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Linking energy shocks and bank performance in developing countries

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Abstract

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1. Introduction

The rapid economic recovery following the Covid-19 pandemic and Russia's 2022 invasion of Ukraine have led to tensions in all global supply chains, including energy (International Energy Agency, 2022). The Russo-Ukrainian war has led to multiple upheavals, among which the energy scene occupies a prominent place. Europe, which is heavily dependent on Russian hydrocarbons, has been particularly hard hit. Energy is essential to the functioning of almost every sector of the economy, and a sudden, major fluctuation in its price could have enormous repercussions on the economy as a whole, and on banks in particular. Energy demand is therefore highly inelastic, and when energy prices change, this has major implications for households, businesses and governments.

The stalemate in the Russo-Ukrainian crisis has inevitably also had an impact on African countries. Supply issues and the dependence of certain African economies on the Russian and Ukrainian markets are the first point of tension with immediate consequences. Oil and natural gas exporting countries, increasingly numerous on the continent, are benefiting in the short term from this increase, which is helping to mitigate the negative shocks to their terms of trade resulting from soaring food prices. While some countries, such as Nigeria and Angola, can benefit from higher energy prices, others cannot. On the whole, the situation seems worrying, as most African countries export energy products such as crude oil. As a result, they are also importers of refined products on the international market (i.e., they are price takers just like countries without energy resources). The Franc Zone countries are a case in point. Consequently, a variation in the price of energy certainly has repercussions on these economies.

In a direct sense, energy is an essential factor of production, and energy price shocks can affect companies' cash flows and pass on these uncertainties to their expected returns (Jones and Kaul, 1996). Companies that use energy as a raw material will find it difficult to meet their commitments to their banks, thus increasing their credit risk. Indirectly, energy shocks trigger systematic monetary policy responses (Bernanke et al., 1997), leading to economic slowdowns. In response to the impact of oil shocks on inflation, for example, the Taylor rule suggests that the central bank uses restrictive monetary policies (Taylor, 1993), such as raising the key interest rate. As an essential source of monetary policy transmission, commercial banks would modify the interest rates on their loans in line with the interest rate set by the central bank, which would have an impact on banking behavior and bank risk. Banks play an essential role in the allocation of capital in an economy, they are major providers of funds for many economic sectors, and they play a significant part in transmitting the central bank's monetary policy to the rest of the economy. The global financial crisis of 2008 made it clear that disruptions to the banking sector have far-reaching repercussions on the economy and society. It is therefore important to understand the influence of energy price shocks on the banking sector (Jin et al, 2022).

Energy price shocks can potentially impact banks both directly, by affecting the value of bank assets (i.e. loans to energy companies), and indirectly, through the macroeconomic determinants that affect the banking sector. From an illustrative perspective, rising energy prices increase inflationary pressures, which can increase credit market frictions and have a negative impact on banks (Huybens and Smith, 1999; Boyd et al. 2001). The banking sector represents the financial backbone of economic life, insofar as banks are the preferred intermediary between savers and investors (Kouomou, 2020).

Several documented facts have highlighted the fact that banks with a significant share of loans in the energy sector (Gorton and Winton, 2002) inevitably expose themselves to energy shocks. For example, loans to the energy sector accounted for around 20% of total loans at Continental Illinois, which was one of the ten largest banks in the USA in 1982. Between 1980 and 1994, 1,617 insured commercial banks and savings banks failed or received financial assistance from the FDIC (Fdic, 2018). Around 60% of these failures occurred in five states: Texas, Louisiana, California, Kansas and Oklahoma. More specifically, bank failures in Texas and Louisiana were strongly linked to the collapse in oil prices.

The relationship between energy prices and economic activity has been the subject of much research since the major oil shocks of the 1970s. Many earlier studies found a negative impact of rising oil prices on economic growth in the major advanced economies (e.g. Bruno and Sachs, 1981, 1985; Darby, 1982; Hamilton, 1983; Burbidge et al. 1984; Gisser and Goodwin, 1986). Other studies have also found links between oil prices and other key macroeconomic variables, particularly inflation (LeBlanc and Chinn, 2004; Choi et al. 2018). Recently, work by Makri et al. (2014), Idris and Nayan (2016) and Nasim and Downing (2023) has demonstrated that energy price shocks impact the banking sector in advanced or oil-exporting countries.

