

DETERMINANTS OF BANK FEE INCOME IN THE EU BANKING INDUSTRY – DOES MARKET CONCENTRATION MATTER?

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Abstract

In this paper, we analyse the key determinants of bank fee and commission income in the European Union with a special emphasis on market concentration. On a sample of 258 EU banks during the 2007–2014 period, we apply System Generalized Method of Moments. First, we argue that the banks facing higher competition tend to expand more aggressively into non-traditional activities, and therefore they report a higher share of fee income in total income. Second, we found that a higher equity to assets ratio is related with higher shares of fee income since the bank needs more capital to prevent or manage the potential risks of the non-traditional activities. Finally, a high deposits to assets ratio tends to increase the fee income share, which may be possibly attributed to relatively high switching costs and to close depositor-bank relationship in the EU banks.

Keywords: bank, fee and commission income, Generalized Method of Moments, Herfindahl index, market concentration

JEL Classification: C23, G21, L25

1. Introduction

Business models for banking have changed significantly over the last few decades. The technological development and digitalization of services has increased the competition among financial institutions, which in turn led to decreased cost advantages of banks. As a result, the profitability of traditional bank activities dropped, which consequently led to an expansion of bank activities into non-traditional fee and commission bearing services (Davis and Tuori, 2000).¹ In Europe, non-interest income (NII) has increased from 26% to 41% of total

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1 Traditional activities include deposit taking and loan providing (core businesses of commercial banking). Non-traditional activities are for example retail brokerage, insurance sales, securities issuance (core businesses of investment banking).

income between 1989 and 1998 (Lepetit *et al.*, 2005). The most pronounced part of NII is net fee and commission income (NFCI) that accounted on average for 58% of all NII between 1993 and 1998 in EU countries. Nevertheless, the composition of NII differs across European countries significantly. Whereas in the United Kingdom NFCI represented more than 70% of NII in 1998, it was only 35% in Portugal and Sweden (ECB, 2000).

A share of NII is connected with the bank business model. Commercial banks are mainly deposit taking and loan providing (*i.e.* having traditional activities). They make money on charging higher interest on loans compared to what they are paying on client deposits. Investment banks provide potentially more risky products than commercial banks. This includes capital raising services, financial advisory to corporations as well as committing capital for securities issuance (*i.e.* non-traditional activities). Investment banks make their money mainly on trading, fee and commission income and report higher than 40% NFCI/total income ratio (NFCI/TI). Universal banks combine commercial and investment banking and their income composition reflects the combined structure of the business (Gambacorta and van Rixtel, 2013).

In this paper, we use EU banks' data to analyse the links between bank NFCI, business strategies, market and macroeconomic conditions between 2007 and 2014, with a special emphasis on the link between market concentration and NFCI share. Increasing competition is assumed to be one of the main reasons forcing banks to switch to non-traditional fee bearing activities. Therefore, we hypothesize that a higher level of competition is connected with higher share of fee income in the banking sector. One can argue that increased share of NII is a product of diversification through which banks are seeking a balanced and sustainable structure of income. But the empirical evidence suggests that diversification benefits, decreased risk and increased risk-adjusted profitability are often not present when increasing NII share (Stiroh, 2002, 2004; De Young and Rice, 2004a; Kim and Kim, 2010). This may be caused primarily by higher volatility of NII compared to interest income or by increasing correlation of NII with interest income observed in recent years (Stiroh, 2002). Our hypothesis is based on the assumption that in highly competitive markets banks tend to increase their share if NII too far and the diversification benefits are more than offset by the increased exposure to volatile NII bearing activities.

The rest of the paper is structured as follows: Section 2 provides a literature review. In Section 3, we study the determinants of fee income magnitude, especially the impact of market concentration on NFCI. Section 4 summarizes the paper and provides our conclusions.

2. Literature Review

The first paper examining the correlation between the Herfindahl index (HI) and NII was Moshirian *et al.* (2011). Based on data from 20 countries, they found that banks facing high concentration have lower levels of NII. They conclude that banks in highly competitive markets are more likely to engage in risky behaviour including expansion in non-traditional activities. A similar result was found in Růžičková and Teplý (2015), on which this paper is based. Similarly as Hahm (2008), whose study is based on data from 29 OECD countries,

Firth *et al.* (2013), who studies China's commercial banks, and U.S. studies Rogers and Sinkey (1999), De Young and Hunter (2003), De Young *et al.* (2004) and De Young and Rice (2004a), Moshirian *et al.* (2011) conclude that large banks with smaller net interest margin (NIM) exhibit higher NII.

Contrary to the U.S. evidence, Craigwell and Maxwell (2005), whose study is based on Barbadian banks, found that larger banks are associated with lower NII. Shahida *et al.* (2006) found on a panel of Malaysian Islamic commercial banks no significant relationship between fee income and NIM. The literature is also not unanimous about the effect of core deposits on the income structure. While Rogers and Sinkey (1999), Bailey-Tapper (2010) and Kim and Kim (2010) found that banks with high NII have relatively fewer core deposits, De Young and Rice (2004a), Shahida *et al.* (2006) and Busch and Kick (2015) found the opposite relationship. On the other hand, higher equity to assets ratio seems to be always connected with higher NII. De Young and Rice (2004a) included to the model also bank macroeconomic and sector specific factors that turned out to be also important determinants of banks' NFCI. The importance of external factor was later confirmed by Hahm (2008), Bailey-Tapper (2010), Kim and Kim (2010). We conclude that common factors determining income diversification exist but their impact on NII varies across countries. The largest differences can be identified when analysing the developed and developing economies separately.

