Ferdowsi University of Mashhad

Iranian Journal of
Accounting, Auditing & Finance

Received: 2021-06-28
Accepted after revision: 2021-09-29
Published online: 2021-11-20

RESEARCH ARTICLE DOI: 10.22067/ijaaf.2021.40647

Single Monetary Policy, Inflation Targeting, Interest Rate Targeting and Bank Efficiency in the Euro Area: Panel Generalized Method of Moments Approach

Ehsan Rajabi

Department of Agriculture and Food Policy, Agriculture Planning, Economic and Rural Development Research Institute (APERDRI), Ministry of Jihad-e Agriculture, Tehran, Iran

Reza Sherafatian Jahromi

Department of Economics, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

Abstract

This study investigates the dynamic linkages between the efficiency of 126 selected banks and the Single Monetary Policy (SMP) defined by credit channel, interest rate channel, exchange rate channel, and price stability in 17 Euro area countries from 1999 to 2012. The dynamic generalised method of moments (GMM) estimator shows a positive relationship between the bank's cost and profit efficiency and bank lending and liquidity by estimating the two-stage panel regression model. Still, capitalisation, exchange rate, inflation targeting (price stability), long term interest rate targeting was associated with lower cost and profit efficiency scores. Therefore, the impact of the Maastricht Protocol targeted policy, coefficients of inflation and long-term interest rate targeting variables are negatively related to the bank efficiency level. Specifically, on average higher bank lending, liquidity and deposit facility can be associated with improving profit efficiency of banks. In contrast, capitalisation, exchange rate, inflation targeting, and long-term interest rate targeting variables had a negative effect on cost and profit efficiency levels. The policy implication arising from the analyses presented is that the European monetary authority has faced significant pressures of inflation targeting and long-term interest rate targeting policy on bank performance that negatively influence bank efficiency.

Keywords

Inflation Targeting**,** Interest Rate Targeting**,** Credit Channel, Interest Rate Channel, Exchange Rate Channel, Price Stability

Corresponding author: Ehsan Rajabi
Email: *rajabi.ehsan63@gmail.com*

Number of Tables: 6
Number of References: 36
Pages: 23

https://ijaaf.um.ac.ir
E-Issn: 2717-4131

RESEARCH ARTICLE

1. Introduction

Since the first of January 1999, eleven mainland European countries have executed a uniform monetary policy, the members of the Economic and Monetary Union (EMU) attuned monetary and even fiscal policies to common targets. This common monetary policy is critical for permanent economic growth, investment decisions, and financial intermediation. Because of inflation management, exchange rate and interest rate significantly impact credit institute performance (like efficiency) by theoretical and empirical linkages. Otherwise, the introduction of the Euro seems to be a crucial stage in the process of rapid change within the financial structure of the European Union by improving the financial landscape to a substantial extent. Particularly in the banking sector, (international) mergers and acquisitions are frequent occurrences. European banks thereby not only expand their scale but also extend their scope of activities. These rapid modifications in banking structures, systems of financial markets, and behaviour offinancial agents make the management of the Single Monetary Policy by the European Central Bank (ECB) much more difficult. It is most likely that the monetary transmission mechanism of economies in the euro area will change further, which complicates the already difficult task of the new European monetary authorities. Consequently, it is essential to gain deeper insights into the monetary transmission mechanism and its linkage and influence on banking activity.

This issue will become more important when a single supervisory mechanism (SSM) for banks in the euro area is a future step in strengthening the EMU. The ultimate responsibility for specific supervisory tasks associated with banks' financial stability will lie with the ECB in the new single mechanism. Therefore, assigning the task of banking supervision to the ECB raises questions regarding the consequences for its primary mandate, Single Monetary Policy, on the euro area banking system. Consequently, the evaluation of ECB monetary policy is an option for the banking system to comprehensively assess the single monetary policy by ECB regarding bank efficiency. As a result, a comprehensive and extensive assessment of ECB policy (as monetary policy-maker) in the case of a single monetary policy could have discovered the weakness and strength of its operation and light up the darkness of newly attributed supervisory power under the European banking union. Therefore, this study will examine the influence of the Single Monetary Policy on banks' cost and profit efficiency in the euro area from 1999 to 2012.

The findings of the current study contributed to the body of knowledge. The empirical finding of studies about the track of bank efficiency from introducing the Euro to 2012 indicates the efficiency level differs over time and from one bank to another, one country to others. Furthermore, a consequence of a series of monetary policy channel factors (bank lending, liquidity and deposit facility, marginal lending facility, capitalisation, exchange rate, inflation targeting, and long-term interest rate targeting) demonstrate its significant influence on bank efficiency. In this path, this paper introduces two new variables in European banking literature for the first time. Inflation targeting and long-term interest rate targeting are external specific factors that influence the degree of efficiency of the bank from the environment in which the bank performs its activities. Introducing these two new variables is necessary because recognising and using factors that significantly influence banks' performance is vital for improving efficiency in the euro area banking market.

The rest of this paper is structured as follows. Section 2 briefly reviewed the literature. The research method is represented in section 3, followed by the result and discussion in section 4. Finally, conclusions depict in section 6.

DOI: 10.22067/ijaaf.2021.40647

RESEARCH ARTICLE

2. Literatures Review

In various countries, monetary policies are used as a powerful tool. However, the consequences are not always predictable. One of the most common ways to prevent unwanted consequences of monetary policies is determining the timeframes and how the policies may influence the country's economy. Commonly employed mechanisms are exchange rate effects, asset pricing effects, interest rate effects and the so-called credit channel.

Despite various research about this issue in the related literature, there is still no general agreement about how monetary policy can affect the economy. The impacts of monetary policies on an economy vary based on the country's level of development. Some channels, such as the exchange rate, can be less effective in countries with a single currency like the Eurozone Member States (see Angeloni et al. 2002).

Monetary policies can influence interest rates. For instance, tightening monetary policy increases interest rates and reduces investment (based on Keynesian theory). The increasing interest rate leads to alterations in asset prices (based on Monetarist theory). Moreover, in case of a reduction of money supply, people liquidate a portion of their equity holdings. Reduction in equity value leads to more challenging times for companies to raise funds to support their investment spending. On the other hand, any reduction in equity values results in a lower expenditure of customers as their wealth effect decreases. The upward pressure interest rate increase puts on the exchange rate causes the price of domestic products to be higher than the foreign products. In all of the above examples, the outcome will be lower demand and outputs (Mishkin, 1995).

Credit channels can be divided into bank lending and bank balance sheet channel. Both of the channels derive from failures of the Modigliani-Miller theorem for banks. The bank lending channel is based on the assumption that monetary policy impacts the liability of the bank. This leads to no substitute perfect in nature for loans in both asset and liability side of the balance sheet (see, among many others, Bernanke & Blinder, 1988; Bernanke & Gertler, 1995; Gertler & Gilchrist, 1993; Trautwein, 2000). Therefore, tightening monetary policy means a reduction of reversible liabilities.

It is questionable, however, whether or not the monetary policy in practice directly affects bank liabilities. The indirect influence of a change in monetary policy on total bank liabilities also remains not straightforward (Altunbaş, Bondt and Marques-Ibanez, 2004). Another critique of the bank-lending channel is that banks can easily switch to alternative forms of financing, issuing certificates of deposits that are sources of loan funding; for instance, by issuing certificates of deposits. A final critique is that banks can liquidate assets other than loans, most likely liquid assets, such as selling treasury securities to reduce their liabilities.

In theory, it can be said that the exchange rate affects the banks in two ways; directly and indirectly. Directly, the bank is affected through its assets' structure, foreign currency liabilities, and services that are not based on assets (Martin & Mauer, 2003). On the other hand, banks will be directly affected by the changes in the exchange rate in cases where they do not hold the same amount of foreign currency assets and liabilities (Sahminan, 2004).

In empirical studies, U.S. studies tend to show a relationship between bank capital and loan growth. They also demonstrate the impact of monetary policy on loan provision that depends on the degree of bank capitalisation. In contrast, the evidence on the transmission of monetary policy analysis in the euro area is somewhat inconclusive on whether bank capital matters for the impact of monetary policy on lending. In their studies, Kishan and Opiela (2000) display the effect of monetary policy on the provision and supply of loans in U.S. bank capital matters from a monetary policy perspective.

