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11000 Beograd, Bulevar kralja Aleksandra 86
bankarstvo@ubs-asb.com
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UVODNA REČ

Sanja Jevtović,
Specijalista za poreski sistem i finansijsko izveštavanje

Bankarski sistem je na najtežem ispitu u periodu pandemije potvrdio svoju stabilnost, efikasnost i visoku kapitalizovanost. Razloga za to je više, a oni najviše leže u činjenici da su u godinama pre krize učinjeni zaista krupni koraci ka stabilizaciji nacionalne ekonomije, ka oporavku javnih finansija, sa čvrstom valutom i jasnom i predvidivom monetarnom politikom. Tako dobrom rezultatu svakako je doprineo i adekvatan odgovor Narodne banke Srbije i Vlade Republike Srbije na COVID krizu, koji je bankama omogućio da podrže privredu na jedan izuzetan način. Uz kontinuitet i neometano obavljanje bankarskog poslovanja, može se reći da podrška banaka obuhvata tri moratorijuma kojima je odloženo plaćanje obaveza prema bankama u vrednosti većoj od 5 milijardi evra, kao i Garantnu šemu preko koje su banke plasirale oko dve milijarde evra veoma povoljnih kredita privredi.

Ako govorimo o tome šta su sledeći izazovi za bankarstvo u Srbiji, nesumnjivo da se u samom vrhu prioriteta nalazi trend koji već uveliko traje, a to je - digitalizacija. U pitanju je proces u koji su banke ušle pre pandemije i u kojem su pod pritiskom ove neočekivane nužnosti, za godinu dana učinjeni veći koraci nego u proteklih nekoliko godina.

Banke danas moraju da ubrzaju svoju digitalnu transformaciju, što zahteva značajna finansijska i ljudska ulaganja, ali na drugoj strani u perspektivi ovaj proces predstavlja potencijal za smanjenje troškova i povećanje prihoda. Izazov za banke svakako predstavlja odgovor na pojavu i jačanje različitih oblika fintech industrije. U tom smislu banke ubrzano rade na prilagođavanju svojih poslovnih modela značajno inovirajući ponudu sa kojom se pojavljuju na tržištu.

Još jedan globalni trend koji je karakterističan za celu Evropu prisutan je i u Srbiju - proces ukрупnjavanja banaka. U cilju poboljšanja performansi i povećanja profitabilnosti poslovanja, promena vlasničke strukture banaka uglavnom je inicirana od matičnih banaka i to zbog promenjenih okolnosti na tržištima, odnosno zbog globalnih procesa ukрупnjavanja u okviru bankarskih grupacija.

I na samom kraju ovog uvodnika, sa ponosom ističemo činjenicu da se 4. decembra ove godine navršilo **100 godina otkako je osnovano Udruženje banaka Srbije**. Na ovim prostorima malo je institucija, firmi i organizacija koje traju ceo jedan vek. Udruženje traje, a to je znak da je za proteklih 100 godina opravdalo razlog svog osnivanja i postojanja, uz želju i uverenje da će i u budućnosti uspešno realizovati očekivanja svojih članica i šire društvene zajednice.



EDITORIAL

Sanja Jevtović,
Tax System and Financial Reporting Specialist

The banking system proved its stability, efficiency, and high capitalisation, by facing its most difficult challenge in the pandemic period. There are several reasons for that, and they are mostly rooted in the fact that, in the years prior to the crisis, significant steps had been made towards the stabilisation of the national economy, and towards the recovery of public finances, with a strong currency and clear and predictable monetary policy. The adequate response by the National Bank of Serbia and the Government of the Republic of Serbia to the COVID crisis enabled the banks to support the economy in an exceptional way, which certainly contributed to such a good result. Regarding the continuity and uninterrupted execution of banking operations, the support of banks includes three moratoriums which postponed the payment of obligations to banks worth more than 5 billion euros, as well as the Guarantee Scheme through which banks placed about two billion euros of highly favourable loans.