3. Empirical Analysis

In this section we examine what determines the magnitude of NFCI. Besides the basic bank interior and exterior factors, we also include market concentration as a determinant of NFCI.

3.1 Dataset

The analysis is based on EU-27 data from 2007 to 2014. The data were taken from the Bankscope database, ECB database, Eurostat, The World Bank Data Bank and Helgi Library database. The final dataset is a balanced panel. Our study is based on data from 258² EU banks (151 commercial banks, 35 savings banks, 26 cooperative banks, 18 real estate and mortgage banks, 10 investment banks, and 18 bank holdings and holding companies), *i.e.* on average, we have data for almost 10 banks in each country available. Table 1 displays the number of banks included in the study by country.³

2 Descriptive analysis is based on data from 261 banks. From this analysis follows that there are 3 outliers in the dataset which may influence the results (see also Figure A.1) and therefore they were excluded for the final empirical analysis.

3 The inclusion of more banks was not possible due to missing data. Strongly unbalanced panel could make the estimation inaccurate. Moreover, we excluded banks with negative operating income from the dataset, because their NFCI/TI ratio would be misleading.

Table 1 | Number of Banks Included in the Study by Country⁴

Austria	:	7	Germany	:	7	Netherlands	:	7
Belgium	:	6	Greece	:	5	Poland	:	10
Bulgaria	:	9	Hungary	:	6	Portugal	:	13
Cyprus	:	5	Ireland	:	4	Romania	:	7
Czech Republic	:	9	Italy	:	30	Slovakia	:	5
Denmark	:	7	Latvia	:	6	Slovenia	:	7
Estonia	:	2	Lithuania	:	5	Spain	:	11
Finland	:	3	Luxemburg	:	1	Sweden	:	28
France	:	28	Malta	:	3	United Kingdom	:	27

Source: Authors' computations

3.2 Methodology

Most of the current authors used FE, RE or pooled OLS estimation method for the analysis of NFCI (NII) magnitude determinants. Since we expect persistence in NFCI magnitude and the inclusion of a lagged dependent variable leads to inconsistency in the previous methods, we will apply System Generalized Method of Moments (GMM), which is appropriate for our data set with large number of banks and small number of time periods and is able to deal with explanatory variables that are not strictly exogenous.⁵

The general model of the data-generating process is as follows:

$$y_{i,t} = \alpha y_{i,t-1} + X'_{it} \beta + \varepsilon_{i,t}, \quad (1)$$

$$\varepsilon_{i,t} = \mu_i + v_{i,t},$$

$$E[\mu_i] = E[v_{i,t}] = E[\mu_i v_{i,t}] = 0,$$

where $|\alpha| < 1$, $i = 1, \dots, N$ is the individual's index and $t = 1, \dots, T$ is a time index. The disturbance is composed of the fixed effects μ_i and the idiosyncratic shocks, $v_{i,t}$. Pooled OLS is inappropriate for the estimation because exogeneity assumption is violated since $y_{i,t-1}$ and μ_i are correlated (Wooldridge, 2002). Particularly, pooled OLS attributes more predictive power to the lagged dependent variable than it should have (Roodman, 2006).

Nickell (1981) and Bond (2002) show that Least Squares Dummy Variable or Within Groups estimator are not able to eliminate the dynamic panel bias. Contrary to pooled OLS within Groups estimator is biased downwards. The true estimate should lie between the pooled OLS and Within Group estimates. Therefore, we will use these two methods for

4 In order to get a representative data set for each country, we had to adjust the number of Italian, French, Swedish and British banks that was considerably higher than in other countries. Only the biggest banks were kept in the final data set.

5 In our case for example *nim*, *cost_inc*, *roae* or *eq_ass* are predetermined or endogenous and therefore they need to be treated adequately. See Section 3.3 for variables description.

a robustness check as suggested also in Bond (2002). Two transformations are commonly used for dynamic panel data. The first method, Difference GMM, was originally developed by Holtz-Eakin *et al.* (1988) and by Arellano and Bond (1991) and it uses the first-difference transformation applied on the original model. This yields the following equation:

$$\Delta y_{i,t} = \alpha_1 \Delta y_{i,t-1} + \Delta X'_{i,t} \beta_1 + \Delta v_{i,t}. \quad (2)$$

As by Within Group transformation, the fixed effects are no more present, but the lagged dependent variable is still endogenous. This can be addressed by assuming that $v_{i,t}$ are serially uncorrelated. The largest drawback of this model is that all time-invariant regressors disappear. This gives rise to the System GMM developed in Blundell and Bond (1998). This method combines the differences Equation 2 with the level Equation 1. As long as $v_{i,t}$ are serially uncorrelated, we do not need to have strict exogeneity of the explanatory variables. This framework allows using time-invariant variables. The instruments are differenced to make them uncorrelated with the fixed effects (Sanya and Wolfe, 2011). This means that the variables in level equation are instrumented with their own differences, which increases the efficiency of the estimation (Gürbüz *et al.*, 2013).