Turning to the euro area evidence, a bank-level panel data study by De Bondt(1999) finds some evidence favouring a bank lending channel in five-euro zone state members. The effect of monetary policy on bank lending behaviour generally depends on the size and liquidity of the bank. Although no evidence of a bank-lending channel was found in any of the countries, French banks were found to have used their excess capital to maintain lending levels. Ehrmann et al.(2001; 2003) show that, in contrast to bank liquidity, neither capitalisation nor bank size plays a role in distinguishing banks' lending behaviour in euro area countries.

The absence of capitalisation impacts and bank size has been explained by maintaining the informational asymmetries within the euro area to be lower than the U.S. Altunbaş Fazylov and Molyneux. (2002) show little evidence of a lending channel via either bank size or capital strength for Germany and France. In contrast, Gambacorta and Mistrulli (2003:2004) find evidence for Italy favouring bank lending and a bank balance sheet channel. The employment of quarterly data for 1992-2001 shows that well-capitalised Italian banks protect their lending from monetary policy shocks comparably better than other banks since they can access non-deposit fundraising more easily. They also find evidence of a mismatch between liabilities and assets in co-operative Italian banks that possess mature balance sheets; therefore, a substantial interest rate mismatch indicates the relatively strong monetary policy effects.

In addition, based on evidence provided by a significant number of recent research, the relevance of bank lending channels is more significant in some European countries than in the USA. This happens due to non-financial company's higher level of bank dependency and the centralisation of banking activities on a limited number of banks. The studies include researches conducted by Garretsen and Swank (1998) in the Netherlands, Escriva and Haldane (1994) in Spain, Dale and Haldane (1995) in the UK, and Buttiglione, Ferri and d'Italia. (1994) in Italy. Moreover, based on Chrystal and Mizen's(2002) findings, credit is pivotal in the UK's transmitting monetary process. Fuinhas(2008) found notable sectoral differences between monetary transmission channels of Portugal.

Furthermore, interest rate shocks generally have greater impacts on economic activities and happen faster in companies lending to individuals. The Garretsen and Swank (2003) study conducted in the Netherlands indicates an instant decrease of household loans with a rise in interest rates. The corporate loans were dropped in a similar situation, causing a delay. The fact that the decline in the household loan was not accompanied by a notable decline in consumer expenditure points to the limited degree of importance the bank lending channel has in the Netherlands' monetary policy transmission. Based on Cecchetti's(1999) arguments, the differences in the significance of credit channel is mostly a result of European countries' heterogeneous financial structure.

Other examples of such research carried out in different countries, including studies conducted by Ferri and Domac (1999), Ding, Domaç and Ferri. (1998), and Kim (1999) in South Korea. Based on these studies, South Korea has had an operative bank-lending channel, particularly before 1997's year-end financial crisis. The findings of Suetorsak's(2006) studies on some East Asian countries reveal the effect of monetary policies on bank decisions on micro-economic issues. Another notable research that Hachicha conducted and Lee (2009) in Egypt reveals the weakening of monetary policy transmission through interest rate channels in the short and, more importantly, the long run.

Lastly, another significant fact on the bank lending behaviour was found from Chu et al. (2007) findings. Based on their finding, banks' commitment with low degrees of capitalisation credit lines has decreased prior to Basle Accord's introduction. Moreover, based on Brooks et al. (2000) arguments, deregulation and re-regulation have case sensitive effects on the banking sector.

DOI: 10.22067/ijaaf.2021.40647

RESEARCH ARTICLE

According to these researches, bank-lending behaviour is affected by monetary policy measures and institutional reforms.

These studies point to the degree to which the central bank's activities change loan supply and the extent to which economies depend on the bank as the main factors determining the significance of the credit channel. In the literature of monetary policy, empirical and theoretical evidence supports the effectiveness of monetary transmission channel on bank lending, liquidity and capitalisation of a bank, so the study employs factors that can measure them as the variable that can affect bank efficiency for the first time in literature.

Because of the literature discussed, we can say that empirical studies in banking efficiency have been conducted extensively (for example, USA, Germany, and Spain) with financial variables and monetary policy; however, few studies have been done to investigate banking efficiency in European countries, especially for all the euro area countries with monetary policy variables. Therefore, more empirical work is needed on the banking efficiency in the euro area member states, and the major objective of this paper is "to investigate the impact of single monetary policy on banking efficiency by applying two-stage procedure to fill the gap of literature; in this region."

Therefore, this study will help you identify the bank performance (efficiency) when this study employs different measures of the ECB's primary monetary policy instrument (i.e., targeted inflation, interest rate stability, and so on), which is highly reliant on the set of macroeconomic changes. This investigation is mainly oriented on the Euro area's economy and banking efficiency from 1999 to 2012.

3. Research Methodology

To examine the correlations of bank efficiency with environmental variables and Single Monetary Policy of ECB, a two-step quantitative research design was employed to accomplish the purpose of the current study: Data Envelopment Analysis (DEA) and panel regression analysis (*i.e.* GMM). The DEA was employed to get the cost and profit efficiency scores of banks. Next, the efficiency scores generated from the DEA linear programing were used as independent variables in a panel regression model to explain bank performance, the dependent variable (Lehmann, Warning, & Weigand, 2004). Using panel regression, a non-parametric method and multivariate analysis may assist in understanding and validating behavioural relationships in the banking sector (Sanjavi, 2006). Therefore, the current study examines if there is a relationship between the efficiency of banks and the Single Monetary Policy of ECB in the euro area. For the second step, a linear regression model is estimated to be in the following form.

$$y_{it} - y_{it-1} = (1-\alpha)y_{it-1} + \beta(L)X_{it} + \eta_i + \varepsilon_{it} \quad (1)$$

Where y_{it} represents the score of efficiency bank i at time t, X represents the set of the explanatory variable, η_i can be described as an unobserved specific effect of the country and ε_{it} can be described as an error term.

These international studies build a common frontier pooling the cross-country bank sand measuring the banking efficiency differences between countries considering environmental conditions. In other words, in existing studies that estimate the efficiency of banks in a cross-national scenario, the standard approach is to construct a common efficient frontier for all firms, considering their home country. However, this approach can compare the different banking systems on an unequal footing because it accounts for cross-country differences in regulation, economic and

demographic conditions, which are beyond the control of bank managers.

The present study focuses on the intermediation approach to construct the DEA frontier to estimate cost and profit efficiency scores. The inputs and outputs selected under the intermediation approach in the present study are summarised in Table 1. Under the intermediation approach (following Berger and Humphrey, 1992), we assume deposits (X_1): demand, savings, and time deposits, labour (X_2): staff of bank together with management expertise required for providing bank services, physical capital (X_3): offices, branches, and computer hardware as inputs and loans (Y_1): is the total amount of loans concerning each banking firm, investment (Y_2): total securities, equity investments and other investments as outputs.

Price of borrowed funds (w_1) was used as interest expenses over the sum of deposits price of labour(w_2) calculated by personnel expenses to the employees' number as the unit price of labour. Price of physical capital (w_3) was measured by non-interest expenses over fixed assets. Price of loan (p_1) was calculated by interest income on loans over the total loan. Price of investment (p_2) was measured by total non-interest operating income plus other interest income over other earning assets. Table 1 summarises inputs, outputs, and their prices employed to estimate the cost and profit efficiency by the DEA approach.

