits, including transfers to pension reserves, marketing expenses, office expenses (i.e., office supplies, operating leases, and IT or software services) as well as all other fixed costs and expenses for property and equipment and related depreciation expenses. Taxes other than income or corporate taxes are also included. Other operating expenses, also known as *overhead expenses*, are the amount that generally does not depend on sales or production and service quantities. It does not include capital expenditures (large expenses such as building expenses).

According to Vernimmen et al. (2017, p. 160): "Other operating expenses comprise outsourcing costs, property or equipment rental charges, the cost of raw materials and supplies that cannot be held in inventory (i.e., water, energy, small items of equipment, maintenance-related items, administrative supplies, etc.), maintenance and repair work, insurance premiums, studies and research costs, external personnel charges, fees payable to intermediaries and professional expenses, advertising costs, transportation charges, travel expenses, the cost of meetings and receptions, postal charges, [. . .] and other items of expenditure."

Appendix B.4. Total Operating Expenses

The Internal Revenue Service (IRS) and the German Federal Ministry of Finance (BMF) allows businesses to deduct operating expenses if the business operates to earn profits.

Operating expense is an expense that an entity incurs in the ordinary course of its business. Operating costs are often abbreviated as OPEX. In the present case, total operating expenses are referred to as TOE and include all costs from 3.2. One of the typical tasks that management has to deal with is determining how operating costs can be reduced without significantly affecting a company's competitiveness vis-à-vis its competitors.

These expenses are necessary and essential for the majority of enterprises. Some corporations reduce operating costs to obtain a competitive advantage and increase revenue. However, this cost reduction can also affect business integrity and product quality. Finding the right balance can be difficult but can bring substantial benefits for the company.

Appendix B.5. Net Operating Revenues

Net operating revenue or net sales is the money received by a bank from interest, commission, trading, and market value gains and losses, less impairment for a certain period of time. It is income received from a bank or a bank-holding company before deduction of general operating costs (TOE).

Appendix B.6. Operating Profit

The term *operating profit* refers to a balance sheet ratio that measures a bank's profit from its core business functions. In the context of a bank, these are primarily net interest, commission and trading income, as well as gains and losses from fair value less impairment losses and operating expenses. This operating value additionally excludes all gains from the company's ancillary investments, such as gains from other transactions in which a company may have a partial interest.

The operating profit serves as a high-precision indicator of a bank's potential profitability, as it excludes all external factors from the calculation. All expenses necessary to maintain business operations are taken into account. The operating profit also takes into account asset-based depreciation (impairment on loans/advances and on other assets), which is an accounting instrument resulting from a company's operations. It therefore differs from net income, which may vary from year to year, due to these exceptions in a company's operating profit.

The operating profit is also referred to as the *operating income*, as is the earnings before interest and taxes (EBIT)—whereby the latter may in part also include non-operating income that is not part of the operating income, which in principle is taken into account in the banking sector at a later stage. If a

bank does not have a non-operating result, or if it has no share of the result of the reported associated companies and joint ventures or a profit/(loss) from the acquisition and disposal of subsidiaries, the operating result would correspond to EBIT.

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