We include time dummies in the regressions,⁶ because they make the assumption of no correlation between idiosyncratic shocks more likely to hold (Roodman, 2006, Sanya and Wolfe, 2011). We use one-step and two-step System GMM with clustered standard errors robust to heteroscedasticity and autocorrelation within individuals and with small sample corrections to the covariance matrix. In order to prevent the downward bias of standard errors in two-step estimation that may arise when the number of instrument is large (Arellano and Bond, 1991), we apply Windmeijer (2005) correction in two-step estimation.

The estimation is performed in Stata. The estimation equation representing our model for each of the NFCI magnitude measure is as follows:

$$Y_{i,c,t} = \alpha + \beta Y_{i,c,t-1} + \gamma X_{i,c,t} + \delta Z_{c,t-1} + \epsilon W_{c,t} + \theta D_i + \vartheta T_t + (\mu_i + v_{i,c,t}), \quad (3)$$

where:

$Y_{i,c,t}$	NFCI share of bank i in country c at time t (dependent variable), namely NFCI/TA and NFCI/total assets ratio (NFCI/TA),
$Y_{i,c,t-1}$	NFCI share of bank i in country c at time $t - 1$, measured as above,
$X_{i,c,t}$	vector of bank-specific variables for bank i in country c at time t ,
$Z_{c,t-1}$	vector of country-specific variables for country c at time $t - 1$,
$W_{c,t}$	vector of banking sector-specific variables for country c at time t ,
D_i	bank type dummy,
T_t	time dummy,
μ_i	unobserved bank-specific time-invariant effect,
$v_{i,c,t}$	disturbance term which is independent across banks.

⁶ The time dummies are not reported in the tables.

3.3 Variables

The dependent variable captures the NFCI magnitude that is measured by NFCI/TI ratio (*nfc_i_ti*) and NFCI/TA ratio (*nfc_i_ta*). By choosing the proper explanatory variables, we follow the papers by De Young and Rice (2004a), Shahida *et al.* (2006), Moshirian *et al.* (2011), ECB FSR (2013) and Fišerová *et al.* (2015). The independent variables are summarized in Table 2.

Table 2 | List of Independent Variables

Variable	Description	Expected coefficient
Bank-specific explanatory variables		
<i>ln_ass</i>	Natural logarithm of total assets	+
<i>nim</i>	Net interest margin	–
<i>depos_ass</i>	Total customer deposits to asset ratio	–
<i>eq_ass</i>	Total equity to total assets ratio	+
<i>npl_loans</i>	Non-performing loans to gross loans ratio	?
<i>loans_ass</i>	Loans to assets ratio	–
<i>roae</i>	Return on average equity	+
<i>cost_inc</i>	Cost to income ratio	–
Banking sector-specific explanatory variables		
<i>hi</i>	Herfindahl index	–
<i>atms</i>	Number of automated teller machines <i>per</i> 100,000 adults	?
<i>cashless</i>	Number of all cards transactions (except e-money function) <i>per capita</i>	?
Country-specific explanatory variables		
<i>lag_gdp</i>	Lagged real annual GDP growth rate	?
<i>lag_inf</i>	Lagged annual inflation rate	?
<i>lag_unem</i>	Lagged annual unemployment rate	?
<i>lag_int</i> ⁷	Lagged long-term annual interest rate	?

Source: Authors

Moreover, we include also lagged dependent variable (*lag_dv*) and bank-type dummy variables: *dcom*: 1 = commercial bank, *dcoop*: 1 = cooperative bank, *dsav*: 1 = savings bank, *dinv*: 1 = investment bank, *dhold*: 1 = bank holdings and holding companies, 0 = real estate and mortgage banks.

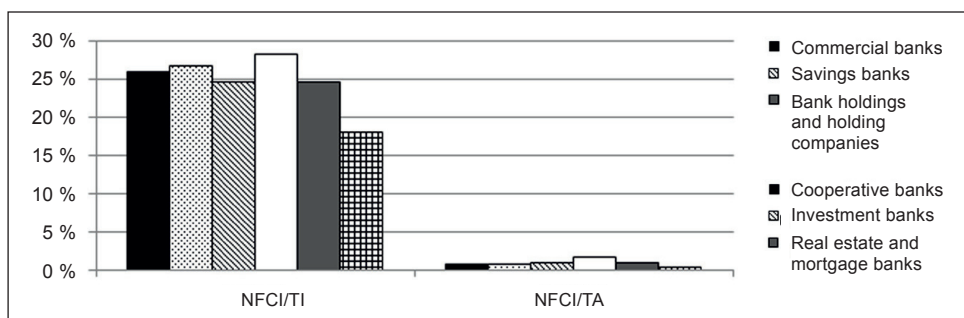
⁷ According to the ECB and Eurostat, there are no Estonian sovereign debt securities that comply with the definition of long-term interest rates for convergence purposes. We use data from Helgi Library as a proxy for long-term interest rate in Estonia.

3.4 Descriptive analysis

In this section, we provide a descriptive analysis of used variables. Firstly, we analyse the dependent variables NFCI/TI and NFCI/TA. The scatter plots depicting the relationship between NFCI share and HI can be found in Figure A.1.