Concerning the next challenges for banking in Serbia, that one of the biggest priorities is a trend that has been going on for a long time, and that is - digitalisation. It is a process that the banks had entered before the pandemic and, under the pressure of this unexpected necessity, larger steps have been made towards achieving it in a year than was the case in the past few years.

Banks today need to accelerate their digital transformation, which requires significant financial and human investment, but, on the other hand, this process has the potential to reduce costs and increase revenues. The challenging aspect for banks is certainly the response to the emergence and strengthening of various forms of fintech industry. In this sense, banks are rapidly working to adapt their business models by significantly innovating the offers with which they appear on the market.

Another global trend that is distinctive across Europe is also present in Serbia - the process of bank consolidation. In order to improve performance and increase business profitability, the changes in the ownership structure of banks were mainly initiated by parent banks due to changed market conditions, i.e., due to global consolidation processes within banking groups.

At the very end of this editorial, we are proud to point out the fact that 4 December 2021 marked **the 100th anniversary of the founding of the Association of Serbian Banks**. There are few institutions, companies, or organisations in this region that have lasted for a whole century. The Association persists, and that is a sign that for the past 100 years it has justified the reason for its founding and functioning, with the desire and belief that it will keep successfully meeting the expectations of its members and the wider community.

ANALIZA UTICAJA PROMENE NOMINALNOG DEVIZNOG KURSA NA STOPU INFLACIJE NA PRIMERU ODABRANIH ZEMALJA

Aleksandra Živković, doktorand, Univerzitet u N. Sadu,
Ekonomski fakultet u Subotici,
email: zivkovicc.aleksandra@gmail.com
prof. dr Ivan Milenković, redovni profesor Univerziteta u N. Sadu,
Ekonomski fakultet u Subotici,
email : ivan.milenkovic@gmail.com

Rezime

Stopa inflacije je jedna od osnovnih makroekonomskih varijabli i predstavlja osnovni cilj monetarne politike. Uslovljena je velikim brojem faktora, te je neophodno analizirati uticaj koji njihove promene imaju na stopu inflacije. Cilj ovog istraživanja je analiza pass-through efekta promene nominalnog deviznog kursa na stopu inflacije na primeru odabranih zemalja u razvoju i razvijenih zemalja u periodu od 2014. do 2020. godine, čije su zajedničke karakteristike targetirana stopa inflacije, kao režim monetarne politike i rukovođeno fluktuirajući devizni kurs, kao režim deviznog kursa. Potvrđena je obrnuta proporcionalnost između kretanja nominalnog deviznog kursa i stope inflacije (depresijacija nominalnog deviznog kursa nacionalne valute vodi ka rastu stope inflacije) i veći pass-through efekat u zemljama u razvoju u odnosu na razvijene zemlje.

Ključne reči: exchange rate pass-through; devizni kurs; stopa inflacije

JEL klasifikacija: E42, E52, E58, C33

Uvod

Radi sprovođenja adekvatne monetarne politike, neophodno je raspolagati tačnim podacima o makroekonomskim agregatima od značaja, ali i međuzavisnošću između njih, kako bi se precizno odredio uticaj koji promena jednog makroekonomskog agregata ima na druge, a samim tim i na ciljeve monetarne i ekonomske politike. Kao značajne varijable u monetarnoj politici izdvajaju se prevashodno stopa inflacije, ali i devizni kurs, te i njihova međuzavisnost.

Predmet istraživanja rada je pass-through efekat – „prelivanje“ promena nominalnog deviznog kursa na stopu inflacije u Srbiji, Mađarskoj i Rumuniji (koje predstavljaju zemlje u razvoju) i Velikoj Britaniji, Kanadi i Novom Zelandu (koje predstavljaju grupu razvijenih zemalja). Posmatrani period nominalnog deviznog kursa i stope inflacije je od 2014. do 2020. godine i prikupljeni podaci su analizirani na kvartalnom nivou.

