Do business cycle and economic liberalization effect banking efficiency in the Eurozone?

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Abstract. We investigate the impact of the business cycle and economic liberalization on banking profitability and risk-taking, using a dynamic panel of 722 European commercial banks covering the period 1999-2013. Findings show that banking efficiency is pro-cyclical. In addition, financial freedom and monetary freedom reduce profitability and increase risk-taking by commercial banks. However, freedom from corruption and fiscal freedom enhance profitability and reduce banking risk. Thus, banking efficiency depends on banks' size and economic liberalization degree. We notice that banking efficiency is pro-cycle before and after 2007 crisis. However, economic liberalization increases banking instability after the crisis. In addition, German banks react differently toward fiscal freedom which is associated to the German Bank levy. This heterogeneity between euro area countries could be explained by risk-taking cultures and banking governance structures.
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1. Introduction

The recent international financial turmoil has illustrated a strong association between financial markets and the real economy (Mclean and Zhao, 2014). The European sovereign debt crisis has added to this global financial and economic crisis,. As mentioned by Amisano and Tristani (2011), one of the notable features of the euro zone sovereign debt crisis has been its progressive spread across various euro zone countries. After the intensification of tension in the Greek government bond market in spring 2010, Ireland, Portugal, Spain and Italy became increasingly engulfed in the sovereign crisis. French and German sovereign credit default swaps (CDS) also increased. If a sovereign debt were to lead to the failure of European banks, the resulting financial instability could be disastrous for the real economy. This type of scenario highlights the need for identifying and understanding the cyclical behavior of banking efficiency. Recall that efficiency is defined as increasing profitability and reducing risk-taking by banks (or increasing in financial stability).

In this paper, we analyze the impact of the business cycle and financial liberalization on profitability and risk-taking by banks in the Euro zone from 1999 to 2013. We investigate whether banking efficiency behaves pro-cyclically or counter-cyclically over the business cycle. Cyclicality is defined as the relationship between the business cycle (economic growth) and banking efficiency. A positive association implies pro-cyclicality (counter-cyclicality) of efficiency during economic upturns (downturns) and a negative relation denotes its counter-cyclicality. We examine, in particular, whether the business cycle and financial openness influence banking profitability and risk-taking among the Euro area commercial banks.

This paper contributes to existing studies in several respects. First, this paper uses the largest

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available data for 722 commercial banks in 16 Euro area countries since the adoption of the Euro in 1999 and up 2013. Our sample includes unlisted banks, which represent the majority of banks in the European Union (EU). European banks became a source of risk to international financial markets during the financial crisis and attention to the European banking sector increased during the sovereign debt crisis (Black et *al*., 2016). Moreover, the bank bailout costs associated with the recent global financial crisis and the large output losses experienced in several European countries (which influence directly the real economy) clearly indicate the need for a better understanding of the cyclical behavior of banking profitability and risk-taking. We focus on the Euro zone because these countries must coordinate their economic and fiscal policies much more clearly than other EU member states (Baselga-Pascual et *al*., 2015). As stated by Poghosyan and Cihák (2011), an important motivation in favor of more centralized banking regulation in the EU is the notion that risks in the banking sectors of EU members have become increasingly homogenous. Second, the existing literature focuses either on cyclical behavior of banking profitability or risk. This paper examines the cyclical behavior of bank efficiency (profitability and risk-taking) and the effect of economic openness on the efficiency of commercial banks. We consider return on assets (ROA) and return on equity (ROE) as indictors of profitability, then, overall bank risk (Z-score), which is an inverse proxy for a bank's probability of failure and it is an indicator of financial stability at the bank level. Consequently, higher values of the Z-score indicate lower risk and greater stability. The Z-score has been used widely in previous empirical literature concerning the measurement and determinants of the safety and soundness of financial institutions (Angkinand and Wihlborg, 2010; Beck et *al*., 2012). In our study, we distinguish between the reverse of Z-score for return on asset (ZA) and the reverse of Z-score for return on equity (ZE). We also include the credit risk, using loan loss provisions over total assets (LLP) as a complementary measure of risk-taking for the Euro area commercial banks. Since insolvency is common risk in commercial banks mainly with credit risk.

Third, we use the Heritage Foundation's Index of economic freedom for practical purposes because their main components, which measure financial freedom**,** freedom from corruption, monetary freedom and fiscal freedom, reflect the financial and economic environment of the banking industry. According to the Heritage Foundation (2015), *the index of economic freedom is a resource for in-depth analysis of a country's political and economic developments*. *It also provides a comprehensive set of principles and facts for those who wish to understand the fundamentals of economic growth and prosperity.*[2]

In addition, this study compares the effect of business cycle and economic openness on banking efficiency between our sample's banks according to their size (largest vs. smallest) and according to European countries' economic liberalization degree (least regulated vs. regulated). Then, we test the effect of 2007/2008 crisis on commercial banks in the euro zone by dividing our sample to two sub-samples (before and after crisis).

Fourth, this paper uses the Generalized Method of Moments (GMM) technique for the dynamic panel data model to estimate cyclical behavior of banking performance and the influence of financial openness. Compared with the conventional static panel data regression model, the GMM technique is much more consistent and efficient in estimating the coefficients and in controlling the potential problems of endogeneity, heteroscedasticity, and autocorrelation (Arellano and Bover, 1995; Lee and Hsieh, 2014; Ben Buheni and Hasnaoui, 2017). In addition, persistence is another crucial feature of banking performance. The dynamic GMM estimator can control unobserved heterogeneity and the persistence of the dependent variable.

[2] See Heritage Foundation (2015): About the index: http://www.heritage.org/index/about

Firstly, findings show that banking efficiency is pro-cycle, which indicates that during economic upturns, while the profitability of commercial banks in the Euro area increases, risk-taking by their managers declines. However, during economic downturns profitability decreases and bank managers become less risk averse. According to the prospect theory proposed by Kahneman and Tversky's (1979) agents are risk-averse when facing sure gains, but they become risk-seeking when faced with sure losses. It is therefore reasonable to argue that bank managers have an incentive to increase risk-taking in a distressed situation (Zhang et *al*., 2016). Secondly, financial freedom, independence from government control, interference in the financial sector, and monetary freedom decrease profitability and increase risk-taking by commercial banks. However, fiscal freedom and Transparency International's Corruption Perceptions Index (CPI) increase return on assets, return on equity and reduce insolvency risk and credit risk. Thirdly, comparison between the largest banks and the smallest banks shows that commercial banks behave differently according to their size, since banks do not have the same incentives to risk-taking. We conclude that the effect of business cycle and liberalization on banking efficiency depends on banks' size and the degree of economic openness. We find then that the banking efficiency is pro-cycle before and after the 2007 crisis. However, more economic freedom encourages risk-taking after the crisis. Lastly, German commercial banks react differently toward fiscal freedom.

Our paper is structured as follows. Section 2 presents literature review; Section 3 presents our data and empirical methodology; Section 4 presents the empirical findings and analysis while Section 5 presents concluding remarks.

2. LITTERATURE REVIEW

Chortareas et al. (2013) point out that the greater the level of a country's financial freedom, the higher the benefits for banks, by highlighting the relationship between financial freedom and bank efficiency. Claessens and Laeven (2004); Roychoudhury and Lawson (2010) and Goddard et *al*. (2011) documented that more openness in the banking markets improves the efficiency and reduces borrowing cost for banks. Furthermore, there have been other studies that examine the international impact of economic freedom on various aspects of economic growth (Gwartney, 2009), bank stability (Nguyen et *al.* 2012), income convergence (Xu and Li, 2008), and global recession (Giannone et *al*. 2011). Nevertheless, most of these studies do not concentrate on the effect of financial freedom on banking lending and capital in the Euro area. The empirical evidence on the impact of financial freedom's effect on banking, lending and capital is relatively scarce. By examining different components of economic freedom, Sufian and Habibullah (2011) find that higher monetary policy increases banks' efficiency, while corruption in the business environment is negatively related to bank efficiency levels in China's banking sector. Other analyses of economic freedom have been considered in various contexts, but few contributions have focused explicitly on the effects of the different components of economic freedom on lending and banking capital. To fill this gap, this paper studies the effect of the different financial development indexes (financial freedom, fiscal freedom, freedom from corruption and monetary freedom) on the banking efficiency of commercial banks in the Euro area.

We measure banking profitability by the operational efficiency (profitability) using the return on assets (ROA) and return on equity (ROE). In addition, following the extant literature (e.g. Beck et al., 2007, 2009; 2012; Berger et al., 2009; Laeven and Levine, 2009; Houston et al., 2010 Cihák and Hesse, 2010; Angkinand and Wihlborg, 2010; Hsieh et al., 2013; Fang et al., 2014; Fazio et al., 2015; Ben Bouheni et al., 2014), we include the inverse of Z-score for

return of assets (ROA) and the inverse of Z-score for return on equity (ROE), as two proxies for risk-taking. The Z-score can be interpreted as the number of standard deviations by which returns would have to fall from the mean to deplete all equity in the bank. Assuming that bank profits are normally distributed (Roy, 1952), the inverse Z-score can be used to approximate a bank's probability of default (Laeven and Levine, 2009; Jiménez et al., 2013).