Despite theoretical arguments and anecdotal evidence, the existing literature paid less attention to the role of energy price shocks on banking performance. The only existing study is that of Nasim and Downing (2023). They only focused on the G7 countries, which are all advanced economies. Developing countries, such as African countries in general and Cameroon in particular, have not yet received the attention of previous studies. Furthermore, other works have analyzed the effect of oil price shocks on banking performance in major importing countries (Lee and Lee 2019; Saif-Alyousfi et al, 2021; Jin et al, 2022) and on banking efficiency in G7 countries (Nasim et al, 2023) using oil prices as a proxy for energy prices, thus neglecting other energy price components notably electricity and gas prices. Oil prices and energy prices are not quite the same (Kilian, 2008). These two main limitations form the basis of this article. The aim of this paper is to analyze the impact of energy price shocks on the performance of Cameroonian banks. In this study, banking sector performance is measured by return on assets and return on equity. The choice of Cameroon is justified by the fact that this country is the locomotive of the Central African Economic and Monetary Community (CAEMC). It is the hub of the sub-region, sharing borders with the other 5 CAEMC countries. Its coastline is used by landlocked countries of the sub-region such as Chad and CAR. In such a context, a threat to Cameroon's banks would undoubtedly have repercussions on the sub-region's financial stability. It is for this reason that such a study will enable specific recommendations to be formulated for banks and policies to safeguard and reinforce financial stability in the sub-region.

The rest of the article is structured into four sections. Section two highlights the lessons learned from the literature. Section three presents the methodological approach. Section four describes the results of the analysis, and section five concludes.

2. Lessons from literature

This section is organized into three points. The first highlights the relationship between energy shocks and macroeconomic variables. The second presents the impact of energy shocks on the financial sector. Finally, the last point develops the existing literature between energy shocks and the financial sector.

2.1 Energy shocks and macroeconomics

Some oil-exporting countries, most of them members of OPEC (Organization of the Petroleum Exporting Countries), have shown a willingness to reduce production to below full potential in order to influence prices (Anderson, 2000). In fact, OPEC has stated that it wishes to see prices stabilize (Khelil, 2001). Indeed, the series of adjustments made to production levels by OPEC members over the last three years was intended to bring the world oil price into a more stable, slightly higher range. However, the price of oil is highly sensitive to fluctuations in supply and demand, and the unpredictability of supply and demand variations has made price range targets very difficult for OPEC to achieve. Many previous studies have found a negative impact of rising oil prices on economic growth, at least in the major advanced economies (e.g. Bruno and Sachs, 1981, 1985; Darby, 1982; Hamilton, 1983; Burbidge et al. 1984; Gisser and Goodwin, 1986). Other studies have also found links between oil prices and other key macroeconomic variables, particularly inflation (LeBlanc and Chinn, 2004; Choi et al. 2018). There are several proposed mechanisms by which energy prices can affect economic activity. On the supply side, higher energy prices (i.e. input costs) reduce the profit-maximizing level of production (Hamilton, 1983). On the demand side, higher energy prices will be inflationary (Nasir et al. 2020, 2020b, 2020c; Pham et al. 2020) and can lead to lower real money balances (Solow, 1980), higher interest rates, lower incomes and reduced consumer spending (Bernanke et al., 1997). The effects of energy price shocks are also felt in the financial sector.

2.2 Energy shocks and the financial sector

The advance of globalization over the last few decades has strengthened the links between energy markets and the financial system, so that sharp variations in energy prices can now have a significant impact on financial markets. These effects can operate through many channels, including their effects on production costs and future cash flows, as well as through inflationary pressures and interest rates. Particularly in emerging markets and/or oil-exporting countries, oil prices can also influence public finances and exchange rates (Demirer et al., 2020). This has led to the development of a substantial literature on the link between energy prices and financial markets. Moreover, much of the focus is on oil prices, particularly the relationship with stock markets (see, Sardosky Pedroni, 1999; Kilian and Park, 2009; Narayan and Gupta, 2015; Du and He, 2015; Nasir et al., 2018b), with less emphasis on other financial markets, including bond markets (see, Kang and Ratti, 2013; Narayan and Gupta, 2015; Demirer et al., 2020), exchange rates (e.g., Benassy-Quere et al., 2007; Chen and Chen, 2007; Narayan et al., 2008; Basher et al., 2016), crypto-currencies (Huynh et al., 2021) and financial stability (Li et al., 2016; Qin, 2020). The banking sector also seems not to be spared from the consequences of energy price shocks.