Figure 1 displays the mean NFCI/TI and NFCI/TA by bank type computed over the period 2007 to 2014. The lowest share of NFCI can be observed in real estate and mortgage banks which have NFCI/TI below 19% and NFCI/TA less than 0.4%. On the other hand, the highest share of NFCI was reported in investment banks with average NFCI/TI of 28.26% and average NFCI/TA of 1.78%.

Figure 1 | Average NFCI/TI and NFCI/TA by Bank Type



Source: Authors based on Bankscope

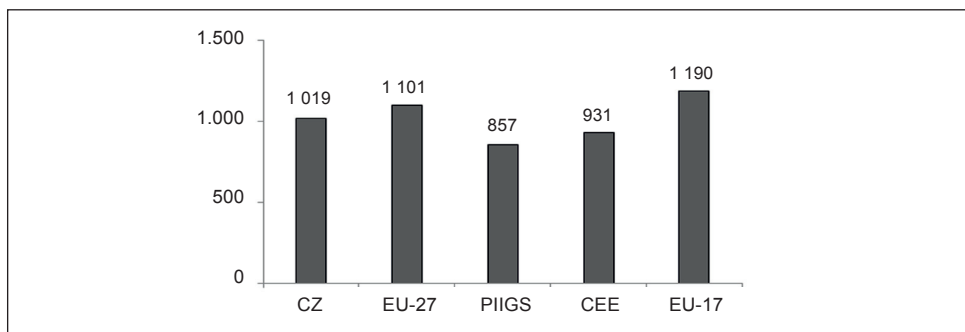
The HI's values range between 0–10,000. Values below 1,000 indicate low concentration, values of 1,000 to 1,800 correspond to moderate concentration, and HI over 1,800 indicates high concentration (Neven and von Ungern-Sternberg, 1998). Figure 2 displays that there is a moderate market concentration in the EU. The Czech Republic lies with the HI of 1,019 slightly below the average which means that the Czech banking sector is more competitive than banking sectors of other EU countries, but still it belongs to the group with moderate concentration. PIIGS⁸ and Central and Eastern Europe (CEE) countries report the HI even lower than the Czech Republic. On the other hand, EU-17⁹ countries post average HI of nearly 1,200. The relatively high HI is caused mainly by Finland, Estonia and Netherlands with HIs above 2,000.

Figure 3 shows the evolution of average NFCI share from 2007 to 2014 by market concentration. As can be seen, the highest NFCI shares are reported in banks in countries with low concentration over the whole considered period, with exception of 2013 and 2014 in which countries with moderate concentration reported slightly higher NFCI/TI. The lowest NFCI/TI shares are present in banks that are facing low competition. This figure supports the hypothesis that increased competition forces banks to switch to non-traditional activities that bear high fee income.

⁸ PIIGS refers to Portugal, Ireland, Italy Greece and Spain.

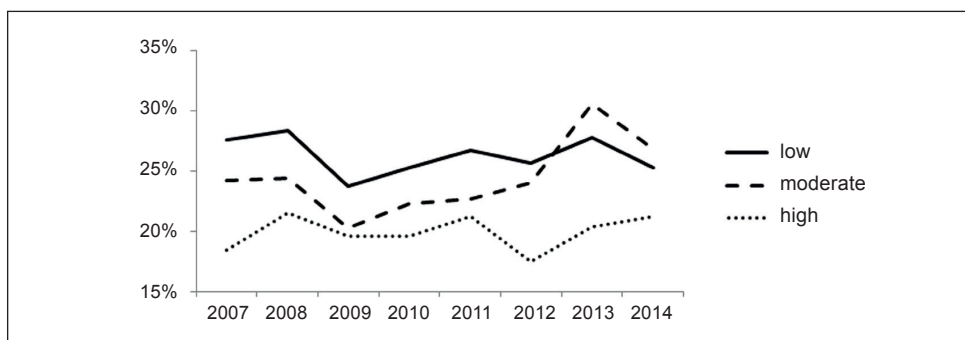
⁹ EU-17 stands for Eurozone countries.

Figure 2 | Average HI from 2007 to 2014



Source: Authors based on ECB

Figure 3 | Development of Average NFCI/TI by Market Concentration



Source: Authors based on Bankscope and the ECB

Figure A.2 captures the development and application of new technologies that is measured by ATMs *per* 100,000 adults and number of cashless transactions *per capita*. It can be seen that those two measures are not necessarily correlated, in some countries there might be positive relation but in other there is negative one. Figure A.3 and Figure A.4 show country-specific macroeconomic indicators in year 2013.¹⁰ It can be seen that the macroeconomic conditions of PIIGS are still very poor. This is reflected by the high government bond yields, very low or negative GDP growth rate and high unemployment rates. Table A.1 shows summary statistics of used variables reporting the mean, median, standard deviation, minimum, maximum and 1st and 3rd quartiles of each variable.

3.5 Results and findings

Because there is no theory supporting our assumption about the autoregressive process in NFCI share, we performed in Table 3 Wooldridge test for autocorrelation. The null

¹⁰ In the model we are using lagged country-specific dependent variables and therefore the last observations entering the model are from 2013.

hypothesis of no first-order autocorrelation was rejected for both dependent variables. Therefore System GMM will be used as the main estimation method. Other methods will be applied for robustness check.