Several notable financial or banking crises have prompted many studies to explore financial liberalization, essentially blaming financial liberalization for having a strong relationship with crises (e.g., Demirgüc-Kunt and Detragiache, 2001; Lee et al., 2016), even as some studies do not concur (e.g., Shehzad and De Hann, 2009). Thus far, the financial liberalization–crisis nexus in the literature offers no concrete conclusion.

3. Data and empirical methodology

3.1. Data

Our empirical analysis is based on the Euro area sample of 722 commercial banks from 16 European countries[3] for the period since the adoption of the Euro as currency in 1999 until 2013. The appended Table A1 presents details on the number and the percentage of banks operating in each country. For the reliability of our results, we highlight countries recently entering the Euro area and which do not provide data for at least five years. Using the European Commission (2015)[4] report, we exclude Lithuania which joined the Euro area in 2015, Latvia in 2014 and Estonia in 2011. Today, the Euro area comprises 19 EU member States. The main data source of bank-level information is from the BankScope of Bureau van Dijk (2015 version), which is a widely used database in banking studies. The financial openness indicators are collected from the Heritage Foundation (2015). As for country-level variables, we collect GDP and inflation from the 2015 World Bank Indicators (WDI).

The database contains both listed[5] and non-listed commercial banks[6]. This is because unlisted banks represent the majority of banks in the EU[7]. We think that our sample should better allow us to identify the relationship between business cycle and banking efficiency, since listed and unlisted banks operate in the same legal and institutional environment. Thus, their stability affects the real economy. We focus on the commercial banks because they differ from different bank types mainly in terms of their business objective[8]. While commercial banks aim at maximizing profits, cooperative banks are created primarily to provide financial services to specific sectors or to improve financial access in selected geographical areas (Köhler, 2014). This suggests that different bank types have different risk-taking behavior. The final sample is an unbalanced panel including 722 commercial banks in 16 countries during the period 1999-2013. This dataset is among the most representative in banking literature in term of the number of years (15 years) and in term of region (the Euro area).

[3] Our sample is composed of the following Euro-area member States: Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain

[4] For Euro-area member States see: http://ec.europa.eu/economy_finance/euro/adoption/euro_area/index_en.htm

[5] In contrast to studies of Demirgüc-Kunt and Huizinga, 2010; Beccalli et *al*., 2015, in which they use only listed banks

[6] We focus on commercial banks that engage in loan operations. We have included all banks that have commercial banking lending activity in our data set. The average ratio of loans to total assets is 0.485, its standard deviation is 0.289 and, the maximum and the minimum values are 0 and 1, respectively. Therefore, there is a large number of banks for which the lending activity is marginal.

[7] Köhler (2014), using both listed and not listed European banks, finds that among the banks included in his sample more than 95% are not listed.

[8] Referring to Bankscope (2015), there are 722 commercial banks operating in the 16 Euro-area member States selected.

3.2. Methodology

This paper investigates whether the real economy and financial openness effect the banking efficiency in the Euro area from 1999 to 2013. To answer this question, we apply the dynamic panel data approach, suggested by Arellano and Bover (1995) and Blundell and Bond (1998), and we use the two-step GMM estimation, because this technique provides a more flexible variance-covariance structure for the moment conditions. As mentioned by Ben Bouheni et *al.* (2016), for the GMM method, the estimators have one- and two-step variants. The two-step estimator used in this paper is more efficient than the one-step estimator, especially for the GMM system (Hansen, 1982). We apply two main statistical tests to check the appropriateness of our dynamic GMM estimates. The first test is the specification test suggested by Blundell and Bond (2000) which applies the Sagan test of over-identifying restrictions. It tests the null hypothesis of valid instruments against its alternative hypothesis of invalid instruments. A further test, to check the validity of our estimates through the application of a serial correlation test on the estimated residuals of our model, is the Arellano–Bond test for autocorrelation of the errors, with a null hypothesis of no autocorrelation in differenced residuals. Specifically, the second-order test in first differences tests for autocorrelation in levels.

Our model is the following:
Panel A: The effect of business cycle and economic openness on banking efficiency:

$$Efficiency_{ijt} = \mu_i + \theta_t + \beta_1 \left(Efficiency\right)_{ijt-1} + \beta_2 \left(Business\text{-}Cycle\right)_{ijt} + \beta_3 \left(Economic\_Libealization\right)_{ijt} + \beta_4 \left(Controls\right)_{ijt} + \varepsilon_{it} \quad \textbf{(1)}$$

Where; Endogenous variable is *Efficiency* which is measured by (1) profitability (ROA and ROE) and, (2) risk-taking (ZE, ZA and LLP).

Explanatory variables are: *Business-Cycle* which reflects the economic stability and it is proxies by (GDPG); *Economic-Liberalization* indicators (MONF, FINF, FISCF and CORRUP) (see Table A2 for definition of variables).

Controls factors: Lending (LA); Capital indicators (ETA and CAPR); Deposit (DEPO); liquidity (LIQ); bank size (SIZE); asset growth rate (AGR); non-interest expenses (NIE) and; inflation (INF).
Lastly, β, μi, θt and εi,j,t respectively, are the estimated parameters, the bank fixed effect, the time fixed effect and the error term.

3.2.1. Endogenous variables: banking efficiency measures

We use return on assets (ROA) and return on equities (ROE) as proxies of bank profitability. As shown in this table 1.1, the return on assets (ROA) and the return on equities (ROE) have, on average values of 0.005 and 0.054, respectively.

We include ZA: the inverse of Z-score for return of assets (ROA) and ZE: the inverse of Z-score for return on equity (ROE), as indicators of risk-taking. According to table 1, ZA and ZE have on average 0.002 and 0.007 respectively. The insolvency risk (default risk) is measured by the reverse of Z-score for ROA (ZA) and the reverse of Z-score for ROE (ZE).

We recall that the theoretical foundation of the Z-score is based on Roy (1952) in which it measures the distance from insolvency. It is specified as the equation of [(the Return on Assets (ROA) + the Equity to Assets ratio (ETA))/standard deviation of ROA (σROA)][9]. It is calculated as the mean over 3 years (present year and the past 2 years). To encompass the features of various banking risk sources, in addition to Z-score indicators, we use credit risk (LLP), which is calculated as loan loss provisions over total assets, which has on average 0.006 (see table 1.1). Fang et al. (2014) uses this ratio as a proxy for credit risk.

3.2.2. Explanatory variables: Business cycle and economic liberalization

Following the exact literature (e.g., Shim, 2013, Bertay and al., 2015, Carvallo and al., 2015) to represent **Business cycle**, we use the annual GDP growth (*GDPG*). We specify this macroeconomic variable, the most natural indicator of the aggregate business cycle for an economy, to investigate the relationship between business cycle and bank efficiency. We predict that financial stability is positively associated with the business cycle during economic upturns. Alternatively, a negative relationship is expected if banks increase their risk-taking during economic downturns. Thus, financial stability would be pro-cycle. In addition, banking profitability is expected to be pro-cycle as well. This means that during economic prosperity, the profitability of banks increases but declines during economic distress.

Financial openness is composed of the following variables: Financial freedom which reflects financial liberalization (**FINF**): "*Financial freedom is a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector. State ownership of banks and other financial institutions such as insurers and capital markets reduces competition and generally lowers the level of available services. In an ideal banking and financing environment where a minimum level of government interference exists, independent central bank supervision and regulation of financial institutions are limited to enforcing contractual obligations and preventing fraud*" (Heritage Foundation, 2015). According to table 1.1, the mean financial freedom index value is 4.16, with a range from 3.40 to 4.50.

Freedom from corruption (**CORRUP**): "Corruption erodes economic freedom by introducing insecurity and uncertainty into economic relationships. The score for this component is derived primarily from Transparency International's Corruption Perceptions Index (CPI) for 2011, which measures the level of corruption in 183 countries. The CPI is based on a 10-point scale in which a score of 10 indicates very little corruption and a score of 0 indicates a very corrupt government. In scoring freedom from corruption, the Index converts the raw CPI data to a scale of 0 to 100 by multiplying the CPI score by 10." Heritage Foundation (2015). Summary of the descriptive statistics (see Table 1.1) shows that the mean of freedom from corruption is 4.24, with a range from 3.40 and 4.60.

Monetary freedom (**MONF**): According to Heritage Foundation (2015), "*Monetary freedom combines a measure of price stability with an assessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomic intervention is the ideal state for the free market. The score for the monetary freedom component is based on*

[9] Aside from ROA, Return on Equity (ROE) is also a measure of bank profitability as ROE includes operational efficiency and loan loss provisioning (Garcia-Herrero et al., 2009). ROE also can be decomposed through the Du Pont Equation into the net return rate and turnover rate of assets (equity), which measure the profitability and the ability of management at the same time (Lee and Hsieh, 2014). Hence, many previous studies use both ROA and ROE as proxies to measure bank profitability (such as Garcia-Herrero et al., 2009; Ben Bouheni et al., 2014) or apply ROE only (such as Goddard et al., 2004). Therefore, this study uses both of them and modifies the original Z-score by replacing ROA with ROE - labeled ZE (such as Lee and Hsieh, 2014).

two factors: (1) The weighted average inflation rate for the most recent three years and (2) Price controls. The weighted average inflation rate for the most recent three years serves as the primary input into an equation that generates the base score for monetary freedom. The extent of price control is then assessed as a penalty of up to 20 points subtracted from the base score". The descriptive statistics show that the mean monetary freedom index value is 4.42, with a minimum of 4.23 and a maximum of 4.51.