2.3 Energy shocks and the banking sector

There is relatively little work directly analyzing the link between energy prices and bank performance. A similar paper is that by Nasim and Downing (2023), which analyzes the impact of oil prices on bank performance in the G7 countries. Using CAMEL indicators (capital adequacy, asset quality, management, earnings and liquidity), Lee and Lee (2019) find that oil prices have a significant impact on bank performance. In a similar vein, Ma et al. (2021) investigate the relationship between oil prices and stock market returns for 16 major banks in China. They find that this relationship fluctuates according to whether price shocks are demand- or supply-driven, and whether shocks are global or oil-specific in nature.

Numerous other articles have analyzed the effect of oil prices on banks in the oil-exporting countries of the Gulf Cooperation Council (GCC). Alodaynic (2016) and Ibrahim (2019) find that oil prices have a significant impact on banks' unprofitable lending, which then has an impact on the macroeconomy. From a behavioral finance perspective, Alqahtani et al. (2020) find a non-linear relationship between oil prices and banks as a function of oil price, while Saif-Alyousfi (2020) found that oil price shocks impact bank performance even when macroeconomic determinants have been taken into account. Maghyereh and Abdoh (2021) found that oil supply shocks have a greater impact on bank risk than oil demand shocks, and that this relationship has changed over time. On a panel of 30 oil-exporting countries, Al-Khazali and Mirzaei (2017) showed that a rise in oil prices significantly reduces banks' non-performing loans.

From this literature, it appears that developing countries have not attracted the attention of previous work on the relationship between energy shocks and banking performance. Moreover, most of the studies that have analyzed the relationship between energy shocks and banking performance have used oil prices as a proxy for energy shocks, thereby neglecting the prices of other energy components, notably gas and electricity. These two limitations are the starting point for this paper.

3. Methodological approach

The methodological approach consists firstly in presenting the characteristics of the variables that will be used in this work, and secondly in outlining the appropriate estimation technique for estimating the equation of our econometric model.

3.1 The data

The data mobilized in this work are from secondary sources and come from the annual reports of the National Credit Council of Cameroon (NCCC) and the databases of the World Bank and the International Monetary Fund. They cover 14 banks (out of the 18 operating in Cameroon) over the period 2017-202. The number of banks and the study period were limited by data availability. The list of banks used in this study is recorded in Table A in the Appendix.

The dependent variable in this study is bank performance. Two indicators of bank performance were mobilized in this work. The first refers to return on assets (ROA), which is calculated as net income over total assets. This indicator measures the profit generated by a bank from its assets. The second indicator is return on equity (ROE), which is calculated as earnings divided by total equity. It measures the profit generated by a bank from shareholders' capital. These indicators have been used in recent literature (Nasim and Downing, 2023). The evolution of bank performance in Cameroon is illustrated in Figure 1, which shows that the profitability of Cameroonian banks has decreased over the period 2018-2022.