Table 3 | Wooldridge Test for autocorrelation – NFCI/TI, NFCI/TA

	<i>nfc_i_ti</i>	<i>nfc_i_ta</i>
F statistics	24.077	20.059
	(d.f. 1, 257)	(d.f. 1, 257)
p-value	0.0000	0.0000

H0: no first-order autocorrelation, d.f. = degrees of freedom

Source: Authors based on Bankscope

Table 4 shows the model that investigates the determinants of NFCI share in EU banks. System GMM yields the best estimation results, because for both dependent variables the lagged dependent variable is positive and significant with a 99% confidence level. The null hypothesis of no first-order autocorrelation in residuals is rejected in Arellano-Bond AR (1) for all models. For NFCI/TI models, we find also a positive and significant second lag and significant Arellano-Bond AR (2). For NFCI/TI higher lags were used as instruments because significant AR (2) made the second lag of the dependent variable endogenous. Furthermore, the significant AR (2) suggests that further lags of the dependent variable may be significant. This possible feature was tested among robustness tests. The Hansen test for over-identification with null hypothesis of exogenous instruments was not rejected. The rule of thumb that instruments should not exceed the number of groups is not violated. Therefore, our model is unlikely to suffer from over-identification. F-test indicates the joint significance of explanatory variables.

The reported outcome does not include all explanatory variables specified in Section 3.3. In order to obtain valid estimates, we excluded variables that were insignificant in the initial estimation with all defined independent variables and significantly correlated with other independent variables. More extended model specification was run among the robustness tests. The results proved to be robust to exclusion of correlated variables.

The coefficients of *eq_ass* are positive and significant meaning that banks with lower capital risk are better able to expand into non-traditional bank activities and to collect more money on fee income. Contrary to our expectation, we found that *depos_ass* is positively related with NFCI/TI as well as with NFCI/TA. This suggests that the depositors' demand for banking services is possibly inelastic and the European banks are able to exploit it by encouraging the depositors to undertake additional fee-based services and/or to charge more by selling those services at higher prices. It might also indicate a high switching costs. Higher cost to income ratio, meaning lower efficiency in expense management, increases NFCI/TI. The coefficients of *dhold* are significantly positive. This suggests that bank holdings and holding companies display on average higher NFCI shares than other bank types. Moreover, *dcoop* and under one-step estimation also *dcom* are positively related with NFCI/TI. All other bank-specific variables are insignificant.

Table 4 | Relationship between NFCI share and HI – System GMM Regression Results

Independent variables	Dependent variable			
	<i>nfc_i_ti</i>		<i>nfc_i_ta</i>	
	two-step	one-step	two-step	one-step
<i>lag_DV</i>	0.4392 (0.0705)***	0.4436 (0.0710)***	0.7502 (0.0696)***	0.7499 (0.0694)***
<i>lag2_DV</i>	0.2033 (0.0451)***	0.2036 (0.0454)***		
<i>nim</i>	−0.5112 (0.6350)	−0.5868 (0.6319)	0.0037 (0.0170)	0.0039 (0.0169)
<i>eq_ass</i>	0.3239 (0.0848)***	0.3207 (0.0864)***	0.0069 (0.0038)*	0.0069 (0.0037)*
<i>npl_loans</i>	−0.0750 (0.0501)	−0.0887 (0.0476)*	0.0015 (0.0014)	0.0016 (0.0014)
<i>cost_inc</i>	0.0848 (0.0426)**	0.0842 (0.0432)*	0.00005 (0.0003)	0.00005 (0.0003)
<i>depos_ass</i>	0.1418 (0.0464)***	0.1442 (0.0500)***	0.0040 (0.0014)***	0.0039 (0.0014)***
<i>hi</i>	−0.0023 (0.0008)***	−0.0024 (0.0007)***	−0.00005 (0.000)**	−0.00005 (0.0000)**
<i>lag_gdp</i>	−0.2472 (0.0920)***	−0.2317 (0.0988)**	0.0027 (0.0035)	0.0025 (0.0034)
<i>lag_inf</i>	0.0341 (0.1280)	0.0238 (0.1360)	0.0023 (0.0052)	0.0026 (0.0052)
<i>dcom</i>	3.4632 (2.3534)	3.6858 (2.1715)*	0.0660 (0.0491)	0.0653 (0.0453)
<i>dcoop</i>	4.6835 (2.4223)*	4.0640 (2.3001)*	0.0406 (0.0495)	0.0519 (0.0454)
<i>dsav</i>	−0.5114 (2.6458)	−0.3795 (2.5332)	−0.0410 (0.0656)	−0.0311 (0.0618)
<i>dinv</i>	2.7358 (3.6790)	3.8057 (3.7700)	0.1069 (0.1096)	0.1068 (0.1083)
<i>dhold</i>	5.2706 (2.5074)**	4.9449 (2.3856)**	0.1341 (0.0692)*	0.1467 (0.0707)**
<i>_cons</i>	−6.0392 (4.1816)	−5.9981 (4.3919)	−0.1444 (0.0707)**	−0.1414 (0.0639)**
Estimation diagnostics				
Number of observations	1548		1806	
Number of groups	258		258	
Observations per group	6		7	
Number of instruments	174		246	
F test	22.75***	18.02***	58.47***	61.86***
Arellano-Bond AR (1)	−2.46**	−2.94***	−2.19**	−2.51**
Arellano-Bond AR (2)	−2.76***	−2.60***	−0.58	−0.58
Hansen test	chi2(153)=172.52 Prob>chi2=0.134		chi2(225)=238.33 Prob>chi2=0.259	