Fiscal freedom (**FISCF**): "Fiscal freedom is a measure of the tax burden imposed by government. It includes direct taxes, in terms of the top marginal tax rates on individual, corporate incomes and overall taxes, including all forms of direct and indirect taxation at all levels of government, as a percentage of GDP. Thus, the fiscal freedom component is composed of three quantitative factors: (1) The top marginal tax rate on individual income, (2) The top marginal tax rate on corporate income, and (3) The total tax burden as a percentage of GDP. In scoring fiscal freedom, each of these numerical variables is weighted equally as one-third of the component. This equal weighting allows a country to achieve a score as high as 67 based on two of the factors even if it receives a score of 0 on the third (Heritage Foundation, 2015). The mean of fiscal freedom for the 16 Euro area countries is 3.97, with a range from 3.50 and 4.49 (see Table 1.1 which provides a summary of the descriptive statistics for the data utilized in this study).

3.2.3. Controls variables

The model includes various **bank and country levels-controls**[10]. Specifically, we control for various bank-specific characteristics including: lending activities (*LA*): This is calculated as net loans over total assets and is used to control for the impact of lending activities on banking performance. Capital ratio indicators use the leveraged capital ratio (ETA), which is obtained as the ratio of shareholders' book equity over total assets, as in Flannery and Rangan (2008); Guidara and al. (2013). ETA= Equity/Total assets**;** The ETA suggested by Berger and al. (2009) represents the capitalization ratio and a higher ETA indicates a lower bank risk. The natural logarithm of regulatory total capital ratio (CAPR) is to control for the bank's soundness. The total regulatory capital includes several specified types of subordinated debt instruments that need not be repaid if the funds are required to maintain minimum capital levels. These comprise tier 2 and tier 3 capital.

Bank size (*SIZE*) is included to capture size effects on bank profitability and risk-taking. Large banks are likely to hold relatively higher risk-taking behavior since larger banks tend to be more diversified and have easier access to the capital markets than smaller banks (Shim, 2013). Larger banks may deter excessive risk-taking behavior to protect their charter or franchise value (Shim, 2013). Bank size is measured by the natural logarithm of total assets (SIZE). *AGR:* Asset growth rate is calculated as ((Asset t – Asset t-1)/Asset t-1). We expect positive correlation between the asset growth rate (AGR) and banking performance, implying that banks with a higher asset growth rate tend to have higher profitability (Ben Bouheni et al., 2016; Shim, 2013). *LIQ*: The ratio of liquid assets to total assets. It can be a measure of bank soundness and its ability to sustain its lending, as well as an indicator of inefficiency since too much liquidity comes at the cost of less bank intermediation (Bertay et al., 2015). Banks with a higher level of liquid assets that can readily be turned into cash if the need arises, have a greater ability to meet short-term financial obligations without having to resort to untimely sale of investments or fixed assets. Banks that are required to maintain a certain level of liquid assets may have less incentive to engage in riskier lending activities (Shim,

[10] Bertay et al. (2015) consider that control variables are taken to be exogenous to limit the number of instruments and prevent overfitting.

2013). We introduce in our regressions the ratio of total deposits to total assets (*DEPO*). While banks with a higher deposits-to-assets ratio are expected to be more risky (Iannotta and al., 2007), the impact on profitability is uncertain. Banks with a larger deposit base could be more profitable because such funds are cheaper especially in the presence of deposit insurance (Gropp and Köhler, 2010) but could also be less profitable because deposits are costly in terms of fixed and labor costs (branching) (Saghi-Zedek and Tarazi, 2015). Lastly, we follow the study of Lee and Hsieh (2014) and introduce the ratio of non-interest expenses to total assets (NIE) to control the banks' specific characteristics.
As for country-level variables, we collect inflation (*INF*) calculated as natural logarithm of consumer price index from the 2015 World Bank World Development Indicators (WDI)**.** We use inflation to control for economic stability as mentioned by Fang et al., 2014.

4. Empirical findings and analysis

Table 1.1 provides summary statistics for the variables of bank performance, explanatory variables and control variables. According to Table 1.2 presented in the appendix, the Pearson correlation coefficients between variables are used in our analysis. The correlation coefficients are usually less than 0.8, indicating that the correlation between variables has weak association. Kennedy (2008) indicates that multicollinearity is a critical problem when the correlation is above 0.80.

Table 1.1: Summary statistics

VBLE |	OBS	MEAN	STD. DEV.	MIN	MAX
ROA |	6647	0.005	0.042	-0.88	1.895
ROE |	6608	0.054	0.829	-37 .167	45.5
ZA |	5008	0.002	0.017	-0.1973	0.968
ZE |	4790	0.007	1.673	-78.991	69.563
LLP |	5891	0.006	0.0247	-0.231	1.389
GDPG |	10826	1.572	2.613	-8.539	10.971
FINF |	10826	4.161	0.1910	3.401	4.500
CORRUP |	10826	4.243	0.214	3.401	4.605
FISCF |	10826	3.972	0.192	3.450	4.494
MONF |	10826	4.420	0.044	4.231	4.509
LA |	6647	0 .484	0.289	0	1
DEPO |	6068	0.749	0.197	0	1.079
ETA |	10826	7.607	14.316	-45.82	100
CAPR |	2642	2.729	0.517	-0.844	6.033
LIQ |	6647	0.317	0.265	0	1
SIZE |	6395	7.367	2.231	0	14.605
AGR |	6395	0.082	1.614	-122.167	1
NIE |	6647	0.0316	0.0565	0	1.073
INF |	10826	4.524	0.108	4.054	4.693

This table reports summary statistics for the main analysis variables. Variable definitions are reported in Appendix in Table A2.

4.1. Full sample results

Table 2 reports the empirical results of investigating the effect of business cycle and financial openness on banking efficiency for the entire sample (722 commercial banks) during 1999-2013. We notice that the persistence coefficients of profitability (ROA and ROE) are negatively significant at 1% level. However, the persistence coefficients of risk-taking (ZE, ZA and LLP) are positively significant, meaning bank risk lasts from one year to the next.

From the results in Table 2 we can see that, as expected, banking efficiency is pro- cycle. Hence, an increase by 1% in GDP growth (GDPG) leads to an increase by 0.2% in profitability (ROE) at 5% level of significance and, a decrease by 2.5-0.1% in risk-taking (ZE, ZA and LLP) at 1% level of significance. This finding indicates that during economic upturns, while the profitability of commercial banks in the Euro area greatens (positive sign), risk-taking by their managers declines (negative sign). However, during economic downturns profitability lowers and bank managers become less risk averse. Banks' managers are risk-averse when facing sure gains, but they become risk-seeking when faced with sure losses (Kahneman and Tversky, 1979). It is therefore reasonable to argue that bank managers have an incentive to increase risk-taking in a distressed situation (Zhang et al., 2016).

As for financial development, overall the four indicators (FINF, CORRUP, FISCF and, MONF) show a significant effect on banking efficiency: financial freedom (FINF) and monetary freedom (MONF) are negative and statistically significant in regressions 1 and 2 (ROA and ROE) at 1% level. However, their coefficients enter with positive signs with banking risk indicators (ZE, ZA and LLP). This leads to the conclusion that financial freedom, which measures banking performance and independence from government control and interference in the financial sector, decreases profitability and increases risk-taking by commercial banks. In addition, monetary freedom, which measures price stability, decreases banking profitability and encourages risk-taking. Thus, an increase by one unit in monetary freedom (MONF) decreases return on asset (ROA) and return on equity (ROE) by, respectively, 0.018 units and 1.186 units. Nevertheless, increasing monetary freedom (MONF) by 1 unit conducts to rising bank risks (ZE, ZA and LLP) by 3.303, 0.004, and 0.007 units respectively.

However, freedom from corruption (CORRUP) and fiscal freedom (FISCF) boost banking profitability (ROA and ROE) and reduce risk-taking (ZE, ZA and LLP). Therefore, in all regressions, freedom from corruption (CORRUP) and fiscal freedom (FISCF) are statistically significant at 1% level. Thus, an increase by 1 unit in the Transparency International's Corruption Perceptions Index (CPI), the indicator of freedom from corruption, increases return on asset (ROA) by 0.006 and return on equity by 0.786. However, increasing the Transparency International's Corruption Perceptions Index by 1 unit reduces insolvency risks (ZE and ZA) and credit risk (LLP) by, 1.969, 0.012 and 0.007 units respectively.

For fiscal freedom (FISCF), its effect on profitability (ROA) is positive. This indicates that an increase of government imposed tax burden by 1 unit leads to an increase in return on assets (ROA) by 0.011 unit and, to a decrease by 4.75, 0.004 and 0.12 in, respectively, insolvency risk using ROE (ZE), insolvency risk using ROA (ZA) and, credit risk (LLP). Therefore, the fiscal freedom in Euro area countries, which is composed of (1) The top marginal tax rate on individual income, (2) The top marginal tax rate on corporate income, and (3) The total tax burden as a percentage of GDP, enhances profitability and lowers risk-taking.

To summarize, strengthening financial autonomy and price stability in the Euro zone encourages risk-taking by commercial banks and reduces their profitability. Nevertheless, economic transparency which introduces security and certainty into economic relationships, and fiscal freedom enhance banking profitability and lower risk-taking.