Table 1. Input, output, and prices under intermediation approach

Name (Symbol)	Description	Definition	Source
Deposits (X_1)	Deposits & short term funding	Sum of demand, savings, and time deposits	Bankscope
Labor (X_2)	Number of employees	Staff of bank	Bankscope
Physical capital (X_3)	Total fixed assets	Offices, branches, and computer hardware	Bankscope
Loan (Y_1)	Total loan	The sum of all loan accounts intermediated by banks less non-performing loans	Bankscope
Investment (Y_2)	Other earning assets	Total securities, equity investments and other investments	Bankscope
Price of borrowed fund (w_1)	Interest expenses over the deposit	Interest expenses over the sum of deposits	Bankscope
Price of labour (w_2	Personnel expenses over total labour	Average personnel expenses for each staff	Bankscope
Price of physical capital(w_3)	Non-interest expenses over fixed assets	Other operating expenses form total non-Interest expenses over fixed assets	Bankscope
Price of loan(P_1)	Interest income on loans over total loan	Average interest income of loan	Bankscope
Price of investment (P_2)	Total non-interest operating income plus other interest income over other earning assets	The average income of other earning assets	Bankscope

Since we assume that banks minimise cost in the euro area, we consider input-oriented efficiency with the variable return to scale in this study. The minimum cost is obtained by solving the DEA linear programming problem:

$$min \sum_{i=1}^{n} w_{io} x_i \qquad (2)$$

DOI: 10.22067/ijaaf.2021.40647

$$subject\ to: \sum_{i=1}^{N} x_{ij}\lambda_j \leq x_i \quad (i = 1, 2, \dots, n)$$

$$\sum_{i=1}^{N} y_{rj}\lambda_j \geq y_{r0} \qquad (r = 1, 2, \dots, m)$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad (j = 1, 2, \dots, N)$$

where $j = 1, \dots, N$ are the number of banks, $i = 1, \dots, n$ are input volumes used by bank j, $r = 1, 2, \dots, m$ measures the volume of output r and w_{io} is the unit cost of the input i of bank DMU_o which is the benchmark projection that can be different from one bank to another. Although the objective is to choose the $x_i$andλ_j values to minimise the total cost of satisfying the output constraints. The w_{io} in the objective represent unit costs. The minimisation problem is calculated for each bank and year in the sample, thus identifying a benchmark combination of inputs and cost.

Every DEA model assumes returns-to-scale characteristics that are represented by the ranges of the sum of the intensity vector λ, *i.e.*, $L \leq \lambda_1 + \lambda_2 + \dots + \lambda_n \leq U$. Here, we compute variable returns to scale and use $L = U = 1$. We consider convex hull representation. Our model allows substitutions in inputs. Based on an optimal solution (x^*, λ^*) of the above problem, the cost efficiency of DMU_o is defined as

$$CE_o = \frac{C_{min}}{C_o} = \frac{\sum_{i=1}^{n} w_{io} x_i^*}{\sum_{i=1}^{n} w_{io} x_{io}} \tag{3}$$

Where CE_o is the ratio of the minimum cost to observed cost for the othfirm. This approach implies that all observed input-cost combinations are measured with no error. Outliers may be classified as very efficient simply because of data error.

Similar to cost efficiency, the profit efficiency (PE) can be estimated by solving the following linear programming problem n times; each time for a different bank in the sample. Therefore, the profit-maximization problem of a multiple-output, multiple-input firm facing input and output prices w and p, respectively, can be formulated as the following DEA problem:

$$\pi = py^* - wx^* = max \sum_{r=1}^{m} p_r y_r - \sum_{i=1}^{n} w_i x_i \tag{4}$$

$$subject\ to: \sum_{j=1}^{N} x_{ij}\lambda_j \leq x_i \quad (i = 1, 2, \dots, n)$$

$$\sum_{j=1}^{N} y_{rj}\lambda_j \geq y_r \quad (r = 1, 2, \dots, m)$$

$$\sum_{j=1}^{N} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad (j = 1, 2, \dots, N)$$

The profit efficiency of DMU_O is defined as the ratio between the observed profits and the

maximum profits as follows:

$$PE_O = \frac{\pi_o}{\pi_{max}} = \frac{\sum_{r=1}^{m} p_{ro} y_{ro} - \sum_{i=1}^{n} w_{io} x_{io}}{\sum_{r=1}^{m} p_r y_r^* - \sum_{i=1}^{n} w_{io} x_i^*} \quad (5)$$

For measuring Single Monetary Policy, this research applies variables that have the proxy to credit channel, interest rate channel, exchange rate channel, and price stability.

To reflect the variables as explained in Table 2. equation 2 is extended, and the baseline regression model is developed as below:

$$\begin{aligned} \mathrm{EF}_{ijt} = \alpha + \lambda\, \mathrm{EF}_{ijt-1} + \beta_1 \ln(LEND)_{ijt} + \beta_2 CAP_{ijt} + \beta_3 LQUID_{ijt} \\ + \beta_4 DINTRS_{ijt} + \beta_5 MINTRS_{ijt} + \beta_6 REXCH_{ijt} + \beta_7 INFLT_{ijt} \\ + \beta_8\, LINTRS_{ijt} + \eta_j + \varepsilon_{ijt} \end{aligned} \quad (6)$$

$$i = 1, \dots, 126, t = 1, \dots, 14\ j = 1, \dots 17$$

As already recorded, EF is cost and profit efficiency of bank i at time t for country j that was estimated by Data Envelopment Analysis (DEA). Therefore, this model was estimated two times for cost and profit efficiency.

Credit channel measured by $(LEND)$ which is defined by domestic credit provided by banking sector for each Member States, (CAP), which is defined by bank capital and reserves to total assets for each Member States, and $(LQUID)$, which is defined by liquid assets such as cash, interbank lending, and securities to total assets for each Member States. Based on assumptions of bank lending channel literature, less capitalised or less liquid bank has more problems to compensate monetary policy caused reduction in deposits. Therefore, it should respond more strongly than a bank with a higher value of the corresponding bank characteristic. This would indirectly suggest positive coefficients regarding interaction terms.

The interest rate channel is another channel through that ECB can affect bank performance, so deposit facility $(DINTRS)$ and marginal lending facility $(MINTRS)$ be used as a measurement of monetary policy for the operational framework of the Euro-system instrument. By applying these interest rates, ECB offers a standing facility as an instrument set for controlling the money market to obtain overnight liquidity from banks.

The exchange rate channel can be measured by ECB reference exchange rate; US dollar/Euro$(REXCH)$.Regarding the exchange rate of the Euro, the ECB is the main authority that is responsible for Euro's management. Therefore, based on Single Monetary Policy that ECB has chosen, exchange rate policy can affect bank efficiency.

The ECB keeps price stability in the euro area by monetary policy to achieve economic growth without inflation. For a sustainable degree of price stability over one year, an unweighted arithmetic average inflation rate should not go beyond more than one and a half percentage points that of, at most, the three performing Member States with the lowest HICP inflation. Therefore, this paper tries to measure price stability $(INFLT)$as the main objective of monetary policy by the difference between the actual level of the average rate of inflation (HICP) and reference value (defined in the Maastricht Protocol), this variable is defined in terms of the time *t* expected difference between Member States inflation (yearly) and the euro area targeted values (2% in the medium term), respectively.

DOI: 10.22067/ijaaf.2021.40647

RESEARCH ARTICLE

Finally, long-term interest rate developments ($LINTRS$) is the euro area control variable measured by the difference between the actual level of average yields for 10-year government bonds and reference value (defined in the Maastricht Protocol). This variable is defined for the criterion on the convergence of interest rates referred to Maastricht Protocol that said, a Member State has had an average nominal long-term interest rate that does not exceed by more than two percentage points that of, at most, the three best performing Member States in terms of price stability.

Table 2. Measurements of single monetary policy

Variable	Symbol	Name	Description	Source	Expected sign
Credit channel	$LEND$	Bank lending	Domestic credit provided by the banking sector for each Member States (USD)	WB	+
	CAP	Capitalisation	Bank capital (capital and reserves) to total assets for each Member States (%)	IMF	+
	$LQUID$	Liquidity	Bank liquid reserves to bank assets ratio for member states (%)	IMF	+/-
Interest rate channel	$DINTRS$	Deposit facility	Deposit facility in percentages per annum by ECB	ECB	-
	$MINTRS$	Marginal lending facility	The marginal lending facility in percentages per annum by ECB	ECB	-
Exchange rate channel	$REXCH$	Exchange rate	ECB reference exchange rate, US dollar/Euro by ECB	ECB	-
Price stability	$INFLT$	Inflation targeting	Difference between the actual level of the average rate of inflation (HICP) and reference value (defined in the Maastricht Protocol)	Eurostat	-
Euro area control variable	$LINTRS$	Long-term interest rate targeting	Difference between the actual level of average yields for 10yr government bonds and reference value (defined in the Maastricht Protocol)	Eurostat	-

Note: The author introduces inflation targeting and long-term interest rate targeting variables.

WB: World Bank national accounts data, ECB: European central bank, Statistical Data Warehouse, IMF: International Monetary Fund, Global Financial Stability Report, Eurostat: statistical office of the European Union.