Cilj istraživanja je empirijski potvrditi obrnutu proporcionalnost kretanja nominalnog deviznog kursa i stope inflacije, tj. potvrditi da depresijacija nominalnog deviznog kursa nacionalne valute vodi ka rastu stope inflacije, kao i veći pass-through efekat u zemljama u razvoju u odnosu na razvijene zemlje.

Metodologija istraživanja obuhvata deskriptivnu statističku analizu podataka, kreiranje panel podataka i utvrđivanje odgovarajućeg panel modela, utvrđivanje dijagrama rasipanja nominalnog deviznog kursa u odnosu na stopu inflacije za svaku posmatranu zemlju, kao i komparativnu analizu radi utvrđivanja sličnosti i razlika između pass-through efekta uticaja promene stope nominalnog deviznog kursa na stopu inflacije u zemljama u razvoju i razvijenim zemljama. Analiza panel podataka je izvršena primenom statističkog softvera STATA, dok je u izradi dijagrama rasipanja korišćen softver Statistica. Statistički značajne razlike se uzimaju kod vrednosti gde je $p < 0,05$.

U prvom delu rada predstavljeni su vladajući stavovi u literaturi, potom su u drugom delu prikazani empirijski podaci o nominalnim deviznim kursevima i stopi inflacije. U trećem delu rada su analizirani dijagram rasipanja nominalnog deviznog kursa u odnosu na stopu inflacije i deskriptivna statistika (za promenljive stopu inflacije i nominalni devizni kurs) i prikazani su rezultati panel analize i odabir odgovarajućeg modela. U poslednjem delu rada izvršeno je poređenje odabranih zemalja regiona (uključujući i Srbiju) i razvijenih zemalja.

Pregled literature

Procena uticaja šokova na kretanje nominalnih deviznih kurseva stranih valuta i prelivanje inflacije na domaće tržište je efekat koji je u literaturi poznat kao “pass-through” efekat. Od presudnog je značaja za monetarne vlasti, jer uslovljava rast domaćih cena. Može se definisati kao procentualna promena stope inflacije izazvana jednocentnom promenom nominalnog deviznog kursa (Ristanović & Tasić, 2018). ERPT (Exchange rate pass-through) može varirati među zemljama sa različitim ekonomskom strukturom, u pogledu stepena otvorenosti, značaja uvoza za tu zemlju itd. (Ortega & Osbat, 2020). Pad ERPT je povezan sa cenovnom stabilnošću, koja je proizvod kredibilne monetarne politike (Allem & Lahiani, 2014). Prema istraživanju MMF-a, sprovedenog na svim članicama u periodu 1960-1990. godine, između zemalja koje koriste različite režime deviznih kurseva postoji različit uticaj koji oni imaju na stopu inflacije. Ukoliko devizne kurseve podelimo u tri grupe: fiksne, rukovođeno fluktuirajuće i slobodno fluktuirajuće, države sa fiksnim deviznim kursevima neretko karakteriše niska stopa inflacije i manje varijacija deviznog kursa (Ghosh i saradnici, 1997).

Analizirajući uticaj promene realnog deviznog kursa na stopu inflacije na primeru azijskih zemlja (ASEAN + Japan, Kina, Južna Koreja) u periodu od 1991. do 2005. godine i poredeći dobijene rezultate sa rezultatima iz Evropske Unije i Severne Amerike, Achsani i saradnici (2010) zaključili su da na tom primeru azijskih zemalja postoji jaka korelacija između deviznog kursa i inflacije i da depresijacija nominalnog (kao i realnog) deviznog kursa utiče na rast inflacije, dok je korelacija između deviznog kursa i inflacije zanemarljiva u EU i Severnoj Americi, ali da je primećen značajan uticaj inflacije na devizni kurs.