Figure1: Performance trends of Cameroon's banks between 2017-2019

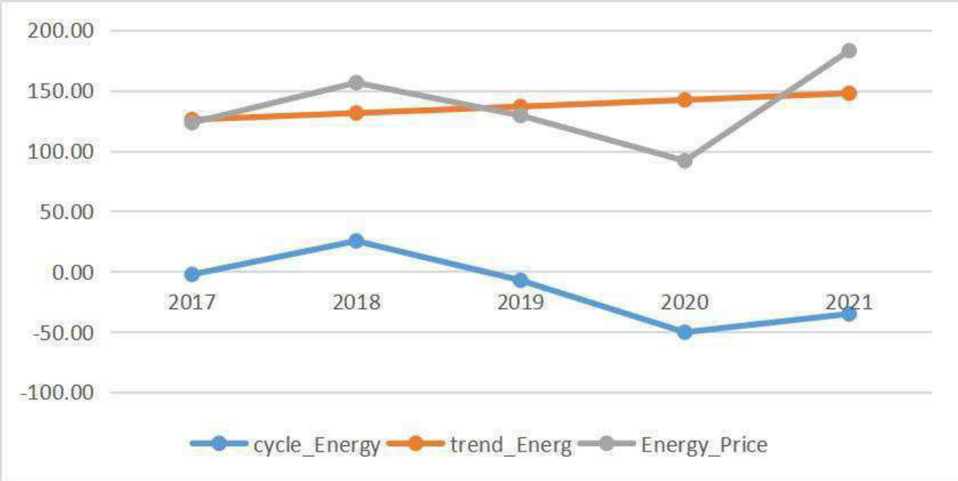
Source: Authors

The independent variable of interest in this study is the price of energy. This variable is captured by the world energy price index (it is provided by the International Monetary Fund through the link https://fred.stlouisfed.org/series/PNRGINDEXM). Data on energy prices were obtained from the International Monetary Fund website. This study uses average annual world energy prices in US dollars. It can also be captured by the cyclical component of the energy price, obtained using the energy price cyclical filter, in particular the Hodrick-Prescott (HP) time series filter (Hodrick and Prescott, 1997). This filter can be seen as an optimal trend signal extractor for the Mean Squared Error (MSE) in a smooth trend model. In this respect, the evolution of the energy price is the sum of the cyclical component (C) and the trend component (T), as shown in equation (1).

$$Energyprice_t = C_t + T_t \qquad (1)$$

The procedure for optimal extraction of the trend signal by mean-squared error (MSE) therefore consists of minimizing the variance of the cyclical component subject to a penalty of the variation of the second difference of the growth component, with a given smoothing parameter. The cyclical component of the energy price is therefore a shock, and the aim is for this component to become zero in the long term, since it represents the difference between the energy price and its growth (or trend) component. Figure 2 shows the evolution of the energy price and its trend and cyclical components after application of the HP filter. The figure shows that the price of energy has risen from $123.3 in 2017 to $183 in 2021, an increase of 48.4% in five years. The trend curve (trend_energy) confirms this evolution.

Figure 2: Energy prices and their components



Source: Authors

Concerning the control variables, we have mobilized domestic investment and information and communication technologies. The work of Bakar et al (2020) has shown that investment in fintech has a positive impact on bank performance. As for information and communication technologies (measured in this study by the rate of internet access per 100 inhabitants), Binuyo and Aregbeshola (2014), have shown that they have a positive impact on bank performance.

3.2 Econometric model

Referring to the literature on banking performance and in particular to the work of Nasim and Downing (2023), we specified the following econometric model:

$$Bankp_{it} = \beta_0 + \beta_1 Energy\ Shocks_t + \beta_2 Internet_t + \beta_3 Invest_t + \varepsilon_{it} \quad (2)$$

Where the variables $Bankp_{it}$, $Energy\ Shocks_t$, $Internet_t$ and $Invest_t$respectively represent the banking performance of bank i in period t, the energy price in period t, the internet access rate in period t and domestic investment in period t. ε_{it} represents the error term. It's important to note that we chose banks operating in one country. In this case, macroeconomic variables do not vary from one bank to another.

3.3 Estimation technique

Although the work of Kilian (2008) admits that world energy prices (particularly oil) have been endogenous to the American economy since the early 1970s, this reality of the American economy cannot be transferred to the Cameroonian economy. Cameroon is a simple oil and gas producer, it does not participate in setting energy prices on the international market, and its imports of energy products are very small compared to countries like the USA and China. Consequently, the problem of the endogeneity of the energy price variable does not arise for a specification in the Cameroonian context. To achieve our objective, we will mobilize the Panel Corrected Standard Error (PCSE) method. Indeed, a popular Prais-Winsten estimate with the panel-corrected standard error (PCSE), suggested by Beck and Katz (1995), has been carried out to offer efficiency and consistency. In fact, Monte Carlo simulations revealed that

PCSE estimators are robust to three econometric problems: autocorrelation, heteroscedasticity and panel correlation (Bai et al. 2021). Given that our sample includes a larger N (14) than T (5), the PCES method is appropriate for our model. In addition, we will use Driscoll and Kraay's method to test the robustness of our results.