Table 2 presents measurements of Single Monetary Policy, source, expected sign of them for all 126 selected banks from all 17-euro area Member States including Spain, Austria, Cyprus, Slovenia, Belgium, Portugal, Estonia, the Netherlands, Finland, Malta, France, Luxembourg, Germany, Italy, Ireland, and Greece from 1999 to 2012. All variables are all 17-euro area member states including Spain, Austria, Cyprus, Slovenia, Belgium, Portugal, Estonia, the Netherlands, Finland, Malta, France, Luxembourg, Germany, Italy, Ireland, and Greece from 1999 to 2012“Bankscope” database of BVD-IBCA, Eurostat, World Bank, ECB from 1999 to 2012 were the source of our data.

4. Results and Discussion

This section provides evidence to explain the effect of the Single Monetary Policy on the

efficiency of the euro area banking sector by analysing 126 banks during the 1999-2012 period[1]. The empirical results are presented following the two-step procedure of the study. The first step is to obtain the efficiency levels by the Data Envelopment Analysis (DEA). The second step is to examine the determinants of efficiency (Single Monetary Policy variables) through regression analysis by GMM estimation. Table 3 reports the results of the DEA models to estimate cost and profit efficiency and score using the entire 126-listed bank dataset for 17-euro area Member States from 1999 to 2012. From Table 3, it can be observed that the mean of the cost efficiency for four banks is 100 %, and the profit efficiency mean for eleven banks are 100 % across the time availability period. For four banks, the mean of the cost and profit efficiency is 100 % efficient. These four banks are "DNB Pank AS" from Belgium, "BPCE Group" from France, "BNG" and "Nederland Waterscapes bank" for the Netherlands. The lowest cost efficiency mean is 7.17% for Luxembourg, and profit efficiency is 0.73% for the same country.

Table 3. Summary of cost and profit efficiency across-listed bank estimated by DEA from 1999 to 2012

No.	Country	No. of bank	List of bank	Mean of cost-efficiency	Mean of profit efficiency
1	Austria	6	Erste Group Bank AG	30.38	10.21
			RaiffeisenZentralbankOesterreich AG – RZB	17.92	7.98
			BAWAG PSK Group	18.86	5.59
			RaiffeisenlandesbankOberösterreich AG	14.95	1.85
			RaiffeisenlandesbankNiederösterreich-Wien AG	22.31	4.37
			OesterreichischeVolksbanken AG	15.75	3.56
2	Belgium	6	AXA Bank Europe SA/NV	17.52	2.10
			Bank of New York Mellon SA/NV	14.03	0.04
			BelfiusBanque SA/NV-Belfius Bank SA/NV	30.98	6.04
			Dexia	88.02	79.00
			Investar-InvesteringsmaatschappijArgenta	21.13	34.34
			KBC Groep NV/ KBC Groupe SA-KBC Group	34.83	13.74
3	Cyprus	3	Bank of Cyprus Public Company Limited-Bank of Cyprus Group	9.62	6.15
			Co-operative Central Bank Limited	28.91	9.87
			Hellenic Bank Public Company Limited	17.10	3.43
4	Estonia	3	DNB Pank AS	100	100
			SEB Pank	27.06	1.14
			Swedbank As	12.68	2.12
5	Finland	3	Danske Bank Plc	18.92	3.31
			Nordea Bank Finland Plc	45.21	46.91
			OP-Pohjola Group	16.34	2.68
6	France	11	Banque PSA Finance	38.97	6.28
			BNP Paribas	87.5	100
			BPCE Group	100	100
			BPIFranceFinancement	22.61	3.40
			CréditAgricole S.A.	94.39	73.76
			CréditAgricole-CréditAgricole Group	77.78	100
			Credit Mutuel (Combined - IFRS)	65.03	21.13

1 We choose an unbalanced panel rather than a balanced panel, to take banks gone into bankrupt or those being absorbed into account. Indeed, the use of a balanced panel may overestimate cost efficiency as it ignores these banks, which may be less efficient on average.

DOI: 10.22067/ijaaf.2021.40647

RESEARCH ARTICLE

Table 3. Continued

No.	Country	No. of bank	List of bank	Mean of cost-efficiency	Mean of profit efficiency
6	France	11	HSBC France	14.17	18.44
			La BanquePostale	7.24	3.84
			Natixis	57.05	44.68
			SociétéGénérale	59.05	23.58
7	Germany	26	Aareal Bank AG		
			BayerischeLandesbank		
			Commerzbank AG		
			DekaBank Deutsche Girozentrale	32.4	12.68
			Deutsche Apotheker- und AerztebankeG	66.36	26.29
			Deutsche Bank AG	88.22	77.56
			DZ Bank AG-Deutsche Zentral-	26.04	17.17
			Genossenschaftsbank	15.31	5.88
			HASPA Finanzholding	85.71	100
			HSH Nordbank AG	48.35	19.51
			Hypo Real Estate Holding AG	14.86	2.75
			IKB Deutsche Industriebank AG	54.77	16.08
			KfWBankengruppe-KfW Group	99.54	100
			Landesbank Baden-Wuerttemberg	22.30	20.44
			Landesbank Berlin Holding AG-LBB	97.34	87.50
			Holding AG	44.34	24.56
			Landesbank Hessen-ThueringenGirozentrale	19.99	3.41
			– HELABA	43.76	7.66
			Landeskreditbank Baden-Wuerttemberg -	27.22	27.05
			Förderbank-L-Bank	92.82	100
			LandwirtschaftlicheRentenbank	81.07	71.70
			MünchenerHypothekenbankeG	46.87	6.06
			NorddeutscheLandesbankGirozentrale	44.70	49.31
			NORD/LB	15.15	6.01
			NRW.BANK	39.73	26.18
			SEB AG	15.16	6.06
			Volkswagen Financial Services AG	88.09	100
			WGZ-Bank AG	23.27	29.89
			WestdeutscheGenossenschafts-Zentralbank	27.01	16.40
			Wuestenrot Bank AG Pfandbriefbank		
			Wüstenrot&Württembergische		
			WüstenrotBausparkasse AG		
8	Greece	4	Alpha Bank AE	11.59	4.32
			EurobankErgasias SA	12.50	5.22
			National Bank of Greece SA	9.97	6.60
			Piraeus Bank SA	10.88	1.95
9	Ireland	5	Allied Irish Banks plc	33.62	15.31
			Bank of Ireland-Governor and Company of	51.42	17.16
			the Bank of Ireland	100	100
			Merrill Lynch International Bank Limited	23.75	7.78
			Permanent TSB Plc	14.29	5.61
			Ulster Bank Ireland Limited		

Table 3. Continued

No.	Country	No. of bank	List of bank	Mean of cost-efficiency	Mean of profit efficiency
10	Italy	15	BancaCarigeSpA Banca Monte deiPaschi di Siena SpA-Gruppo Monte deiPaschi di Siena Bancapopolaredell'Emilia Romagna BancaPopolare di Milano SCaRL BancaPopolare di SondrioSocietaCooperativa per Azioni BancaPopolare di Vicenza Societacooperativa per azioni BancoPopolare - SocietàCooperativa-BancoPopolare CreditoEmilianoSpA-CREDEM CreditoValtellineseSoc Coop Iccrea Holding SpA IntesaSanpaolo MediobancaSpA UniCreditSpA Unione di BancheItalianeScpa-UBI Banca Veneto Bancascpa	13.78 44.63 11.62 10.68 12.82 14.43 31.13 10.24 12.82 13.82 81.21 29.72 84.06 33.10 15.80	3.19 10.63 3.98 3.18 1.80 1.69 3.43 1.71 1.32 2.06 98.78 8.16 90.73 6.03 1.22
11	Luxembourg	6	BanqueInternationale à Luxembourg SA Clearstream Banking SA KBL European Private Bankers SA RBC Investor Services Bank S.A. State Street Bank Luxembourg S.A UBS (Luxembourg) SA	9.63 65.27 7.17 10.07 29.77 23.34	14.80 51.39 1.95 0.73 79.92 12.15
12	Malta	3	Bank of Valletta Plc HSBC Bank Malta Plc Raiffeisen Malta Bank Plc	16.01 16.11 84.76	4.41 3.84 100
13	Netherlands	6	Bank NederlandseGemeenten NV, BNG ING Bank NV Nederlandsche Bank NV (De) NederlandseWaterschapsbank NV Rabobank Nederland-Rabobank Group SNS Bank N.V.	100 94.05 44.07 100 92.91 31.54	100 100 37.77 100 77.86 5.71
14	Portugal	4	Banco BPI SA BancoComercialPortuguês, SA-Millennium bcp BancoEspirito Santo SA CaixaGeral de Depositos	15.68 16.46 15.88 19.15	1.44 2.58 3.26 2.98
15	Slovakia	3	Slovenskasporitel'na as-Slovak Savings Bank Tatra Banka a.s. VseobecnaUverova Banka a.s.	9.73 12.67 11.19	3.44 3.14 3.26
16	Slovenia	4	AbankaVipadd NLB dd-Nova Ljubljanska Banka d.d. Nova Kreditna Banka Maribor d.d. SID - Slovene Export and Development Bank, Inc,	27.22 11.03 20.03 44.92	3.00 3.00 2.15 28.35