U korist smanjenja pass-through efekta nakon uvođenja režima ciljanja stope inflacije kao osnovnog cilja monetarne politike, govori i analiza sprovedena u 27 zemalja u razvoju od kojih 15 ima kao cilj targetiranu inflaciju, a 12 ne, primenom VAR metode. Utvrđeno je da je pass-through efekat smanjen kod sledeća tri cenovana indeksa: CPI (Consumer Price Index), PPI (Producer Price Index), IMP (Import Price Index) (Coulibaly & Kempf, 2010). Tezu da je ERPT efekat niži prilikom fluktuirajućih deviznih kurseva potvrđuju i Kara & Ogunc (2005), na primeru turske lire. Otkako se devizni kurs turske lire slobodno formira na osnovu kretanja ponude i tražnje na tržištu, ERPT efekat je smanjen.

Uticaj promene nominalnog deviznog kursa na inflaciju analiziran je na primeru odabranih afričkih zemalja u periodu od 1978. do 1989. godine – analizirane zemlje su bile: Gambija, Gana, Kenija, Nigerija, Sijera Leone, Somalija, Tanzanija, Uganda, Kongo i Zambija. Primenom bivarijatnog (primena (1) monetarnog agregata i nivoa cena kao varijabili ili (2) deviznog kursa i nivoa cena) i trivarijatnog Grejndžerovog testa (monetarni agregat, nivo cena i devizni kurs kao varijable), potvrđen je veliki uticaj promene deviznog kursa na stopu inflacije u Sijera Leone, Tanzaniji i Kongu, dok je ista korelacija potvrđena primenom bivarijatnog testa u Keniji i trivarijatnog u Gambiji (Canetti & Greene, 1991). Imimole & Enoma (2011) dokazali su primenom ADRL modela na primeru Nigerije da depresijacija nominalnog deviznog kursa nigerijske naire utiče na rast stope inflacije analizirajući podatke u periodu 1986-2008. Korišćenjem mesečnih podataka o stopi inflacije i kursu nigerijske naire u periodu od januara 2006. godine do decembra 2015. godine, primenom GARCH modela (Generalised Auto Conditional Heteroscedastic model) dokazana je negativna veza između volatilnosti deviznog kursa i stope inflacije na kratak rok – rast deviznog kursa za 1% vodi ka padu inflacije za 0,003% (Osabuohien i saradnici, 2018).

Pregled nominalnih deviznih kurseva i stope inflacije u odabranim zemljama

U zemljama koje su usvojile ciljanje inflacije (Inflation targeting) za režim monetarne politike kao osnovni cilj monetarnih vlasti, zabeleženo je smanjenje pass-through efekta nominalnog deviznog kursa na stopu inflacije (Edwards, 2006), te su upravo i predmet ovog istraživanja zemlje koje spadaju u ovu grupu (targetirana stopa inflacije kao režim monetarne politike + rukovođeno fluktuirajući devizni kurs kao režim deviznog kursa). U istraživanje su uključeni Novi Zeland i Kanada, kao prve države koje su usvojile ciljanje inflacije kao osnovni cilj monetarnih vlasti, nakon kojih su i druge razvijene zemlje i zemlje u razvoju preuzele ovaj režim monetarne politike (Stevanović & Milenković, 2020).

Radi statističke obrade podataka svi nominalni devizni kursevi su izraženi u evrima (kako bi sve nacionalne valute bile izražene u istoj jedinici). Podaci o kvartalnoj vrednosti evra izraženog u srpskim dinarima preuzeti su sa sajta Narodne Banke Srbije, dok su podaci u preostalim valutama preuzeti sa

sajta Evropske Centralne Banke. U Tabeli 1 prikazani su nominalni devizni kursevi za svaku posmatranu nacionalnu valutu, kao i procentualna promena na kvartalnom nivou. Za svaku nacionalnu valutu, nominalne vrednosti deviznih kurseva su prikazane u koloni (1), dok su procentualne promene prikazane u koloni (2).