Robust standard errors adjusted for 258 clusters in index are in parentheses, ***/**/* indicates significance at 1%/5%/10%, time dummies included in the regression are not reported in the table, *_cons* stands for constant

Source: Authors based on Bankscope, Eurostat, the ECB and the World Bank

11 See also Gambacorta and van Rixtel (2013) and De Young and Rice (2004b).

As depicted by Figure 3 and the correlation between NFCI/TI, NFCI/TA and *hi*, we have found significantly negative coefficient for *hi*. More precisely, for two-step estimator the coefficient of *hi* in NFCI/TI and NFCI/TA regression was -0.0023 and -0.00005 , respectively. Therefore, the more competitive is the market in which the bank operates, the higher the average NFCI share is. From this we can conclude that the competition pushes the banks to offer more non-traditional fee income bearing bank services which are potentially more risky than the traditional ones. This method of arriving at a conclusion may be done since we are using NFCI/TI ratio. NFCI *per se* includes both, fee income from traditional as well as fee income from non-traditional bank activities and alone cannot be used to measure the extent of non-traditional activities in a given bank. On the other hand, NFCI/TI is commonly used as a proxy for non-traditional bank activities.¹¹ Other bank sector-specific variables were excluded, because they were insignificant and highly correlated with *hi*. Among the country-specific variables, coefficients of *lag_gdp* are significantly negative for model with NFCI/TI as dependent variable. Inflation rate does not seem to influence fee income magnitude in banks.

To make sure that the results are valid, we have run many regressions using System GMM with different independent variables and sets of instruments. This is necessary since the optimal set of instruments is difficult to determine and too many instruments may hamper the regression results and Hansen test. The results were stable in terms of coefficients. Mostly, only the significances have changed. We never observed one coefficient to be significantly positive under one specification and significantly negative under another. We performed also the robustness check described by Bond (2002). Our System GMM results proved to be valid since the estimate of lagged dependent variable lies above the FE estimate and below pooled OLS estimate (see Table A.2).

3.5.1 Summary and comparison of results

Table 5 provides the comparison of results found in our study and the current literature. Operators \pm stands for positive/negative coefficient significant at least at 10% level. 0 indicates that the estimated coefficient is insignificant. Unlike most of the other academic papers, we examined the determinants of NFCI and not NII as a whole. Still, we believe that the results may be compared because NFCI represents the greatest part of NII in most of the banks.

The signs of all significant coefficients in this study are in line with most of the current literature. Higher equity to assets ratio, *i.e.* low capital risk, is related with higher NFCI shares. Deposits to assets ratio influences the NII share positively in U.S., German and Malaysian banks. On the contrary, in Jamaican and Korean banking markets, the effect seems to be the opposite. This may be caused by different levels of switching costs and dissimilar attitude of the customers. In the U.S., German and Malaysian markets the demand for bank services may be less elastic, which enables to charge higher fees on it. Our results suggest that EU-27 banking sector resembles the U.S., German and Malaysian banking market since the coefficient on *depos_ass* is significantly positive in our study. We have estimated a negative relationship between HI and NFCI share. This result supports the

findings of Moshirian *et al.* (2011). Macroeconomic conditions seem to play only limited role in NFCI share determination in most of the studies. Still, we are in line with Hahm (2008) that higher lagged GDP growth is connected with lower NII and therefore NFCI shares.

Table 5 | Comparison of estimated signs and significance levels for the coefficients on NFCI magnitude

Authors	Data	Coefficients							
		<i>nim</i>	<i>eq_ass</i>	<i>npl_loans</i>	<i>cost_inc</i>	<i>depos_ass</i>	<i>hi</i>	<i>lag_gdp</i>	<i>lag_inf</i>
Rogers and Sinkey (1999)	U.S. banks, 1989 – 1993	–	+	+		–			
DeYoung and Rice (2004a)	U.S. banks, 1989 – 2001					+			
Craigwell and Maxwell (2005)	Barbadian banks, 1985 – 2001					0			
Shahida, Abd. Ghafar, Sanep (2006)	Malaysian Islamic banks, 1994 – 2004	0	+	–		+			
Hahm (2008)	29 OECD countries' banks, 1992 – 2006	–	+	+	+			–	–
Bailey-Tapper (2010)	Jamaican banks, 1999 – 2010			+		–		0	
Kim and Kim (2010)	South Korean banks, 1999 – 2009					–			
Moshirian, Sahgal and Zhang (2011)	20 developed countries' banks, 1996 – 2010		+				–	0	0
Firth, Li, Wang (2013)	China's commercial banks, 1998 – 2007	–		0					
Busch, Kick (2015)	German banks, 1995 – 2011		+	0		+			
This study (2016)	EU-27 banks, 2007 – 2014	0	+	–/0	+/0	+	–	–/0	0

+/- indicates a statistically positive/negative coefficient at the 10% level or better, 0 indicates insignificant coefficients, in case of absence of the variable in the given study the cell is left blank, Hahm (2008) is using lagged independent variables, Rogers and Sinkey (1999), Bailey-Tapper (2010) and Firth et al. (2013) are not using *npl_loans* as a measure of loans quality but use provision for loan losses magnitude

Source: Authors based on individual papers and own results

Our results are in line with most of the current literature. Nevertheless, there are still opportunities for further research that should mainly aim to capture the banking market fragmentation better. Another improvement might be longer time period of the analysis. This would allow drawing more general results from the model. Moreover, since some variables needed to be excluded due to their correlation with HI, other measures capturing the technologic development in a given country that would not be correlated with other regressors should be included in the model.