DOI: 10.22067/ijaaf.2021.40647

RESEARCH ARTICLE

Table 3. Continued

No.	Country	No. of bank	List of bank	Mean of cost-efficiency	Mean of profit efficiency
17	Spain	18	Banco Bilbao VizcayaArgentaria SA		
			Banco de Sabadell SA		
			BancoFinanciero y de Ahorros SA-Bankia	60.06	23.29
			Banco Mare Nostrum SA-BMN	20.66	4.34
			Banco Popular Espanol SA	65.62	15.18
			Banco Santander SA	18.68	2.78
			Bankia, SA	30.62	9.25
			Bankinter SA	96.31	84.04
			Caixabank, S.A.	57.57	12.93
			Caja de Ahorros y Monte de Piedad de	15.73	3.45
			Zaragoza, Aragon y Rioja-Ibercaja	67.07	12.75
			Caja de Ahorros y Pensiones de Barcelona-LA	15.09	3.42
			CAIXA	62.35	24.07
			CajaEspana de Inversiones Salamanca y	10.90	1.48
			SoriaCaja de Ahorros y Monte	12.14	1.81
			Caja Rural de Aragón SociedadCooperativa de	25.36	53.77
			Crédito	23.51	5.70
			CatalunyaBanc SA	14.62	1.88
			Deutsche Bank SAE	15.79	2.26
			Kutxabank SA	15.93	2.71
			Liberbank SA		
			Santander Consumer Finance		

Efficiency score is in percentage

Table 4. Descriptive summary of single monetary policy variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Bank lending(LEND)	1142	27.213	2.000	21.295	29155
Capitalization (CAP)	1142	5.483	1.620	2.7	13.3
Liquidity (LQUID)	1142	4.888	8.494	0.027	6.942
Deposit facility (DINTRS)	1142	1.259	1.098	0.000	3.75
Marginal lending facility (MINTRS)	1142	2.940	1.275	1.5	5.75
Exchange rate (REXCH)	1142	1.308	0.138	0.881	1.472
Inflation targeting (INFLT)	1142	0.907	1.019	-2.53	8.03
Long-term interest rate targeting (LINTRS)	1142	0.352	1.881	-3.03	17.97

The baseline regression results focusing on the relationship between bank cost efficiency and the explanatory variables (Single Monetary Policy) are presented in Table 5. We report the results for both difference and system GMM estimator for both one-step and two-step versions. A lot of applied work using the GMM estimator has focused on results for the two-step estimator than the one-step estimator because the standard covariance matrix is robust to panel-specific autocorrelation and heteroscedasticity. This paper has focused on a two-step estimator, which suggests a very modest efficiency gain than the one-step version. Nevertheless, the one-step estimator was reported in all GMM estimation tables. System panel GMM requires more assumptions (employed to generate consistent and efficient parameters) than the first difference panel GMM. Still, if the assumptions hold, it will achieve greater efficiency. Therefore, system

panel GMM estimations are focused on while the first difference panel GMM are presented in all tables. In the baseline estimation, the endogeneity problem of bank lending variable (domestic credit provided by banking sector US$) is controlled, instrumented with GMM-style instruments, *i.e*. lagged values of the variables in levels. Although, for controlling a huge number of the instrument, which is a real danger of overfitting the endogenous variables when the period is long, GMM has instructed to use only one lag depth for the endogenous variables as instruments. Furthermore, the number of instruments is less than cross-sectional observations (banks) when the rule of thumb keeps the number of instruments less than or equal to the number of groups. Finally, several diagnostic tests are performed to show that results are warranted.

Table 5. Baseline analysis for the effect of single monetary policy on cost efficiency (controlling endogeneity)

Regressors	GMM-DIF One-step	GMM-DIF Two-step	GMM-SYS One-step	GMM-SYS Two-step	GMM-SYS♣ One-step	GMM-SYS♣ Two-step
Initial of cost efficiency (L1)	0.348*** (0.000)	0.348*** (0.000)	0.452*** (0.000)	0.452*** (0.000)	0.442*** (0.000)	0.439*** (0.000)
Bank lending[1]	-0.167*** (0.000)	-0.164*** (0.000)	0.012*** (0.000)	0.012*** (0.000)	0.008*** (0.000)	0.008*** (0.000)
Capitalization	0.004 (0.561)	0.004*** (0.000)	-0.010* (0.106)	-0.010*** (0.000)	-0.012** (0.042)	-0.013*** (0.000)
Liquidity	0.002* (0.094)	0.002*** (0.000)	0.001 (0.372)	0.001*** (0.000)	0.000 (0.755)	0.000*** (0.000)
Deposit facility	0.076*** (0.000)	0.075*** (0.000)	0.030** (0.018)	0.030*** (0.000)	0.035*** (0.005)	0.035*** (0.000)
Marginal lending facility	-0.062*** (0.000)	-0.062*** (0.000)	-0.011 (0.289)	-0.012*** (0.000)	-0.006 (0.555)	-0.006*** (0.000)
Exchange rate	0.169*** (0.003)	0.169*** (0.000)	-0.060* (0.081)	-0.056*** (0.000)	-0.064** (0.043)	-0.063*** (0.000)
Inflation targeting	-0.001 (0.776)	-0.002*** (0.000)	-0.012 (0.012)	-0.012*** (0.000)	-0.011** (0.017)	-0.012*** (0.000)
Long-term interest rate targeting	0.001 (0.597)	0.001*** (0.000)	-0.008 (0.005)	-0.008*** (0.000)	-0.011*** (0.000)	-0.011*** (0.000)
Sargan test (*p*-value)[2]	0.000	0.144	0.000	0.398	0.000	0.509
Serial correlation test: AR(1) (*p*-value)[3] AR(2) (*p*-value)	 0.000 0.381	 0.000 03499	 - -	 0.000 0.195	 - -	 0.000 0.337
Wald test for joint significance (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000
No. of instruments	97	97	121	121	122	122
Cross-sectional observations	123	123	126	126	126	126

Note: ♣The regressions also include time trend variables for the different periods that are not reported.
[1]In the regression, this variable is included as log (variable).
[2]The null hypothesis is that model, and overidentifying conditions are correctly specified.
[3]The null hypothesis is that there is no serial correlation in the first-differenced disturbances.
Values in parenthesis are *t*-statistics.
***,**,* indicates significance at 1%,5% and 10% levels respectively.

The model performs reasonably well, with most of the variables remaining sable across the various regressions tested. For all the GMM estimation models discussed in the following subsections, the Sargent test (under Sargent thought) for overidentifying restriction and the

DOI: 10.22067/ijaaf.2021.40647

RESEARCH ARTICLE

Arrelano-bond (AR(2)) test shows that at the 5% significance level, our instruments are appropriately orthogonal to the error and no second-order serial correlation is detected, respectively (see Baum et al. 2010)[1],[2]. The first two columns of Table 5 report the results for GMM-DIF, and the next two columns report GMM-SYS, respectively. Using the first-differenced GMM estimator in this panel, the coefficient on the lagged cost-efficiency variable is only 0.3484, suggesting implausibly low returns to scale. Using the system GMM estimator, which exploits the moment conditions, the coefficient on the lagged cost-efficiency variable is 0.4522. It could be argued that a certain level of accumulated knowledge and technological endowment, which may represent by the previous year's efficiency, help banks generate higher outputs with their inputs by adapting relatively quickly to the changes brought about by the environmental conditions.

The coefficients of all single monetary policy variables are significant at least at 1% level system panel GMM in the two-step version. Hence credit channel, interest rate channel, exchange rate channel and price stability factors play an important role in determining cost efficiency.