Tabela 1. Nominalni devizni kursevi odabranih nacionalnih valuta u periodu Q1 2014 – Q4 2020

Kvartal	Srpski dinar RSD/EUR		Mađarska forinta HUF/EUR		Rumunski lej RON/EUR		Britanska funta GBP/EUR		Kanadski dolar CAD/EUR		Novozelandski dolar NZD/EUR	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Q1 2014	0,00864	/	0,00325	/	0,22222	/	1,20482	/	0,66225	/	0,60976	/
Q2 2014	0,00865	0,12	0,00327	0,62	0,22573	1,58	1,23457	2,47	0,66667	0,67	0,62893	3,14
Q3 2014	0,00852	-1,50	0,00320	-2,14	0,22676	0,46	1,26582	2,53	0,69444	4,17	0,63694	1,27
Q4 2014	0,00831	-2,46	0,00324	1,25	0,22573	-0,45	1,26582	0,00	0,70423	1,41	0,62500	-1,87
Q1 2015	0,00823	-0,96	0,00324	0,00	0,22472	-0,45	1,35135	6,76	0,71429	1,43	0,66667	6,67
Q2 2015	0,00830	0,85	0,00327	0,93	0,22523	0,23	1,38889	2,78	0,73529	2,94	0,66225	-0,66
Q3 2015	0,00832	0,24	0,00320	-2,14	0,22573	0,22	1,38889	0,00	0,68966	-6,21	0,58480	-11,69
Q4 2015	0,00828	-0,48	0,00320	0,00	0,22422	-0,67	1,38889	0,00	0,68493	-0,69	0,60976	4,27
Q1 2016	0,00814	-1,69	0,00320	0,00	0,22272	-0,67	1,29870	-6,49	0,66225	-3,31	0,60241	-1,21
Q2 2016	0,00813	-0,12	0,00319	-0,31	0,22222	-0,22	1,26582	-2,53	0,68493	3,42	0,61350	1,84
Q3 2016	0,00811	-0,25	0,00321	0,63	0,22371	0,67	1,17647	-7,06	0,68493	0,00	0,64935	5,84
Q4 2016	0,00811	0,00	0,00323	0,62	0,22173	-0,89	1,14943	-2,30	0,69444	1,39	0,65789	1,32
Q1 2017	0,00807	-0,49	0,00324	0,31	0,22124	-0,22	1,16279	1,16	0,70922	2,13	0,66667	1,33
Q2 2017	0,00813	0,74	0,00323	-0,31	0,21978	-0,66	1,16279	0,00	0,67568	-4,73	0,64103	-3,85
Q3 2017	0,00835	2,71	0,00326	0,93	0,21834	-0,66	1,11111	-4,44	0,68027	0,68	0,62112	-3,11
Q4 2017	0,00840	0,60	0,00321	-1,53	0,21645	-0,87	1,12360	1,12	0,66667	-2,00	0,59172	-4,73
Q1 2018	0,00844	0,48	0,00322	0,31	0,21459	-0,86	1,13636	1,14	0,64516	-3,23	0,59172	0,00
Q2 2018	0,00846	0,24	0,00315	-2,17	0,21505	0,21	1,13636	0,00	0,64935	0,65	0,59172	0,00
Q3 2018	0,00846	0,00	0,00309	-1,90	0,21505	0,00	1,12360	-1,12	0,65789	1,32	0,57471	-2,87
Q4 2018	0,00845	-0,12	0,00310	0,32	0,21459	-0,21	1,12360	0,00	0,66225	0,66	0,58824	2,35
Q1 2019	0,00846	0,12	0,00315	1,61	0,21142	-1,48	1,14943	2,30	0,66225	0,00	0,59880	1,80
Q2 2019	0,00848	0,24	0,00310	-1,59	0,21053	-0,42	1,14943	0,00	0,66667	0,67	0,58824	-1,76
Q3 2019	0,00849	0,12	0,00305	-1,61	0,21142	0,42	1,11111	-3,33	0,68027	2,04	0,58480	-0,58
Q4 2019	0,00851	0,24	0,00301	-1,31	0,20964	-0,84	1,16279	4,65	0,68493	0,69	0,58140	-0,58
Q1 2020	0,00851	0,00	0,00295	-1,99	0,20833	-0,62	1,16279	0,00	0,67568	-1,35	0,57471	-1,15
Q2 2020	0,00850	-0,12	0,00284	-3,73	0,20661	-0,83	1,12360	-3,37	0,65359	-3,27	0,56180	-2,25
Q3 2020	0,00850	0,00	0,00283	-0,35	0,20619	-0,20	1,09890	-2,20	0,64103	-1,92	0,56497	0,56
Q4 2020	0,00850	0,00	0,00277	-2,12	0,20534	-0,41	1,11111	1,11	0,64516	0,64	0,57471	1,72