4. Conclusion

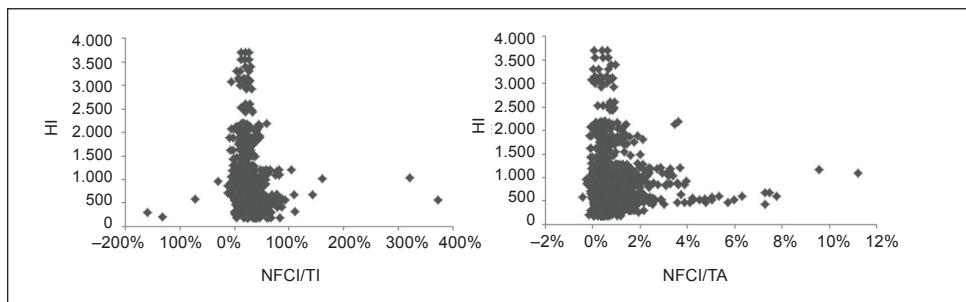
This paper focussed on the key determinants of bank fee and commission income in the EU. Since fee income represents the largest part of non-interest income earned by banks, it remains a major challenge for bank management to set and maintain an appropriate fee policy. Nevertheless, solving for the optimal fee structure has been yet accomplished neither on theoretical nor empirical levels.

The study was performed on balanced panel data from 258 EU-27 banks spanning the period from 2007 to 2014. Unlike in the existing studies, we have used System GMM estimation method as suitable for time persistent data. Different bank-specific, banking sector-specific and macroeconomic factors were considered. Our results confirm that the share of fee income is highly dependent on the bank business strategy as well as on market conditions. We were primarily concerned about the potential relationship between market concentration and fee income magnitude which in fact turned out to be present. The analysis suggests that banks facing higher competition tend to expand into potentially riskier non-traditional activities more aggressively and therefore they exhibit higher shares of fee and commission income.

Banks with a higher fee income share tend to rely more on equity financing, which in turn means that they report lower capital risk. This is possibly related to the fact that banks expanding into non-traditional businesses need more capital to prevent the potential risks of the new activity. Higher shares of fee income are also reported in banks with lower efficiency of expense management. Contrary to our expectation, we have found that high deposits to assets ratio, a proxy for traditionally-oriented banking, tends to be related with higher shares of fee income. This result seems to be largely dependent on the data used since the same relationship was found also in studies from the U.S. but not in studies from Jamaica and South Korea. Moreover, such conclusion may reflect either different levels of switching costs or different attitudes of bank clients. Our result suggests an inelastic depositors' demand for banking services what allows the European banks to sell more additional fee-based services and/or to sell those services at higher prices. Among macroeconomic conditions only GDP growth significantly affects banks' fee income policy, while other factors seem to play secondary role by fee income determination.

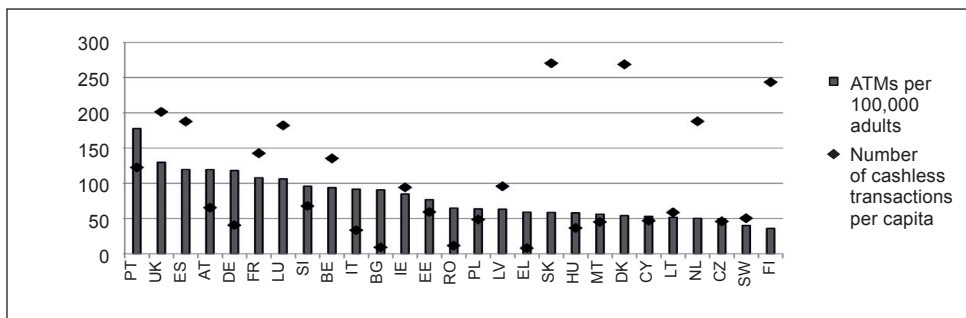
Appendix

Figure A.1 | Scatter Plot NFCI Share and HI



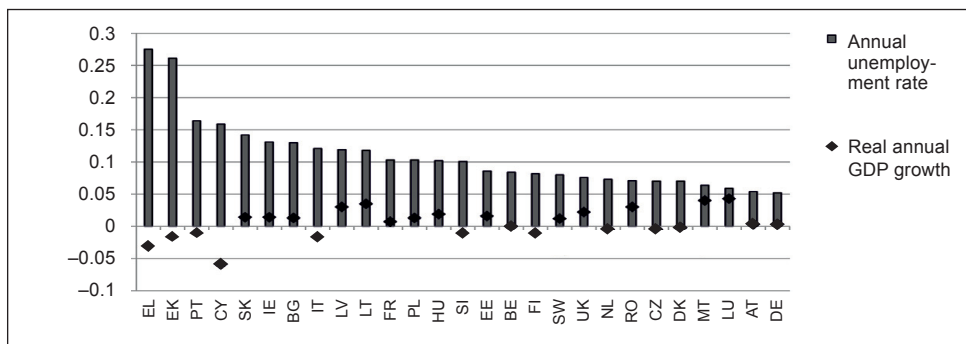
Source: Authors based on Bankscope and the ECB