In the first set of variables, to capture the credit channel and its correlation with bank cost efficiency, the bank lending variable has a positive sign, indicating higher domestic credit provided by the banking sector contributes to lower banking costs. Higher bank lending ability contributes to a decrease in banking costs, causing higher cost-efficiency. Furthermore, the bank lending channel (BLC) has focused on the possible effect of monetary policy actions on the supply of loans by affecting the liability side of bank balance sheets. According to theory, an expansionary monetary policy increases reservable liabilities, leading banks to increase lending due to the growth of funding sources. In other words, the significant and positive coefficient of bank lending variable justifies single monetary policy influence on bank efficiency from bank lending channel linkage.

The negative sign of capitalisation shows that the higher the bank capital to total assets ratio is, the higher the operating and financial costs are. Therefore, a higher ratio of capital to assets in the banking system can be associated with somewhat lower efficiency levels, indicating that the bank operates in a high capitalisation banking sector ratio (high capital adequacy ratio) is not enabled to offer more output (loan and profit) and finally improves cost-efficiency. The reaction term between banking system liquidity and cost efficiency is also positive and significant, indicating that an increase in the liquidity ratio of the banking sector increases bank efficiency. These findings signal that sound banking characteristics in terms of liquidity play an important role in influencing the banks' cost efficiency. The second set of variables was used to capture standing facility instruments of a single monetary policy by ECB. The sign of the deposit facility variable coefficient is positive, while the marginal lending facility variable has a negative coefficient (-0.0307).

Standing facilities aim to provide and absorb overnight liquidity, signal the general monetary policy stance, and bound overnight market interest rates. Two standing facilities, deposit and marginal lending facilities, are available to eligible counterparties on their own initiative. Counterparties can use the marginal lending facility to obtain overnight liquidity from the NCBs against eligible assets. The interest rate on the marginal lending facility normally provides a ceiling for the overnight market interest rate. Also, counterparties can use the deposit facility to make overnight deposits with the NCBs. The interest rate on the deposit facility normally provides a floor for the overnight market interest rate. Our results underline that bank costs may increase when the

1-Baum et al. (2010) points out that in a dynamic panel data context, first order serial correlation could be expected, but the second-order serial correlation should not be detected if the instruments are appropriately uncorrelated with the error term.

2- The Sargent test is most common diagnostic utilized in GMM estimation to evaluation the suitability of the model. A rejection ofthe null hypothesis implies that the instrument is not satisfying the orthogonality condition required for their employment (Baum at al. 2007).

marginal lending facility is higher because the overnight interest rate can increase up to its ceiling rate. Therefore, higher marginal lending facility contributes to an increase in banking costs, causing lower cost efficiency.

Similarly, under normal circumstances, there are no deposit limits or other restrictions on counterparties' access to the facility; the deposit facility provides a minimum interest rate that makes cheaper loanable fund costs for banks that desire to pay more at the interbank market overnight interest rate will close. Consequently, the relationship between deposit facility and cost efficiency is straightforward: increased deposit facility has forced banks to become more efficient.

The third set of variables representing the reference exchange rate of the Eurozone consists of the following variable. The coefficient on the *exchange rate* has an expected negative sign, indicating that a higher amount of exchange rate (the increase of the value of a national currency) increases banking costs (*i.e.*, decrease in cost efficiency). In essence, the empirical findings suggest that in the case of the euro area banking system, the value of foreign assets, including loans, reserve and investment security, will be negatively affected by increased exchange rate. As a result, the negative relationship between exchange rate and bank efficiency may reflect how fluctuating and volatile exchange rates may have contributed to the asset profile of banks (the increased risk of exchange rate fluctuations in banking operations) and have reduced the cost-efficiency.

To investigate the relationship between Maastricht Protocol targeted policy and the Eurozone bank efficiency, inflation and long-term interest rate targeting variables are introduced as explanatory variables in cost efficiency model regressions. The sign of the inflation targeting variable is negative (-0.0124), the same as the long-term interest rate targeting variable coefficient (-0.0086). The results have indicated an increasing difference between the actual level of the average rate of inflation (HICP) and the unweighted arithmetic average of the inflation rate in three best performing Member States in terms of price stability is associated with decreasing bank efficiency at the domestic country level. In addition, the difference between the actual level of average yields for 10-year government bonds and the unweighted arithmetic average of the long-term interest rates of the same three Member States was used to calculate the reference value for the criterion on price stability have a negative impact on bank efficiency. Those two variables relate to sustainable convergence for ensuring that economic development within EMU is balanced and does not give rise to tensions between the EU Member States.

Maintaining stable prices (the primary objective of the Single Monetary Policy) on a sustained basis is a crucial precondition for increasing economic welfare and an economy's growth potential. This enables the bank to make better-informed decisions on costs and investment. In turn, this allows the banks to allocate resources more efficiently and divert resources to productive uses. But, in a high inflation environment, the bank should pay more for production inputs to produce a certain level of outputs that have decreased bank efficiency. Furthermore, suppose investors cannot be sure that prices will remain stable in the future (i.e., associating inflation risk premium). In that case, they will not demand nominal assets (money or some financial assets) over the long term, which have increased the price of deposits and funds for the bank, resulting in lower cost-efficiency. Overall, this measure of price stability does significantly explain bank efficiency positively because achieving the best performing Member States in terms of price stability might affect the ability of the bank to perform better. The negative sign of the long-term interest rate targeting coefficient suggests that the higher difference of long-term government bonds interest rate from the reference value contributes to higher banking costs (*i.e.*, decrease in cost efficiency). The core reason for this may be that high-interest government bonds negatively influence borrowing deposit costs for the bank over the long term. When government funds a deficit by issuing high-interest rate government

RESEARCH ARTICLE

bonds, it can increase interest rates across the market because government borrowing creates a higher demand for credit in the financial markets. Therefore, the cost of borrowing deposits will be increased for a bank to increase banking costs. The paper also explains the association of profit efficiency with efficiency correlates, namely credit channel, interest rate channel, exchange rate channel, price stability and the euro area control variables. The first two columns of Table 6 presents the results for first-difference panel GMM and next two columns report system panel GMM, respectively. Using the first-differenced GMM estimator in this panel, the coefficient on the lagged profit efficiency variable is only 0.3922, suggesting implausibly low returns to scale.

Table 6. Baseline analysis for the effect of single monetary policy on profit efficiency (controlling endogeneity)

Regressors	GMM-DIF One-step	GMM-DIF Two-step	GMM-SYS One-step	GMM-SYS Two-step	GMM-SYS♣ One-step	GMM-SYS♣ Two-step
Initial of profit efficiency (L1)	0.391*** (0.000)	0.392*** (0.000)	0.418*** (0.000)	0.421*** (0.000)	0.404*** (0.000)	0.410*** (0.000)
Bank lending[1]	-0.128*** (0.008)	-0.126*** (0.000)	0.012*** (0.000)	0.012*** (0.000)	0.011*** (0.000)	0.011*** (0.000)
Capitalization	0.001 (0.912)	0.001*** (0.000)	-0.009 (0.272)	-0.009*** (0.000)	-0.010 (0.226)	-0.009*** (0.000)
Liquidity	0.001 (0.520)	0.001*** (0.000)	0.000 (0.766)	0.000*** (0.000)	0.000 (0.996)	-0.000 (0.511)
Deposit facility	-0.010 (0.684)	-0.010*** (0.000)	-0.052*** (0.002)	-0.051*** (0.000)	-0.050*** (0.002)	-0.049*** (0.000)
Marginal lending facility	0.008 (0.716)	0.009*** (0.000)	-0.053*** (0.000)	0.518*** (0.000)	0.056*** (0.000)	0.054*** (0.000)
Exchange rate	-0.003 (0.959)	-0.003*** (0.000)	-0.183*** (0.000)	-0.175*** (0.000)	-0.193*** (0.000)	-0.184*** (0.000)
Inflation targeting	-0.000 (0.950)	-0.000*** (0.000)	-0.009 (0.137)	-0.009*** (0.000)	-0.008 (0.178)	-0.008*** (0.000)
Long-term interest rate targeting	-0.001 (0.842)	-0.000*** (0.000)	-0.008** (0.034)	-0.008*** (0.000)	-0.010*** (0.014)	-0.009*** (0.000)
Sargan test (*p*-value)[2]	0.004	0.425	0.000	0.597	0.000	0.597
Serial correlation test: AR(1) (*p*-value)[3] AR(2) (*p*-value)	0.000 0.431	0.000 0.642	- -	0.000 0.607	- -	0.000 0.668
Wald test for joint significance (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000
No. of instruments	97	97	121	121	122	122
Cross-sectional observations	123	123	126	126	126	126

Note: ♣The regressions also include time trend variables for the different periods that are not reported.
[1]In the regression, this variable is included as log(variable).
[2]The null hypothesis is that model, and over-identifying conditions are correctly specified.
[3]The null hypothesis is that there is no serial correlation in the first-differenced disturbances.
Values in parenthesis are *t*-statistics.
***,**,* indicates significance at 1%,5% and 10% levels respectively.