Turing to control variables, capital indicators (ETA and CAPR) and asset growth rate (AGR) are statistically significant at 1% level. They are positively associated with bank profitability (ROA and ROE) and negatively correlated with bank risk (ZE, ZA and LLP). We conclude that increasing bank capitalization, capital requirements and asset growth rate of commercial banks grow profitability and decrease risk-taking. Nevertheless, estimated coefficients of non-interest expenses ratio (NIE) and inflation (INF) are significantly negative in profitability regressions, and positive in all risk regressions, implying that an increase in non-interest expenses ratio and consumer price index is associated with an increase in banking profitability and a decrease in risk-taking. Meanwhile, the other controls such as lending (LA), deposit (DEPO), liquidity (LIQ) and size (SIZE) enter with mixed effects on banking profitability and risk-taking.

In addition, the panel dynamic estimates wholly pass the specification tests – the Sagan tests and the serial-correlation tests do not reject the null hypothesis of correct specification, which means that instruments are valid and there is no serial correlation.

Table 2: Impact of business cycle and economic openness on banking efficiency

	(1) ROA	(2) ROE	(3) ZE	(4) ZA	(5) LLP
LAG ROA	-0.062***				
	(-5.70)				
LAG ROE		-0.017***			
		(-12.47)			
LAG ZE			0.099***		
			(59.59)		
LAG ZA				0.239***	
				(66.75)	
LAG LLP					0.493***
					(47.36)
GDPG	-0.001	0.002**	-0.025***	-0.001***	-0.001***
	(-0.24)	(2.93)	(-7.52)	(-4.89)	(-9.43)
FINF	-0.008***	-0.229***	2.980***	0.001	0.002*
	(-3.71)	(-4.20)	(14.06)	(0.36)	(2.02)
CORRUP	0.006**	0.786***	-1.969***	-0.012***	-0.007***
	(2.65)	(7.28)	(-11.63)	(-18.13)	(-5.66)
FISCF	0.011***	0.034	-4.750***	-0.004***	-0.012***
	(4.49)	(0.39)	(-16.98)	(-10.33)	(-8.92)
MONF	-0.018***	-1.186***	3.303***	0.004***	0.007**
	(-3.78)	(-8.27)	(8.40)	(4.64)	(2.60)
LA	0.026***	-0.284**	2.148***	0.014***	-0.008***
	(8.69)	(-2.65)	(13.17)	(13.58)	(-5.50)
DEPO	0.023***	0.565***	2.933***	-0.008***	-0.022***
	(5.45)	(4.99)	(11.62)	(-10.19)	(-17.68)
ETA	0.002***	0.004	-0.146***	-0.000	-0.000***
	(23.87)	(1.42)	(-10.39)	(-0.10)	(-5.29)
CAPR	0.0129***	0.349***	-0.203***	-0.0115***	-0.009***
	(7.91)	(7.46)	(-7.51)	(-25.62)	(-13.81)
LIQ	0.0101***	-0.179*	-1.513***	0.010***	-0.002*
	(3.33)	(-2.34)	(-9.75)	(10.61)	(-1.99)
SIZE	0.003***	-0.120***	0.602***	0.000	-0.005***
	(3.81)	(-9.57)	(11.40)	(1.62)	(-11.48)
AGR	0.008***	0.255***	-1.026***	-0.003***	-0.0168***
	(5.79)	(7.49)	(-13.80)	(-12.40)	(-17.46)
NIE	-1.230***	-3.217***	39.63***	0.039***	0.367***
	(-66.41)	(-7.12)	(14.61)	(5.29)	(11.70)
INF	-0.077***	-0.079	4.539***	0.004**	0.032***
	(-16.49)	(-0.63)	(10.28)	(3.14)	(12.18)
_CONS	0.312***	3.259***	-43.97***	0.055***	-0.123***
	(13.82)	(4.10)	(-14.59)	(6.65)	(-8.75)
N	2260	2260	1680	1 720	2129
Instruments	119	119	92	105	119
AR(2)	0.180	0.320	1.101	0.010	0.649
P-value	(0.857)	(0.749)	(0.281)	(0.996)	(0.516)
Sargan	12.301	11.961	15.843	28.350	12.146
P-value	(0.14)	(0.256)	(0.122)	(0.104)	(0.896)

Notes: The dynamic panel system and GMM technique are adopted. The dependent variables: ROA is the return on assets. ROE is the return on equity. ZA is the inverse of Z_score of ROA indicating the insolvency risk, ZE is the inverse of Z_Score of ROE and, LLP is the total loan loss provision divided by total assets. LAG ROA and LAG ROE indicate the lagged one period of the banking profitability. LAG ZE, LAG ZA and LAG LLP indicate the lagged one period of risk-taking. The explanatory variables: GDPG is the annual GDP growth rate. FINF is the natural logarithm of financial freedom index. CORRUP is the natural logarithm of freedom from corruption. FISCF is the natural logarithm of fiscal freedom. MONF is the natural logarithm of monetary freedom. Control variables comprise various bank characteristics and country macro-factor including: LA which is the net loan over total assets. DEPO is the total deposits over total assets. ETA is the ratio of equity to total assets. CAPR is the natural logarithm of Regulatory Total Capital Ratio (tier 2 and tier 3 capital). LIQ is the ratio of liquid assets to total assets. SIZE is the natural logarithm of total assets. AGR is the asset growth rate calculated as ((Asset t – Asset t-1)/Asset t-1). NIE is the ratio of non-interest expenses to total assets.

INF is the natural logarithm of consumer price index. T-statistics are presented in brackets.* Significance at the 10% level.** Significance at the 5% level and *** Significance at the 1% level.

4.2. Results for largest banks vs. smallest banks

For deep analysis, we split our sample in two sub-samples: the largest banks with total assets >median total assets in 2013; and the smallest banks with total assets <median total assets in 2013. Following the study of Jokipii and Milne (2008), we differentiate between "smallest" and "largest" banks, defining the largest banks as those with total assets exceeding the 2013 median of €1244 million in 2013 and the smallest banks are those with total assets less than the 2013 median of €1244 million (results are presented in Tables 3 and 4).

According to Table 3, the smallest commercial banks display significant and positive effect of GDP growth (GDPG) on return on assets (ROA) and credit risk (LLP), implying that during economic upturns, ROA and credit risk increase, but during economic downturns, return on asset and credit risk decrease. However, GDP growth (GDPG) is statistically significant and negatively associated with return on equity (ROE) and insolvency risk (ZE and ZA). Thus, an increase by 1% in GDP growth (GDPG) leads to a decrease in ROE, ZE and ZA, respectively, by 0.8%, 0.1% and, 0.1%. According to Zhang et *al.* (2016), bank managers may have incentives to offer more risky lending than the optimal level. They explain such behavior using Jensen and Meckling's (1976) study which suggests two kinds of moral hazard problems. One is managerial risk-seeking, which arises when managers pursue their private benefits by investing in irrational projects or through insufficient monitoring of loans. The second moral hazard problem occurs from a conflict of interest between shareholders and creditors. Shareholders may want to make risky loans but eventually shift the risk to the depositors. Jensen and Meckling (1976) suggest that both of these moral hazard problems lead to a higher loan growth and a larger number of non-performing loans.

Meanwhile, as displayed in Table 4, the impact of GDP growth (GDPG) on efficiency of largest commercial banks is statistically significant and negative indicating that, an increase by 1% in GDP growth is associated with a decrease in profitability (ROE) by 0.2% hence, profitability of biggest banks is anti-cycle. Moreover, increasing GPD growth by 1% leads to a decrease in risk-taking (ZE, ZA and LLP) by, 3%, 0.1% and 0.1% respectively. We thus conclude that the stability of largest banks is pro-cycle.

As for economic openness, Table 4 shows that financial freedom (FINF) and monetary freedom (MONF) negatively affect profitability and positively affects risk-taking by the largest commercial banks. Nevertheless, financial freedom (FINF) increases both profitability ((ROA and ROE) and risk-taking (ZE, ZA and LLP) by small banks (see Table 3). Unlike the findings for the largest banks, monetary freedom (MONF) is positively associated with profitability (ROA and ROE) and negatively correlated with risk-taking (ZE, ZA and LLP) by the smallest banks.

In addition, as presented in table 3, fiscal freedom (FISCF) has a significant and negative impact on profitability and risk-taking by the smallest banks, but has a positive influence on the profitability of the largest banks. However, freedom from corruption (CORRUP) exhibits the same effect on both the largest and smallest banks (See tables 3 and 4). It means that freedom from corruption increases banking profitability (ROA and ROE) and reduces insolvency risk (ZE and ZA) and credit risk (LLP) for both smallest and largest banks.

To summarize, financial liberalization encourages risk-taking by both the smallest and the largest commercial banks and inversely affects their profitability (it increases the profitability of the smallest banks and decreases the profitability of the largest banks). Nevertheless, an increasing in Transparency International's Corruption Perceptions Index (CPI) and raising the tax burden imposed by government, lowers risk-taking by both the smallest and the largest banks. While price stability –monetary freedom indicator- increases profitability and reduces risk-taking by smallest banks, it reversely affects the largest banks, meaning that price stability decreases profitability and increases risk-taking by the largest commercial banks in the euro area. We conclude that the effect of economic openness on banking efficiency depends not only on banks' size but also on the economic liberalization indicators employed.