Izvor: www.ecb.europa.eu

Na osnovu tabelarnog prikaza se zaključuje da su sve posmatrane valute u posmatranom vremenskom intervalu nominalno depresirale u odnosu na evro. U toku posmatranog intervala, bilo je oscilacija u kretanju nominalnih deviznih kurseva - najveće su zabeležene kod kanadskog i novozelandskog dolara. Najveća procentualna depresijacija u odnosu na evro zabeležena je kod mađarske forinte, dok je najmanje oscilacija pretrpeo kurs britanske funte.

Kvartalni podaci o stopi inflacije za sve posmatrane zemlje preuzeti su od strane BIS banke (Bank for International Settlements) i predstavljeni su u Tabeli 2.

Tabela 2. Stopa inflacije u odabranim državama u periodu
Q1 2014 – Q4 2020

Kvartal	Srbija	Mađarska	Rumunija	Velika Britanija	Kanada	Novi Zeland
Q1 2014	2,67	0,04	1,06	1,78	1,39	1,53
Q2 2014	1,79	-0,17	0,93	1,76	2,22	1,62
Q3 2014	1,88	-0,06	1,08	1,45	2,08	1,01
Q4 2014	2,00	-0,68	1,19	0,91	1,93	0,76
Q1 2015	0,89	-1,04	0,55	0,10	1,07	0,25
Q2 2015	1,74	0,26	0,10	-0,03	0,90	0,42
Q3 2015	1,53	0,01	-1,75	0,03	1,19	0,42
Q4 2015	1,40	0,49	-1,21	0,10	1,33	0,08
Q1 2016	1,46	0,33	-2,62	0,33	1,54	0,42
Q2 2016	0,51	-0,05	-2,48	0,33	1,55	0,42
Q3 2016	1,00	0,06	-0,50	0,70	1,23	0,42
Q4 2016	1,54	1,28	-0,56	1,20	1,39	1,34
Q1 2017	3,11	2,61	0,15	2,17	1,91	2,17
Q2 2017	3,69	2,06	0,71	2,76	1,32	1,74
Q3 2017	3,00	2,42	1,47	2,81	1,37	1,90
Q4 2017	2,88	2,29	3,08	3,02	1,79	1,59
Q1 2018	1,60	1,97	4,65	2,71	2,06	1,10
Q2 2018	1,84	2,73	5,34	2,42	2,30	1,50
Q3 2018	2,39	3,44	4,86	2,51	2,68	1,90
Q4 2018	2,07	3,22	3,64	2,26	2,04	1,89
Q1 2019	2,44	3,17	3,74	1,85	1,61	1,48
Q2 2019	2,28	3,73	4,00	2,02	2,15	1,67
Q3 2019	1,35	3,06	3,84	1,85	1,94	1,46
Q4 2019	1,41	3,42	3,73	1,40	2,10	1,85
Q1 2020	1,76	4,32	3,23	1,66	1,81	2,53
Q2 2020	0,96	2,49	2,53	0,68	0,02	1,45
Q3 2020	1,92	3,71	2,65	0,62	0,27	1,44
Q4 2020	1,58	2,82	2,14	0,58	0,78	1,44