Using the GMM estimator, which exploits the moment conditions, the coefficient on the lagged profit efficiency variable is higher than first-differenced GMM (0.4219) and statistically significant. These results address that the initial profit efficiency (L1) is significantly and positively related to the efficiency of the current year in both models. By including the efficiency of the previous year (L1) as an independent variable, we capture the dynamic nature of bank efficiency, which is significantly different from zero, indicating profit efficiency influenced by previous years' efficiency.

The results from the specification tests, i.e. Sargan test and AR(1) and AR(2) statistics, for the first-differenced and system GMM estimators confirm the overall validity of the instruments and thus the consistency of the GMM estimators. Results from the Sargan difference test justify the additional instruments and, thus, the advantage of the system-GMM estimator over the first-differenced GMM estimator. Comparing the first-differenced and system GMM estimator, we find a substantial improvement in the precision of the latter in terms of standard errors (see Blundell & Bond, 1998). The inference in this section, therefore, is based upon the system-GMM estimates. Like the cost efficiency model, the coefficients of all single monetary policy variables are significant, at least at 1%, which is in line with our expectations. Consequently, credit, interest, exchange rate, and price stability factors are essential in determining profit efficiency.

Concerning the credit channel and its correlation with bank profit efficiency, the *bank lending* variable has a positive sign, indicating higher domestic credit provided by the banking sector contributes to lower banking costs. Higher bank lending ability contributes to decreased banking costs, causing higher profit efficiency in the euro area banking sector. A plausible reason is the bank-lending channel (BLC) has focused on the possible effect of monetary policy actions on the supply of the loans by affecting the liability side of bank balance sheets. Therefore, an expansionary monetary policy increases reservable liabilities, which leads banks to increase lending due to the growth of funding sources. In other words, the significant and positive coefficient of bank lending variable justifies Single Monetary Policy influence on bank profit efficiency from bank lending channel linkage.

Concerning the *capitalisation* results, the empirical findings indicate that bank capital to total assets ratio to be negatively related to the cost efficiency of banks operating in the euro area banking sector. The results imply that the more capitalised banking system tends to exhibit a lower efficiency level, which indicates that a bank operating in a high capitalisation banking sector ratio (high capital adequacy ratio) cannot offer more output (loan and profit) improves cost-efficiency. A well-capitalised banking system is less prone to financial crises, whereas an inadequately capitalised system is more vulnerable. Inadequate capitalisation can thus have a systemic adverse effect on bank efficiency irrespective of whether or not an individual bank is adequately capitalised. However, the empirical evidence from some of the euro area countries is that multiple recapitalisations often strengthened rather than severed the ties between banks and weak state-owned enterprises (SOEs) to which they had large exposures (see Wachtel & Bonin, 2004). Government inability or unwillingness to deal with this problem created a moral hazard problem that adversely affected bank performance and, thus, efficiency

Likewise, the liquidity coefficient enters the regression models with a positive sign and is statistically significant at a 1% level in the GMM-SYS regression model. The result indicates that more liquidity in the banking sector trends to report higher bank efficiency. At this point, though, the increased cost for screening and mentoring by a higher share of loans in bank assets profile (instead of liquid assets) makes high operational costs in a bank portfolio. Therefore, this finding signals that sound banking characteristics in terms of liquidity play an important role in influencing

the banks' profit efficiency.

The impact of standing facility instruments of the Single Monetary Policy by ECB on bank efficiency is statistically significant in all cases. It can be observed from Table 6 that the *deposit facility* has a negative relationship with the Eurozone banks' efficiency, which could be due to the deposit facility normally providing a floor for the overnight market interest rate. Therefore, the bank costs may increase by borrowing from the overnight market when the deposit facility is, causing lower profit efficiency.

Similarly, a higher *marginal lending facility* has allowed overnight interest rates to increase up to this ceiling rate. As a consequence, the price of the loanable fund can increase for banks that want to lend to others. So, the relationship between the marginal lending facility and profit efficiency is straightforward: the increased marginal lending facility has enabled banks to become more efficient.

The third set of variables representing the reference exchange rate of the Eurozone consists of the following variable. The exchange rate level is positively related to the efficiency of the Eurozone banks, indicating, on average, a higher exchange rate (the increase of the national currency value) can be associated with the deteriorating profit efficiency of banks. In essence, the empirical findings suggest that in the case of the euro area banking system, the value of foreign assets, including loans, reserve and investment security, will be negatively affected by increasing the exchange rate. This indicates that as the exchange rate becomes more unstable, banks find it difficult to manage their loan profile. The core reason for this may be that the deteriorating exchange rate of the national currency may contribute to high costs for borrowers who may find it difficult to repay bank loans, resulting in loss of loan provision and non-performing loans. Furthermore, in international banking, most of the bank foreign exchange income results from the commissions and fees of foreign exchange operations, which could be decreased due to the high value of a national currency.

Turning to the impact of the Maastricht Protocol targeted policy, from Tables 5 and 6 we can observe that the coefficients of inflation and long-term interest rate targeting variables are negatively related to the bank efficiency level.

The results have stated that, on average, the increasing difference between the actual level of the average rate of inflation (HICP) and the unweighted arithmetic average of the rate of inflation in three best performing Member States in terms of price stability is associated with decreasing bank efficiency at the domestic country level. In addition, the difference between the actual level of average yields for 10-year government bonds and the unweighted arithmetic average of the long-term interest rates of the same three Member States was used to calculate the reference value for the criterion on price stability have a negative impact on bank efficiency. Those two variables related to sustainable convergence ensure that economic development within EMU is balanced and do not give rise to tensions between the EU Member States.

5. Conclusion

This paper proposes to estimate the efficiency of the Euro's banking system in maintaining an unbiased monetary policy with price stability, recognise bank structural problems and find ways to improve the performance of Eurozone banks through the further debt crisis and single supervisory mechanism (SSM).

The statistical testing results showed a significant relationship between a single monetary policy and the bank's efficiency in general. Specifically, on average higher bank lending, liquidity and deposit facility can be associated with improving profit efficiency of banks. In contrast,

capitalisation, exchange rate, inflation targeting, and long-term interest rate targeting variables had a negative effect on cost and profit efficiency levels. Overall, these measures of price stability and long-term interest rate targeting did significantly explain bank efficiency positively because achieving the best performing Member States in terms of price stability might affect the ability of the bank to perform better.

Finally, the empirical results indicate a large asymmetry between countries regarding their profit efficiency level. However, the evolution of profit efficiency in each country shows no clear trend in general. The efficiency scores have been decreasing from starting to ending years in most of the countries in the sample.

The policy implication arising from the analyses presented is that the European monetary authority has faced significant pressures of inflation targeting and long-term interest rate targeting policy on bank performance that negatively influence bank efficiency. Therefore, ECB should adjust and regulate new price stability and long-term interest rate policy to improve the efficiency of the banking sector can cause better banking performance, decrease costs, improve quality of services, and betterment the allocation of resources and increase the productivity of the entire economy.

A second policy implication is that bank regulators and management in Slovakia, Greece, and Portugal (as the most inefficient banks), under a market economy and facing a fiercely competitive banking market, should focus on improving management and innovating technology and enhance the quality of employees.

Our study contributes to the literature in several aspects. First, the literature is a treasure of country studies on efficiency in the banking industry. Studies on international comparison of efficiency are rare. Second, our study contributes to the literature by providing estimations of banks' cost and profit efficiency based on non-parametric frontier analysis for all the euro area member states; it also compares efficiencies scores derived from the Member States. Finally, the findings of the current study contributed to the body of knowledge. The empirical finding of studies about the track of bank efficiency from introducing the Euro indicates that the efficiency level differs over time and from one bank to another, one country to others.