It is briefly worth noting that the effect of some bank-level indicators on banking efficiency depends on banks' size: for instance lending activities (LA) and presence of liquidity (LIQ) have a significant and negative impact on profitability and risk-taking by smallest banks. However, they positively affect profitability and risk-taking by the largest commercial banks. In addition, deposit (DEPO) has a positive impact on profitability (ROA and ROE) of both the smallest and largest banks, but has a different effect on their risk-taking (ZE, ZA and LLP) – deposit enters with positive signs for largest banks and with negative signs for smallest banks. Lastly, capital indicators (ETA and CAPR) increase banking profitability and decrease risk-taking by both smallest and largest commercial banks operating in the same financial and economic conditions.

Finally, to check the specification as well as the statistical properties of our estimators, the Sagan and the serial-correlation tests proposed by Blundell and Bond (2000) were applied, and both validated our specifications.

Table 3: Total assets of smallest banks < median total assets in 2013 = 1244

	(1) ROA	(2) ROE	(3) ZE	(4) ZA	(5) LLP
LAG ROA	0.035***				
	(10.49)				
LAG ROE		1.019***			
		(11.54)			
LAG ZE			2.456***		
			(52.92)		
LAG ZA				0.469***	
				(32.84)	
LAG LLP					0.489***
					(99.01)
GDPG	0.001***	-0.008***	-0.001	-0.001***	0.001***
	(18.41)	(-5.06)	(-1.68)	(-6.01)	(7.82)
FINF	0.010***	0.972***	0.106***	0.027***	0.020***
	(6.10)	(5.00)	(26.21)	(41.06)	(11.17)
CORRUP	0.068***	2.298***	-0.049***	-0.005***	-0.031***
	(43.54)	(18.53)	(-10.96)	(-11.19)	(-40.54)
FISCF	-0.010***	-1.201***	-0.021***	-0.005***	-0.010***
	(-6.99)	(-8.90)	(-4.31)	(-5.58)	(-4.95)
MONF	0.033***	0.968***	-0.232***	-0.072***	-0.140***
	(11.19)	(5.42)	(-25.80)	(-25.77)	(-42.54)
LA	-0.007***	-1.632***	-0.144***	-0.011***	-0.043***
	(-4.38)	(-13.22)	(-21.81)	(-13.33)	(-22.72)
DEPO	0.118***	2.745***	-0.127***	-0.058***	-0.066***
	(38.67)	(14.24)	(-18.87)	(-14.72)	(-27.61)
ETA	0.004***	0.052***	-0.003***	-0.001***	-0.001***
	(60.38)	(14.83)	(-9.96)	(-15.13)	(-30.81)
CAPR	0.021***	3.531***	-0.121***	-0.041***	-0.011***
	(42.57)	(25.40)	(-40.98)	(-34.90)	(-46.67)
LIQ	-0.016***	-2.721***	-0.046***	-0.015***	-0.017***
	(-10.19)	(-21.03)	(-14.07)	(-19.25)	(-12.35)
SIZE	0.019***	1.684***	0.034***	-0.011***	-0.016***
	(16.21)	(19.21)	(15.74)	(-37.58)	(-29.53)
AGR	0.031***	0.377***	0.057***	-0.013***	-0.028***
	(73.37)	(9.74)	(46.55)	(-35.12)	(-117.54)
NIE	-0.940***	3.117***	-0.119***	0.027***	0.371***
	(-126.90)	(5.40)	(-4.10)	(12.96)	(17.26)
INF	-0.104***	-6.259***	-0.201***	0.0491***	0.065***
	(-23.01)	(-22.53)	(-33.09)	(32.38)	(27.34)
_CONS	-0.305***	-5.973***	-1.273***	0.475***	0.611***
	(-19.52)	(-4.26)	(-13.60)	(25.12)	(30.46)
N	636	636	412	434	579
Instruments	119	119	92	105	119
AR(2)	1.256	1.103	1.53	0.053	0.865
P-value	(0.209)	(0.269)	(0.596)	(0.962)	(0.387)
Sargan	17.786	97.437	74.213	81.805	10.159
P-value	(0.354)	(0.636)	(0.536)	(0.691)	(0.561)

Table 4: total asset of largest banks > median of total assets in 2013=1244

	(1) ROA	(2) ROE	(3) ZE	(4) ZA	(5) LLP
LAG ROA	-0.015***				
	(-5.46)				
LAG ROE		-0.048***			
		(-24.92)			
LAG ZE			0.121***		
			(14.07)		
LAG ZA				0.254***	
				(34.94)	
LAG LLP					0.484***
					(24.16)
GDPG	-0.001	-0.002*	-0.030***	-0.001***	-0.001***
	(-0.65)	(-2.54)	(-11.30)	(-25.59)	(-67.22)
FINF	-0.016***	-0.543***	5.021***	0.003***	0.006***
	(-20.95)	(-12.21)	(29.98)	(27.35)	(32.22)
CORRUP	0.014***	0.483***	-2.525***	-0.007***	-0.009***
	(21.02)	(13.31)	(-23.36)	(-54.78)	(-16.81)
FISCF	0.009***	0.374***	-8.027***	-0.003***	-0.011***
	(14.40)	(9.54)	(-43.78)	(-20.39)	(-51.11)
MONF	-0.019***	-2.258***	4.752***	0.013***	0.023***
	(-13.90)	(-16.52)	(16.45)	(71.81)	(35.74)
LA	0.036***	1.072***	2.719***	0.015***	0.020***
	(27.38)	(14.93)	(18.71)	(47.97)	(37.67)
DEPO	0.012***	1.141***	2.553***	0.003***	0.003***
	(10.73)	(15.85)	(15.44)	(23.40)	(4.83)
ETA	0.002***	0.011***	-0.316***	-0.000***	-0.000***
	(46.10)	(3.60)	(-25.00)	(-24.08)	(-20.90)
CAPR	0.006***	0.664***	-0.071**	-0.000***	-0.004***
	(18.46)	(24.17)	(-2.58)	(-22.13)	(-26.21)
LIQ	0.020***	0.218***	3.456***	0.002***	0.005***
	(34.48)	(6.95)	(20.93)	(9.13)	(13.20)
SIZE	0.012***	-0.488***	0.274***	0.004***	-0.005***
	(34.80)	(-22.74)	(10.68)	(69.04)	(-37.11)
AGR	0.000*	0.112***	-0.924***	-0.002***	-0.003***
	(1.99)	(7.96)	(-26.60)	(-76.72)	(-9.88)
NIE	-0.184***	-26.08***	136.6***	0.011***	0.209***
	(-11.92)	(-34.98)	(42.13)	(14.35)	(15.91)
INF	-0.089***	1.201***	8.932***	-0.017***	0.025***
	(-48.65)	(12.38)	(23.13)	(-53.72)	(36.51)
_CONS	0.292***	12.68***	-66.45***	-0.000	-0.207***
	(31.55)	(15.86)	(-29.35)	(-0.15)	(-38.67)
N	1624	1624	1268	1286	1550
Instruments	119	119	92	105	119
AR(2)	1.135	0.404	1.728	0.146	0.747
P-value	(0.256)	(0.686)	(0.184)	(0.963)	(0.454)
Sargan	44.655	34.987	34.982	38.162	37.195
P-value	(0.104)	(0.189)	(0.201)	(0.107)	(0.137)

Notes: We use the same variables in tables 3 and 4. The dependent variables: ROA is the return on assets. ROE is the return on equity. ZA is the inverse of Z_Score of ROA indicating the insolvency risk, ZE is the inverse of Z_Score of ROE and, LLP is the total loan loss provision divided by total assets. LAG ROA and LAG ROE indicate the lagged one period of the banking profitability. LAG ZE, LAG ZA and LAG LLP indicate the lagged one period of risk-taking. The explanatory variables: GDPG is the annual GDP growth rate. FINF is the natural logarithm of financial freedom index. CORRUP is the natural logarithm of freedom from corruption. FISCF is the natural logarithm of fiscal freedom. MONF is the natural logarithm of monetary freedom. Control variables comprise various bank characteristics and country macro-factor including: LA is the net loan over total assets. DEPO is the total deposits over total assets. ETA is the ratio of equity to total assets. CAPR is the natural logarithm of Regulatory Total Capital Ratio (tier 2 and tier 3 capital). LIQ is the ratio of liquid assets to total assets. SIZE is the natural logarithm of total assets. AGR is the asset growth rate calculated as ((Asset t – Asset t-1)/Asset t-1). NIE is the ratio of non-interest expenses to total assets. And INF is the natural logarithm of consumer price index. T-statistics are presented in brackets.* Significance at the 10% level.** Significance at the 5% level and *** Significance at the 1% level.

5. Robustness check

We apply 3 different tests as follows:

5.1. Least regulated countries vs. regulated countries

To check the robustness of our findings, we divide the sample into two sub-samples, depending on the degree of their economic openness[11]. Thus, according to the Heritage Foundation Country Rankings (2016)[12]; Germany, the Netherlands, Luxembourg, Finland, Austria and Ireland are the freest countries in the euro area, we identify this group as "least regulated". However, Cyprus, Spain, Belgium, Malta, Slovakia, Slovenia, Portugal, Italy and France are mostly not free and Greece is considered moderately free; it is identified as the "regulated" group. At the end, our sample is divided into two groups: least regulated countries: Germany, Netherlands, Luxembourg, Finland, Austria and Ireland; and regulated countries: Cyprus, Spain, Belgium, Malta, Slovakia, Slovenia, Portugal, Italy, France and Greece.