Figure A.2 | The Development of Banking Sector in 2014 by Country¹²



Source: Authors based on World Bank and the ECB

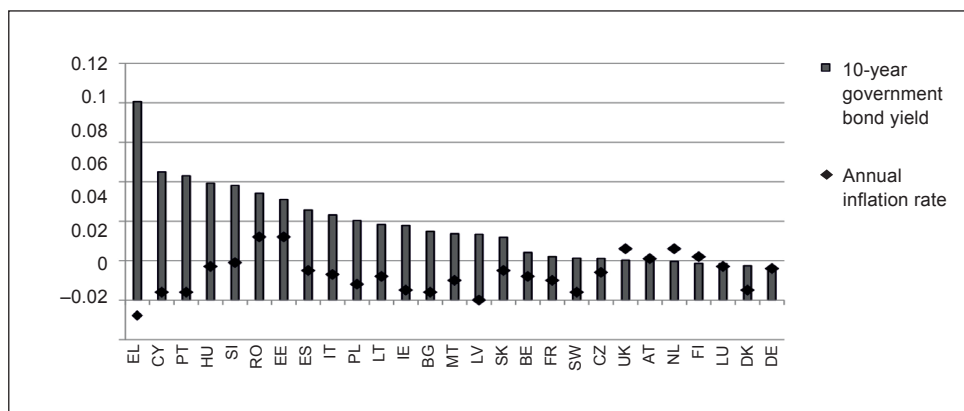
Figure A.3 | Macroeconomic Conditions in 2013 – Annual Unemployment Rate and Real Annual GDP Growth



Source: Authors based on Eurostat

¹² For Germany ATMs *per* 100,000 adults was not available in 2014 and therefore it was approximated by 2013 value.

Figure A.4 | Macroeconomic Conditions in 2013 – Long-Term Interest Rate and Annual Inflation Rate



Source: Authors based on Eurostat, the ECB and Helgi Library

Table A.1 | Summary statistics of used variables

Variable	Mean	Std. Dev.	Min	1 st quartile	Median	3 rd quartile	Max
<i>atms</i>	89.7	37.71	35.71	56.08	92.82	109.11	195.04
<i>cashless</i>	89.88	70.37	1.35	27.81	65.44	136.07	270.21
<i>cost_inc</i> (%)	63.89%	32.79%	9.05%	51.09%	59.99%	69.33%	656.76%
<i>depos_ass</i> (%)	52.65%	23.53%	0.01%	37.17%	53.78%	72.73%	95.40%
<i>eq_ass</i> (%)	8.18%	5.67%	-45.82%	4.94%	7.05%	10.05%	56.19%
<i>Hi</i>	858.5	512.58	183	519	797	1077	3700
<i>lag_gdp</i> (%)	0.97%	3.52%	-14.80%	-0.60%	1.50%	2.70%	11.90%
<i>lag_inf</i> (%)	2.56%	1.86%	-1.70%	1.60%	2.30%	3.30%	15.30%
<i>lag_int</i> (%)	4.39%	2.02%	1.40%	3.36%	4.23%	4.80%	22.50%
<i>lag_unem</i> (%)	8.76%	3.75%	3.10%	6.70%	7.90%	9.70%	27.50%
<i>ln_ass</i> (%)	16.55	2.47	10.55	14.82	16.66	18.24	21.67
<i>loans_ass</i> (%)	60.03%	19.26%	0.52%	49.77%	63.60%	74.19%	99.04%
<i>nfc_i_ta</i> (%)	0.82%	0.77%	-0.42%	0.41%	0.69%	1.04%	11.22%
<i>nfc_i_ti</i> (%)	25.37%	18.14%	-159.50%	17.56%	24.44%	31.16%	372.76%
<i>Nim</i> (%)	2.23%	1.44%	-0.47%	1.27%	2.04%	2.78%	13.40%
<i>npl_loans</i> (%)	7.25%	8.60%	0.00%	2.30%	4.37%	8.59%	67.71%
<i>roae</i> (%)	3.05%	29.86%	-992.29%	1.98%	6.31%	11.36%	185.71%

Source: Authors based on Bankscope, Eurostat, the ECB, HelgiLibrary and the World Bank

Table A.2 | Relationship between NFCI share and HI – robustness check

Independent variables	Dependent variable					
	<i>nfc_i_ti</i>			<i>nfc_i_ta</i>		
	OLS	System GMM	FE	OLS	System GMM	FE
lag_DV	0.5999 (0.0533)***	0.4392 (0.0705)***	0.2356 (0.0401)***	0.8437 (0.0479)***	0.7502 (0.0696)***	0.4858 (0.0535)***
lag2_DV	0.2254 (0.0306)***	0.2033 (0.0451)***	-0.0084 (0.0494)			

Robust standard errors adjusted for 258 clusters in index are in parentheses, ***/**/* indicates significance at 1%/5%/10%, other independents variables included in the regression are not reported in the table

Source: Authors based on Bankscope, Eurostat, the ECB and the World Bank

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