4. Presentation of results

This section is devoted to presenting and interpreting the results of our econometric model estimations. This section is divided into two sub-sections: the first is devoted to the presentation of descriptive statistics and the second to the interpretation of the main results.

4.1 Presentation of descriptive statistics

This subsection presents the descriptive statistics table and the correlation matrix. The results of the descriptive statistics are shown in Table 1. This table shows, for example, that the number of observations is equal to 70 for all variables, which means that our panel is balanced. The table also shows that the mean and standard deviation of asset profitability respectively are 0.013 and 0.021. The coefficient of variation is 1.61 (0.021/0.013). This coefficient is greater than 0.15, reflecting heterogeneity in the distribution of return on assets between Cameroonian banks. The same analysis can be made for return on equity. As for the energy price variable, it shows an average of US$136.76 over the period 2017-2021. Concerning the correlation matrix, the results are recorded in Table 2. This table reveals that all the correlation coefficients between the explanatory variables are individually lower than 0.87; this means that our model does not suffer from the multicollinearity issue according to Thumb's rule (Young, 2018). Furthermore, we noticed a negative correlation between energy prices and asset profitability.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Roe	70	.539	.625	-1.583	2.06
Roa	70	.013	.021	-.057	.067
Energyprice	70	136.763	31.197	91.7	183
Internet	70	36.115	8.858	23.203	45.602
Inv	70	18.993	.467	18.192	19.55
Cycle_Energy	70	0	30.1852	-50.47	35.26

Source : Authors

Table 2: Correlation matrix

	(1)	(2)	(3)	(4)
(1)Roa	1.00			
(2) Energyprice	-0.002	1.00		
(3) Internet	-0.027	0.043	1.00	
(4) Inv	0.052	0.488	-0.807	1.00

Source : Authors

4.2 Main results

The results of this study will be presented in two points. First, we will analyze the results of the effect of energy price shocks on bank performance using the Panel Corrected Standard Error method (Table 3). The second point highlights the results obtained using the Driscoll-Kraay method.

Estimating the effect of energy price shocks on bank performance shows that there is an inverse relationship between the two variables. Thus, a one-unit change in the cyclical part of the energy price leads to a 0.01% and 0.22% drop in bank performance respectively for ROA and ROE (columns 2 and 4). The value of the energy price and its trend component confirm these results. These results can be explained by the fact that an increase in the price of energy automatically generates inflation. Inflation, in turn, not only has an impact on companies' production costs, but also increases their indebtedness (because money has lost its value). This reduces their profit margins and forces them to renege on their commitments to the various banks to which they have granted credit. Consequently, a shock to energy prices on the international market increases the credit risk of Cameroonian banks. These results are consistent with the work of Nasim and Downing (2023), who found the same results in the G7 countries.

The internet variable has a positive and significant effect at the 1% threshold on banking performance. Thus, an increase of one unit in the internet rate leads to an increase in bank performance of 0.03% and 3.6% respectively for ROA and ROE (columns 3 and 6). This result can be explained by the fact that internet access reduces production costs such as communications costs, thus saving money and increasing profitability.This result is consistent with the work of Binuyo and Aregbeshola (2014).

As for domestic investment, it has a significant positive impact on bank profitability. Thus, an increase in domestic investment of one unit leads to an increase in bank performance of 1.2% and 23.8% respectively for ROA and ROE (columns 3 and 6). This result is justified by the fact that the private sector in an economy is financed by banks through their credit granting activities. This result is consistent with the work of Bakar et al (2020), who found that investment in fintech had an impact on bank performance in Malaysia.