Tables 5 and 6 present results for the two groups of countries. It is shown in Table 5 that GDP growth (GDPG) is statistically significant at 1% level and positively associated with profitability (ROA and ROE) of commercial banks in the most economically open countries (or least regulated) in the Euro area, which means that profitability is pro- cycle. However, the relationship between business cycle (GDPG) and risk-taking (ZA, ZE and LLP) is significant and negative, implying that banking stability is pro- cycle. Thus, the efficiency of commercial banks in the least regulated European countries is pro- cycle.

Table 6 shows that the profitability and the risk-taking by banks operating in regulated countries (least economically open countries) are counter-cycle. It means that during economic upturns (downturns) both profitability and risk decrease (increase). We conclude thus that there is a best risk management by banks in the least regulated counties since their risk-taking decreases when the profitability increases.

Turning to economic openness, we conclude that- with less regulation in the Euro area- financial freedom (FINF) and freedom from corruption (CORRUP) are statistically significant and negative with profitability (ROA and ROE). However, they show a positive relationship with risk-taking (ZA, ZE and LLP). We conclude then that increasing financial freedom, independence from government control, interference in the financial sector, and the Transparency International's Corruption Perceptions Index (CPI) in European countries with substantial financial openness reduce banking profitability and encourage risk-taking by managers.

Nevertheless, the relationship between fiscal freedom (FISCF), monetary freedom (MONF) and profitability (ROA and ROE) is statistically significant and positive, which means that raising the tax burden imposed by government and price stability increase banking profitability. While fiscal freedom (FISCF) encourages risk-taking (ZA, ZE and LLP), price

[11] Heritage Foundation (2015) measures economic freedom based on 10 quantitative and qualitative factors, grouped into four broad categories, or pillars, of economic freedom: (1) Rule of Law (property rights, freedom from corruption); (2) Limited Government (fiscal freedom, government spending); (3) Regulatory Efficiency (business freedom, labor freedom, monetary freedom); and (4) Open Markets (trade freedom, investment freedom, financial freedom). Each of the ten economic freedoms within these categories is graded on a scale of 0 to 100. A country's overall score is derived by averaging these ten economic freedoms, with equal weight being given to each. The scale is the following: 39.9-0: Not ranked; 49.9-40: repressed; 59.9-50: mostly unfree; 69.9-60: moderately free; 79.9-70: mostly free; and 100-80: free.

[12] For further information see: **http://www.heritage.org/index/ranking**

stability (MONF) reduces insolvency risk (ZA and ZE) and credit risk (LLP) of commercial banks in the least regulated countries.

Meanwhile, for the regulated European countries, results displayed in Table 6 show that financial and monetary freedoms decrease profitability of commercial banks. However, freedom from corruption and fiscal freedom increase profitability. In addition, financial freedom and fiscal freedom reduce risk-taking, however, monetary freedom and freedom from corruption increase insolvency risk and credit risk.

Comparing between bank-level indicators of commercial banks in the European countries with less regulation (Table 5) and European countries with more regulation (Table 6), we notice that lending activities and presence of liquidity in banks in the least regulated countries lower profitability and risk-taking by commercial banks. In contrast, lending and liquidity in regulated countries increase profitability and encourage risk-taking. We conclude that same bank specific factors perform differently according to the degree of economic openness. Nonetheless, deposit (DEPO), bank capitalization (ETA) and capital requirement (CAPR) exhibit the same effect on commercial banks in the Euro area. Indeed, deposit, bank capitalization and capital requirement increase banking profitability and decrease risk-taking.

Lastly, the panel dynamic estimates wholly pass the specification tests – the Sagan tests and the serial-correlation tests do not reject the null hypothesis of correct specification, which means that we have valid instruments and no serial correlation.

Table 5: LEAST REGULATED COUNTRIES: Germany, Netherlands, Luxembourg, Finland, Austria and Ireland

	(1) ROA	(2) ROE	(3) ZA	(4) ZE	(5) LLP
LAG ROA	-0.021***				
	(-4.65)				
LAG ROE		0.010***			
		(6.67)			
LAG ZA			0.383***		
			(104.40)		
LAG ZE				-0.013***	
				(-77.38)	
LAG LLP					0.510***
					(62.07)
GDPG	0.001**	0.002**	-0.001***	-0.016***	-0.001***
	(3.22)	(2.68)	(-33.56)	(-27.02)	(-10.95)
FINF	-0.022***	-1.663***	0.004***	-0.873***	0.010***
	(-16.98)	(-23.39)	(41.47)	(-35.46)	(11.01)
CORRUP	-0.025***	-3.696***	0.002***	0.082***	0.014***
	(-6.35)	(-28.61)	(10.29)	(3.92)	(6.89)
FISCF	0.007***	1.359***	-0.003***	-0.620***	0.007***
	(8.03)	(27.82)	(-45.37)	(-26.18)	(12.80)
MONF	0.021***	1.856***	-0.003***	-1.105***	-0.014***
	(9.14)	(22.71)	(-10.23)	(-42.87)	(-9.46)
LA	-0.006***	-0.522***	-0.004***	-0.391***	-0.007***
	(-5.12)	(-6.40)	(-17.51)	(-14.29)	(-6.58)
DEPO	0.008***	2.345***	-0.005***	-1.960***	-0.005***
	(5.37)	(19.15)	(-24.68)	(-38.94)	(-5.02)
ETA	0.000***	0.051***	-0.000**	-0.016***	-0.000***
	(14.45)	(12.07)	(-2.84)	(-13.18)	(-12.76)
CAPR	-0.000	0.368***	-0.002***	-0.308***	-0.004***
	(-1.15)	(16.03)	(-26.80)	(-28.67)	(-13.58)
LIQ	-0.002	-0.135*	-0.002***	-0.423***	-0.010***
	(-1.46)	(-2.19)	(-15.78)	(-28.68)	(-11.77)
SIZE	0.000*	-0.044***	0.000***	0.014***	-0.000***
	(2.29)	(-5.25)	(12.27)	(7.37)	(-4.59)
AGR	0.001***	0.195***	0.000	-0.116***	-0.007***
	(5.56)	(19.02)	(1.30)	(-27.17)	(-25.49)
NIE	-0.809***	-5.206***	0.003***	2.162***	0.042***
	(-16.53)	(-16.53)	(4.65)	(25.30)	(5.08)
INF	-0.033***	-0.388***	0.001**	3.158***	-0.000
	(-13.62)	(-4.16)	(3.20)	(24.80)	(-0.47)
_CONS	0.238***	-23.53***	-0.002	-10.94***	-0.049***
	(10.04)	(-28.84)	(-1.31)	(-18.14)	(-3.88)
N	958	958	734	717	868
Instruments	119	119	92	105	119
AR(2)	0.678	1.330	1.092	0.812	0.858
P-value	(0.497)	(0.183)	(0.275)	(0.417)	(0.391)
Sargan	18.374	16.699	99.569	96.894	93.837
P-value	(0.143)	(0.392)	(0.211)	(0.153)	(0.729)

T-statistics are presented in brackets.* Significance at the 10% level.** Significance at the 5% level and *** Significance at the 1% level.

Table 6: REGULATED COUNTRIES: Cyprus, Spain, Belgium, Malta, Slovakia, Slovenia, Portugal, Italy, France and Greece

	(1) ROA	(2) ROE	(3) ZE	(4) ZA	(5) LLP
LAG ROA	0.058***				
	(7.18)				
LAG ROE		-0.070***			
		(-59.84)			
LAG ZE			-0.261***		
			(-34.03)		
LAG ZA				0.183***	
				(73.74)	
LAG LLP					0.312***
					(37.60)
GDPG	-0.000***	-0.002*	-0.052***	-0.000***	-0.000***
	(-3.77)	(-2.15)	(-22.50)	(-5.07)	(-3.47)
FINF	-0.012***	-0.083	-9.517***	-0.004***	-0.008***
	(-5.79)	(-1.60)	(-35.79)	(-7.28)	(-5.42)
CORRUP	0.020***	0.952***	5.936***	0.015***	0.002
	(13.83)	(18.49)	(51.20)	(24.40)	(0.92)
FISCF	0.010***	0.556***	-18.08***	-0.010***	-0.044***
	(5.64)	(12.66)	(-91.84)	(-30.61)	(-23.38)
MONF	-0.028***	-3.293***	17.20***	0.022***	0.005
	(-6.17)	(-15.85)	(36.88)	(24.09)	(1.43)
LA	0.051***	0.103	4.320***	0.008***	0.033***
	(20.83)	(1.36)	(37.61)	(14.54)	(10.48)
DEPO	0.038***	0.581***	-4.878***	-0.010***	-0.019***
	(11.76)	(6.43)	(-22.68)	(-7.40)	(-7.34)
ETA	0.002***	0.003	-0.250***	0.000	-0.001***
	(32.80)	(0.96)	(-36.71)	(0.04)	(-23.62)
CAPR	0.025***	0.668***	-0.130***	-0.018***	-0.009***
	(20.61)	(18.76)	(-6.85)	(-23.34)	(-11.02)
LIQ	0.002	0.399***	0.767***	0.009***	0.013***
	(0.94)	(7.15)	(12.18)	(15.60)	(6.02)
SIZE	0.004***	-0.172***	1.673***	0.001***	-0.008***
	(6.45)	(-12.19)	(34.71)	(5.02)	(-13.14)
AGR	0.031***	0.976***	-2.446***	-0.009***	-0.031***
	(17.13)	(29.48)	(-52.61)	(-23.09)	(-42.82)
NIE	-1.615***	-6.752***	99.66***	0.052***	1.539***
	(-40.68)	(-8.06)	(37.06)	(3.90)	(37.54)
INF	-0.114***	-0.273***	5.548***	-0.007***	0.099***
	(-39.78)	(-3.32)	(28.63)	(-6.99)	(33.35)
CONS	0.435***	9.628***	-111.5***	0.092***	-0.589***
	(20.08)	(9.60)	(-37.92)	(11.49)	(-26.18)
N	1302	1302	963	986	1261
Instruments	119	119	92	105	119
AR(2)	0.169	0.152	1.077	0.162	0.933
P-value	(0.945)	(0.959)	(0.282)	(0.951)	(0.351)
Sargan	18.119	16.888	12.457	85.048	14.742
P-value	(0.146)	(0.165)	(0.104)	(0.598)	(0.433)