Acknowledgement

The authors thank the anonymous reviewers for their careful reading of our manuscript and many insightful comments and suggestions

References

1. Altunbaş, Y., de Bondt, G. and Marques-Ibanez, D. (2004). Bank capital, bank lending, and monetary policy in the euro area. *Kredit Und Kapital*. https://ssrn.com/abstract=658982
2. Altunbaş, Y., Fazylov, O. and Molyneux, P. (2002). Evidence on the bank lending channel in Europe. *Journal of Banking & Finance*, 26(11), pp. 2093-2110. https://doi.org/10.1016/S0378-4266(02)00201-7.
3. Angeloni, I., Kashyap, A., Mojon, B. and Terlizzese, D. (2002). Monetary transmission in the euro area: Where do we stand?. *European Central Bank*, https://ssrn.com/abstract=299382
4. Bernanke, B.S. and Blinder, A.S. (1988). Credit, money, and aggregate demand. *The American Economic Review*, 78(2), pp. 435-39. https://www.jstor.org/stable/1818164
5. Bernanke, B. S. and Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *The Journal of Economic Perspectives*, 9(4), pp. 27-48. https://www.aeaweb.org/articles?id=10.1257/jep.9.4.27

RESEARCH ARTICLE

6. Berger, A. N., & Humphrey, D. B. (1992). Measurement and efficiency issues in commercial banking. *In Output measurement in the service sectors* (pp. 245-300). University of Chicago Press.
7. Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), pp. 115-143. https://doi.org/10.1016/S0304-4076(98)00009-8.
8. Brooks, R.D., Faff, R.W., McKenzie, M.D. and Ho, Y.K. (2000). US banking sector risk in an era of regulatory change: A bivariate GARCH approach. *Review of Quantitative Finance and Accounting*, 14(1), pp. 17-43. https://doi.org/10.1023/A:1008324023419.
9. Buttiglione, L., Ferri, G. and d'Italia, B. (1994). Monetary policy transmission via lending rates in italy: Any lessons from recent experience? *Banca d'Italia*.
10. Cecchetti, S.G. (1999). Legal structure, financial structure, and the monetary policy transmission mechanism. *Economic Policy Review*, 5(2), pp. 9-28. https://ssrn.com/abstract=1004314
11. Chrystal, A. and Mizen, P. (2002). Modelling credit in the transmission mechanism of the United Kingdom. *Journal of Banking & Finance*, 26(11), pp. 2131-2154. https://doi.org/10.1016/S0378-4266(02)00203-0.
12. Chu, L., Mathieu, R., Robb, S. and Zhang, P. (2007). Bank capitalisation and lending behavior after the introduction of the Basle accord. *Review of Quantitative Finance and Accounting*, 28(2), pp. 147-162. https://doi.org/10.1007/s11156-006-0009-4.
13. Dale, S. and Haldane, A. G. (1995). Interest rates and the channels of monetary transmission: Some sectoral estimates. *European Economic Review*, 39(9), pp. 1611-1626. https://doi.org/10.1016/0014-2921(94)00108-1.
14. De Bondt, G.J. (1999). Banks and monetary transmission in Europe: empirical evidence. Banca Nazionale del Lavoro Quarterly Review, 52(209), pp. 149-168.
15. Ding, W., Domaç, I. and Ferri, G. (1998). Is there a credit crunch in East Asia?. *The Asia Pacific Journal of Economics & Business*, 2(2), pp. 4-32.
16. Ehrmann, M., Gambacorta, L., Martinez-Pages, J., Sevestre, P. and Worms, A. (2003). The effects of monetary policy in the euro area. *Oxford Review of Economic Policy*, 19(1), pp. 58-72. https://doi.org/10.1093/oxrep/19.1.58.
17. Ehrmann, M., Gambacorta, L., Martínez-PagØs, J., Sevestre, P. and Worms, A. (2001). Financial systems and the role of banks in monetary policy transmission in the euro area. Available at SSRN: https://ssrn.com/abstract=356660
18. Escrivá, J.L. and Haldane, A.G. (1994). The interest rate transmission mechanism: Sectoral estimates for spain , *Banco de España. Servicio de Estudios*. https://repositorio.bde.es/handle/123456789/6538
19. Ferri, G. and Domaç, I. (1999). The Real Impact of Financial Shocks: Evidence from the Republic of Korea. The World Bank. https://doi.org/10.1596/1813-9450-2010
20. Fuinhas, J.A. (2008). Monetary transmission and bank lending in Portugal: A sectoral approach. *The IUP Journal of Monetary Economics*, 6(1), pp. 34-60. https://ideas.repec.org/a/icf/icfjmo/v06y2008i1p34-60.html
21. Gambacorta, L. and Mistrulli, P. E. (2004). Does bank capital affect lending behavior?. *Journal of Financial Intermediation*, 13(4), pp. 436-457. https://doi.org/10.1016/j.jfi.2004.06.001
22. Gambacorta, L. and Mistrulli, P. E., (2003). Bank capital and lending behavior: Empirical evidence for Italy Banca d'Italia. https://www.bis.org/bcbs/events/wkshop0303/p06gambmis.pdf

23. Garretsen, H. and Swank, J. (1998). The transmission of interest rate changes and the role of bank balance sheets: A VAR-analysis for the Netherlands. J*ournal of Macroeconomics*, 20(2), pp. 325-339. https://doi.org/10.1016/S0164-0704(98)00060-3
24. Garretsen, H. and Swank, J. (2003). The bank lending channel in the Netherlands: The impact of monetary policy on households and firms. *De Economist*, 151(1), pp. 35-51. https://doi.org/10.1023/A:1022984614506
25. Gertler, M. and Gilchrist, S. (1993). The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence. T*he Scandinavian Journal of Economics*, 95(1), pp. 43-64. https://doi.org/10.2307/3440134.
26. Hachicha, A. and Lee, C. (2009). Are structural VARs with long-run restrictions useful for developing monetary policy strategy in Egypt?. *Review of Pacific Basin Financial Markets and Policies*, 12(03), pp. 509-527. https://doi.org/10.1142/S0219091509001721
27. Kim, H.E. (1999). Was the credit channel a key monetary transmission mechanism following the recent financial crisis in the Republic of Korea? (No. 2103). *World Bank Publications*. https://doi.org/10.1596/1813-9450-2103
28. Kishan, R. P., & Opiela, T. P. (2000). Bank size, bank capital, and the bank lending channel. *Journal of Money, credit and banking*, pp. 121-141.
29. Lehmann, E., Warning, S., & Weigand, J. (2004). Governance structures, multidimensional efficiency and firm profitability. Journal of Management and Governance, 8(3), pp. 279-304.
30. Martin, A.D. and Mauer, L.J. (2003). Exchange rate exposures of US banks: A cash flow-based methodology. *Journal of Banking & Finance*, 27(5), pp. 851-865. https://doi.org/10.1016/S0378-4266(02)00253-4
31. Mishkin, F.S. (1995). Symposium on the monetary transmission mechanism. *The Journal of Economic Perspectives*, 9(4), pp. 3-10. https://www.aeaweb.org/articles?id=10.1257/jep.9.4.3
32. Sahminan, S. (2004). Balance-sheet effects of exchange rate depreciation: Evidence from individual commercial banks in Indonesia The University of North Carolina.
33. Suetorsak, R. (2006). Banking crisis in east Asia: A micro/macro perspective. *Review of Quantitative Finance and Accounting*, 26(3), pp. 219-248. https://doi.org/10.1007/s11156-006-7432-4.
34. Sanjeev, G. M. (2006). Data Envelopment Analysis (Dea) for Measuring Technical Efficiency of Banks. *Vision*, *10*(1), pp. 13-27. https://doi.org/10.1177/097226290601000102
35. Trautwein, H. (2000). The credit view, old and new. *Journal of Economic Surveys*, 14(2), pp. 155-190. https://doi.org/10.1111/1467-6419.00108
36. Wachtel, P. and Bonin, J. (2004). Dealing with Financial Fragility in Transition Economies,(No. 22/2004). Bank of Finland, Institute for Economies in Transition. https://www.econstor.eu/handle/10419/212552

RESEARCH ARTICLE

How to cite this article:

Rajabi, E., Sherafatian Jahromi, R. (2021). Single Monetary Policy, Inflation Targeting, Interest Rate Targeting and Bank Efficiency in the Euro Area: Panel Generalized Method of Moments Approach. Iranian Journal of Accounting, Auditing and Finance, 5(3), 1-23. doi: 10.22067/ijaaf.2021.40647

URL: https://ijaaf.um.ac.ir/article_40647.html