Table 3: Effect of energy price shocks on bank performance (PCES)

	1	2	3	4	5	6
Variables	ROA	ROA	ROA	ROE	ROE	ROE
Energyprice	-0.000149***			-0.00210***		
	(1.67e-05)			(0.000418)		
Cycle_Energy		-0.000160***			-0.00223***	
		(2.00e-05)			(0.000484)	
Trend_Energ			-0.00185***			-0.0285***
			(7.03e-06)			(0.00179)
Internet	0.000764***	0.000645***	0.00204***	0.0164***	0.0147***	0.0369***
	(0.000105)	(0.000103)	(8.10e-06)	(0.00265)	(0.00250)	(0.00206)
Invest	0.0189***	0.0193***	0.0122***	0.321***	0.324***	0.238***
	(0.00250)	(0.00277)	(6.40e-05)	(0.0626)	(0.0672)	(0.0163)
Constant	-0.353***	-0.377***	-0.0403***	-5.860***	-6.146**	-1.423***
	(0.0491)	(0.0563)	(0.000615)	(1.231)	(1.363)	(0.156)
Obs	70	70	70	70	70	70
R-squared	0.014	0.013	0.015	0.006	0.006	0.007
Nb i	14	14	14	14	14	14
F-Stat	44.07	34.43	36624	42.42	33.74	475.5
Prob (F-stat)	0.00	0.00	0.00	0.00	0.00	0.00

Source: Authors. Values in parentheses represent standard deviations of coefficients. *** p<0.01, ** p<0.05, * p<0.1

To test the sensitivity of our results, we used the Driscoll-Kraay method. The results of this estimation are shown in Table 4. Analysis of this table reveals that all variables retain not only their sign but also their significance. This proves that our results are robust. Overall, this presentation shows that energy shocks have a negative and significant impact on bank performance in Cameroon.

Table 4: Effect of energy price shocks on bank performance (Driscoll-Kraay)

	1	2	3	4	5	6
Variables	ROA	ROA	ROA	ROE	ROE	ROE
EnergyPrice	-0.0001***			-0.0021***		
	(2.58e-05)			(0.000646)		
Cycle_Energy		-0.00016***			-0.0022***	
		(3.04e-05)			(0.000736)	
Trend_Energ			-0.0018***			-0.0285***
			(1.28e-05)			(0.00325)
Internet	0.00076***	0.000645***	0.00204***	0.0164***	0.0147***	0.0369***
	(0.000134)	(0.000128)	(1.37e-05)	(0.00336)	(0.00310)	(0.00349)
Invest	0.0189***	0.0193***	0.0122***	0.321***	0.324***	0.238***
	(0.00291)	(0.00325)	(8.15e-05)	(0.0730)	(0.0788)	(0.0208)
Constant	-0.353***	-0.377***	-0.0403***	-5.860***	-6.146***	-1.423***
	(0.0568)	(0.0661)	(0.00121)	(1.424)	(1.601)	(0.307)
Obs	70	70	70	70	70	70
R^2	0.014	0.013	0.015	0.006	0.006	0.007
Number of i	14	14	14	14	14	14
Prob(Chi2)	0.00	0.00	0.00	0.00	0.00	0.00

Source: Authors. Values in brackets represent standard deviations of coefficients. Note : *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion and Policy implication

The neo-liberal economy is inescapably exposed to external shocks, and these are not without consequences for the sectors in which it operates. Given the variation of energy prices on the international market on the one hand and on the other hand, the importance of banking activity in the real sphere of the economy; it was appropriate to study the relationship between the two macroeconomic quantities for a net energy-importing country (Cameroon). To achieve this, we mobilized the Standard Error Corrected Panel method. The analyses revealed that energy price shocks have a significant negative impact on bank performance in Cameroon. Consequently, banks need to strengthen their resilience by building up provisions for financing granted to the energy sector and to companies that use energy as a raw material. Monetary policy also needs to be readjusted. A tighter monetary policy in response to energy price inflation could lead to an economic slowdown, while an insufficient response could lead to an excessive rise in inflation. Finally, the Cameroonian government should put in place mechanisms to refine its oil sufficiently, for instance, to mitigate the effect of energy shocks not only on banks but on the economy as a whole.

This study has two main limitations. The first underlines the absence of transmission mechanisms through which energy price shocks impact the Cameroonian banking sector. The second is the fact that the price of energy is the average price of components such as electricity, kerosene, firewood, gas and oil. The use of the average energy price does not allow us to identify which component has the greatest or least impact on banking performance. Future work will consider disaggregated energy price indicators and the channels through which its shocks impact bank performance.

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Table A: List of selected banks in Cameroon

AFBK	CITIBANK	BICEC	ECOBANK	BAC
CBC	UBC	SCB	SGC	BC-PME
BGFI	NFC	STDBK	UBA	

Source : Authors