T-statistics are presented in brackets.* Significance at the 10% level.** Significance at the 5% level and *** Significance at the 1% level.

5.2. Financial crisis effect: Before 2007 vs. After 2007

We have identified two sub-periods to detect the effect of the financial crisis likewise the study of Maudos (2017). The banks' distribution was calculated separately for the expansion sub-period from 1999 to 2007 and the crisis sub-period from 2008 to 2013, so as to be able to ascertain whether there had been any change in the effect of business cycle and economic liberalization on banking efficiency before and during crisis.

Tables 7 and 8 exhibit findings about the effect of real economy (GDPG) and economic liberalization index (ECF) on profitability (ROA and ROE) and risk-taking (LLP and Z-SCORE) before and after the financial crisis of 2007. In fact, Table 7 shows that, before the 2007 financial crisis, GDP growth has a positive and significant association with ROE at 1% level of significance. But, GDP growth impacts negatively the insolvency risk (Z-SCORE) at a weak level of significance (10%). In addition, economic liberalization index (ECF) have a negative effect on the Z_SCORE at 1% level of significance. Indeed, increasing economic openness by 1% leads to decreasing default risk by 0.5%.

However, after the 2007 crisis, Economic openness (ECF) effects negatively the profitability (ROE) at 1% level of significance, and positively the default risk (Z_SCORE) at 10% level of significance (see Table 8). This finding reveals that lower degree of controls and restrictions in the European economy after the recent financial crisis may threaten banking efficiency.

Like the period before 2007 crisis, the GDP growth has a positive relationship with profitability (ROE) and it is strongly negative with risk-taking (LLP and Z_SCORE) at 1% level of significance. Thus, we conclude that the European economic recovery is the best way to reduce credit and insolvency risks for commercial banks and hence, increases their profitability and their stability.

In sum, banking efficiency is pro-cycle before and after 2007 crisis. However, economic liberalization encourages risk-taking after this crisis (it reduces risk-taking before the crisis). Consequently, European economic prosperity boosts banking stability and profitability. However, European banks need more efficient regulation and supervision since economic liberalization increases banking instability after the 2007 crisis.

Table 7: Before 2007 financial crisis

	(1) ROA	(2) ROE	(3) LLP	(4) Z_SCORE
LAG ROA	0.342***			
	(48.68)			
LAG ROE		0.071***		
		(21.66)		
LAG LLP			0.008***	
			(8.06)	
LAG ZSCORE				0.016***
				(5.10)
GDPG	0.001	0.007***	-0.001	-0.001*
	(1.03)	(3.94)	(-1.47)	(-2.03)
ECF	-0.011	-0.137	0.013	-0.005***
	(-0.95)	(-1.34)	(1.66)	(-4.86)
CONS	0.053	0.641	-0.051	0.022***
	(1.04)	(1.50)	(-1.53)	(4.89)
N	2118	2109	1842	1316
Instruments	30	30	30	23
AR(2)	0.69	-1.77	-1.20	-0.85
P-Value	(0.48)	(0.27)	(0.22)	(0.39)
Sargan	(25.69)	40.34	45.23	49.21
P-Value	(0.48)	(0.23)	(0.11)	(0.12)

Table 8: After 2007 financial crisis

	(1) ROA	(2) ROE	(3) LLP	(4) Z_SCORE
LAG ROA	0.032***			
	(18.01)			
LAG ROE		-0.001		
		(-0.65)		
LAG LLP			0.079***	
			(11.46)	
LAG ZSCORE				0.272***
				(17.82)
GDPG	0.001	0.003**	-0.001***	-0.001***
	(1.53)	(3.20)	(-4.42)	(-3.74)
ECF	0.011	-1.112***	0.010	0.002*
	(1.30)	(-4.26)	(1.80)	(1.97)
_CONS	-0.042	4.728***	0.047*	-0.008
	(-1.23)	(4.29)	(1.99)	(-1.85)
N	3256	3239	2841	2711
Instruments	72	72	72	66
AR(2)	0.83	0.47	0.91	-1.34
P-Value	(0.41)	(0.66)	(0.37)	(0.19)
Sargan	114.1	131.1	86.89	87.1
P-Value	(0.22)	(0.40)	(0.26)	(0.31)

Notes: in Tables 7 and 8, the dynamic panel system and GMM technique are adopted. The dependent variables: ROA is the return on assets. ROE is the return on equity. Z_SCORE indicator of default risk and, LLP is the total loan loss provision divided by total assets. LAG ROA and LAG ROE indicate the lagged one period of the banking profitability. LAG Z-SCORE and LAG LLP indicate the lagged one period of risk-taking. The explanatory variables: GDPG is the annual GDP growth rate. ECF is the natural logarithm of overall economic liberalization index. T-statistics are presented in brackets.* Significance at the 10% level.** Significance at the 5% level and *** Significance at the 1% level.

5.3. Country with the largest number of banks: Germany

The majority of commercial banks from our sample is in Germany. Thus, we test the effect of GDP growth and economic liberalization on banking profitability and risk-taking for 137 German commercial banks, which represents the important number from our sample. In addition, we focus on commercial banks operating in the European leader "Germany", because Germany is considered as the European *flight-to-safety country* as mentioned by Beetsma et al. (2016).

Table 9 presents estimates using 137 German commercial banks during the period 1999-2013. Findings confirm that during economic upturns, profitability (ROA and ROE) increases and risk-taking (LLP and Z_SCORE) decreases, indicating that banking efficiency of German commercial banks is strongly pro-cycle at 1% of significance. Moreover, financial freedom (FINF), fiscal freedom (FISCF) and monetary freedom (MONF) reduce profitability (ROA and ROE) and, they increase credit risk (LLP) and default risk (ZSCORE). However, freedom from corruption (CORRUP) boosts profitability (ROA and ROE) and reduces default risk (Z_SCORE).

We conclude that, unlike euro zone commercial banks, the fiscal freedom in Germany tightens banking profitability (ROA and ROE) and encourages risk-taking (LLP and Z_SCORE). Indeed, increasing fiscal freedom (FISCF) by 1% declines profitability (ROA and ROE) by 0.7% and 19.9% respectively. However, decreasing FISCF by 1% leads to an increase by 2% in credit risk (LLP) and by 0.1% in default risk (Z_SCORE).

Buch et al. (2016) analysis the effects of the German bank levy, which has been implemented since 2011 as part of the German Bank Restructuring Act[13], on banking behavior.

Their findings show that the majority of German banks were exempt from paying the tax. The bulk of the tax payments comes from large commercial banks and central institutions of savings banks and credit unions. In addition, for largest banks, which were affected by the levy, they find evidence for a reduction in lending and higher deposit rates.

[13] "*The tax base for the levy is calculated by taking banks' total liabilities deducting equity and retail deposits. Banks are exempt from paying the tax if their contribution-relevant liabilities are less than €300 million. For contribution-relevant liabilities exceeding €300 million, tax payments are increasing progressively but are capped at 20% of profits. The levy has the objectives to generate resources for a restructuring fund and to internalize banks' contributions to systemic risk*" (Buch et al.,2016. p1).

Table 9: German banks: effect of business cycle and economic freedom on banking efficiency

	(1) ROA	(2) ROE	(3) LLP	(4) Z_SCORE
LAG ROA	0.228***			
	(38.03)			
LAG ROE		0.069***		
		(33.93)		
LAG LLP			0.003***	
			(37.41)	
LAG ZSCORE				0.355***
				(27.39)
GDPG	0.001***	0.004***	-0.001***	-0.001***
	(33.14)	(21.06)	(-47.15)	(-62.67)
FINF	-0.001***	-0.109***	0.001	-0.002***
	(-20.47)	(-24.25)	(0.22)	(-70.37)
CORRUP	0.041***	0.255***	0.073***	-0.004***
	(85.49)	(10.51)	(44.70)	(-72.01)
FISCF	-0.007***	-0.199***	0.021***	0.001***
	(-43.05)	(-69.45)	(67.98)	(71.64)
MONF	-0.062***	-0.106***	0.161***	-0.007***
	(-38.87)	(-85.48)	(77.14)	(-54.51)
_CONS	0.130***	0.628***	-1.109***	0.060***
	(13.05)	(53.81)	(-47.78)	(76.99)
N	1290	1280	1168	894
Instruments	110	110	110	96
AR(2)	1.09	0.99	-0.46	-1.59
P-Value	(0.27)	(0.31)	(0.64)	(0.11)
Sargan	112.1	112.2	106.2	95.8
P-Value	(0.25)	(0.25)	(0.40)	(0.30)

Notes: The dependent variables: ROA is the return on assets. ROE is the return on equity. Z_SCORE indicator of default risk and, LLP is the total loan loss provision divided by total assets. LAG ROA and LAG ROE indicate the lagged one period of the banking profitability. LAG Z_SCORE and LAG LLP indicate the lagged one period of risk-taking. The explanatory variables: GDPG is the annual GDP growth rate. ECF is the natural logarithm of overall economic liberalization index. T-statistics are presented in brackets.* Significance at the 10% level.** Significance at the 5% level and *** Significance at the 1% level.

6. Conclusion

We have used a dynamic panel of 722 commercial banks during the period 1999-2013 and the GGM system to investigate the cyclical behavior of banking efficiency in the Euro zone and the effect of financial liberalization. Findings show that banking efficiency is pro-cycle, implying that during economic upturns banking profitability and stability increase, unlike during economic downturns. In addition, financial freedom and monetary freedom decrease profitability and increase risk-taking by commercial banks. However, freedom from corruption and fiscal freedom enhance profitability and reduce banking risk. Thus, strengthening financial autonomy and price stability in the Euro zone encourages risk-taking by commercial banks and reduces their profitability. Nevertheless, economic transparency - which introduces security and certainty into economic relationships- and tax burden boost banking profitability and lower risk-taking. Therefore, comparing the largest and smallest banks reveals that commercial banks behave differently according to their size, since banks do not have the same incentives to risk-taking. Thus, we conclude that the effect of business cycle and economic liberalization on banking efficiency depends not only on banks' size but also on the economic freedom indicators employed. Hence, the heterogeneity between euro area countries could be explained by risk-taking cultures and banking governance structures.

Robustness check shows that that commercial banks in the least regulated countries react differently towards economic openness and business cycle from commercial banks in regulated countries. Moreover, banking efficiency is pro-cycle before and after 2007 crisis. However, economic liberalization increases banking instability after the crisis. Consequently, European economic prosperity boosts banking stability and profitability; and European banks need more efficient regulation and supervision to reduce risk appetite. In addition, unlike euro zone commercial banks, the fiscal freedom in Germany tightens banking profitability and reduces stability, which could be explained by the German Bank Restructuring Act "levy".

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Appendix

Table A1: Distribution of banks per country

Country name	Number of banks	% distribution of commercial banks per country
Austria	69	0.0955
Belgium	30	0.0415
Cyprus	17	0.0235
Finland	19	0.0263
France	123	0.1703
Germany	137	0.1900
Greece	9	0.0124
Ireland	14	0.0193
Italy	92	0.1274
Luxembourg	67	0.0927
Malta	9	0.0166
The Netherlands	31	0.0429
Portugal	25	0.0346
Slovakia	12	0.0166
Slovenia	17	0.0235
Spain	51	0.0706
Total	722	1

Table A2: Description of the relevant variables

Variable name	Description and source

1. Dependent variables: Banking efficiency measures

Profitability:

ROA The ratio of return to total assets. Source: Bank scope (2015) and authors' calculation

ROE The ratio of return to total equities. Source: Bank scope (2015) and authors' calculation

Risk-taking:

ZA The inverse of Z-Score for ROA = (ROA+ETA)/σROA. Source: Bank scope (2015) and authors' calculation

Here, ROA is the ratio of return to total assets, ETA is the equity percent of assets, and σROA is standard deviation of return on assets as a proxy for return volatility, using 3-year moving average. A larger value of the bank-level Z-Score indicates a higher stability and less overall bank risk. We use the inverse Z-score to approximate a bank's probability of default.

ZE The inverse of Z-Score for ROE = (ROE+ETA)/σROE. Source: Bank scope (2015) and authors' calculation

Here, ROE is the ratio of return to total equities and σROE is standard Deviation of return to total equities as a proxy for return volatility

LLP Total loan loss provision divided by total assets. Source: Bank scope (2015) and authors' calculation.

2. Explanatory variables

Business cycle

GDP_G The annual GDP growth from the World Bank's WDI 2015

Economic Freedom (source: Heritage Foundation – 2015 Index of Economic Freedom)

FINF: The natural logarithm of Financial freedom which is a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector. State ownership of banks and other financial institutions such as insurers and capital markets reduces competition and generally lowers the level of available services. In an ideal banking and financing environment where a minimum level of government interference exists, independent central bank supervision and regulation of financial institutions are limited to enforcing contractual obligations and preventing fraud. Credit is allocated on market terms, and the government does not own financial institutions. Financial institutions provide various types of financial services to individuals and companies. Banks are free to extend credit, accept deposits, and conduct operations in foreign currencies. Foreign financial institutions operate freely and are treated the same as domestic institutions. Five areas are considered to assess an economy's overall level of financial freedom that ensures easy and effective access to financing opportunities for people and businesses in the economy. An overall score on a scale of 0 to 100 is given to an economy's financial freedom through deductions from the ideal score of 100[14].

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CORRUP: The natural logarithm of Freedom from corruption: "Corruption erodes economic freedom by introducing insecurity and uncertainty into economic relationships. The score for this component is derived primarily from Transparency International's Corruption Perceptions Index (CPI) for 2011, which measures the level of corruption in 183 countries. The CPI is based on a 10-point scale in which a score of 10 indicates very little corruption and a score of 0 indicates a very corrupt government. In scoring freedom from corruption, the Index converts the raw CPI data to a scale of 0 to 100 by multiplying the CPI score by 10. For example, if a country's raw CPI data score is 5.5, its overall freedom from corruption score is 55.

For countries that are not covered in the CPI, the freedom from corruption score is determined by using the qualitative information from internationally recognized and reliable sources. This procedure considers the extent to which corruption prevails in a country. The higher the level of corruption, the lower the level of overall economic freedom and the lower a country's score." Heritage Foundation (2015)

MONF: The natural logarithm of Monetary freedom which combines a measure of price stability with an assessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomic intervention is the ideal state for the free market. The score for the monetary freedom component is based on two factors: (1) The weighted average inflation rate for the most recent three years and (2) Price controls. The weighted average inflation rate for the most recent three years serves as the primary input into an equation that generates the base score for monetary freedom. The extent of price controls is then assessed as a penalty of up to 20 points subtracted from the base score.

FISCF: The natural logarithm of "Fiscal freedom which is a measure of the tax burden imposed by government. It includes direct taxes, in terms of the top marginal tax rates on individual and corporate incomes, and overall taxes, including all forms of direct and indirect taxation at all levels of government, as a percentage of GDP. Thus, the fiscal freedom component is composed of three quantitative factors: The top marginal tax rate on individual income, The top marginal tax rate on corporate income, and the total tax burden as a percentage of GDP. In scoring fiscal freedom, each of these numerical variables is weighted equally as one-third of the component. This equal weighting allows a country to achieve a score as high as 67 based on two of the factors even if it receives a score of 0 on the third. Fiscal freedom scores are calculated with a quadratic cost function to reflect the diminishing revenue returns from very high rates of taxation." Heritage Foundation (2015).

ECF: The natural logarithm of overall score of economic freedom. Heritage Foundation (2015) measures economic freedom based on 10 quantitative and qualitative factors, grouped into four broad categories, or pillars, of economic freedom:

1. Rule of Law (property rights, freedom from corruption);
2. Limited Government (fiscal freedom, government spending);
3. Regulatory Efficiency (business freedom, labor freedom, monetary freedom); and
4. Open Markets (trade freedom, investment freedom, financial freedom).

3. Controls

Bank & country levels:

LA Lending measure: Net loan over total assets. Source: Bank scope (2015) and authors' calculation

ETA Bank-level capitalization ratio, measured as the ratio of equity to total assets. Source: Bank scope (2015)

CAPR Natural logarithm of Regulatory Total Capital Ratio. The total regulatory capital includes several specified types of subordinated debt instruments that need not be repaid if the funds are required to maintain minimum capital levels (these comprise tier 2 and tier 3 capital). Source: Bank scope (2015) and authors' calculation

DEPO Total deposits divided by total assets. Source: Bank scope (2015) and authors' calculation

LIQ Ratio of liquid assets to total assets. Source: Bank scope (2015) and authors' calculation

SIZE The natural logarithm of total assets. Source: Bank scope (2015) and authors' calculation

AGR The asset growth rate = (Asset t – Asset t-1)/Asset t-1. Source: Bank scope (2015) and authors' calculation

NIE The ratio of non-interest expenses to total assets. Source: Bank scope (2015) and authors' calculation

INF The natural logarithm of consumer price index (2010 = 100) from the World Bank's WDI 2015

Table 1.2. Correlation coefficients