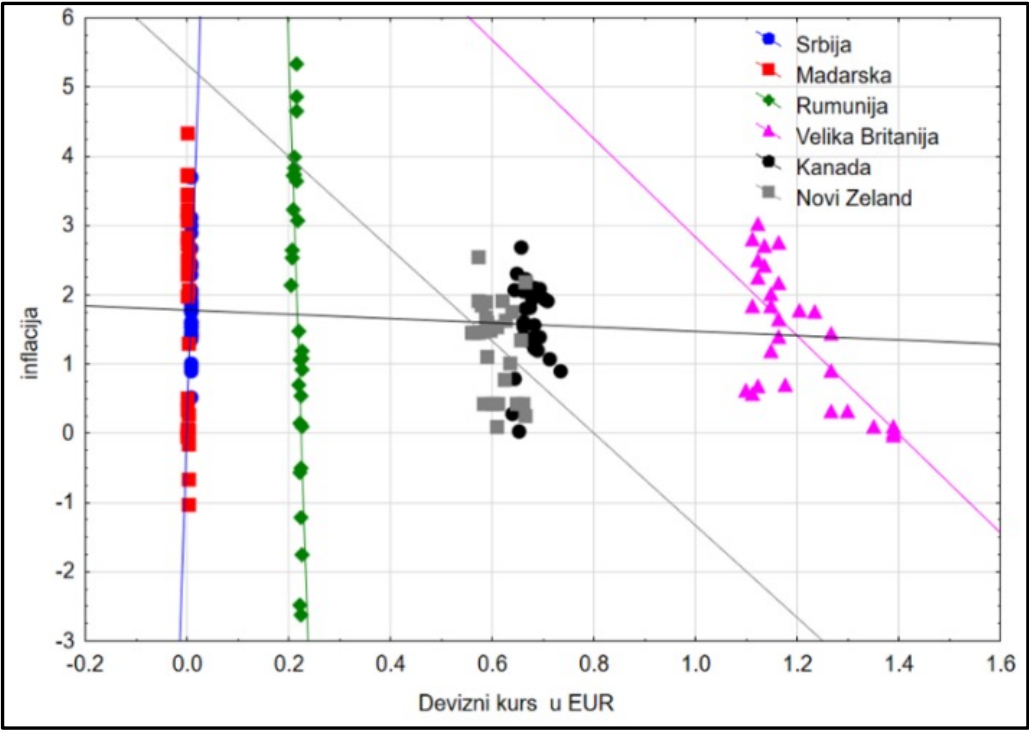
Izvor: www.bis.org

Kretanje stope inflacije u posmatranim zemljama beleži oscilacije u toku posmatranog perioda, ali je primetan zajednički trend kretanja kod svih zemalja. Od početka posmatranog perioda do prve polovine 2016. godine stopa inflacije ima pretežno negativan trend kretanja (Rumunija beleži negativnu stopu u trajanju od 6 kvartala), nakon čega dolazi do rasta stope inflacije i ovaj trend kretanja se menja tek od 2020. godine i početka izbijanja pandemije korona virusa, kada dolazi do pada privredne aktivnosti, što vodi ka smanjenju stope inflacije.

„Pass-through“ efekat nominalnog deviznog kursa na stopu inflacije

Početak empirijske analize podataka upućuje na dijagrame rasipanja nominalnog deviznog kursa u odnosu na stopu inflacije. Za svaku pojedinačnu državu je prikazana jednačina koja objašnjava povezanost nominalnog deviznog kursa i stope inflacije. Nominalni devizni kurs izražen u evrima predstavlja nezavisnu promenljivu, dok je stopa inflacije zavisna promenljiva. Nedostatak dijagrama rasipanja je što se ne uzimaju u obzir različiti vremenski momenti, koji će biti uvaženi prilikom obrade panel podataka.

Slika 1. Dijagrami rasipanja nominalnog deviznog kursa u odnosu na stopu inflacije



Izvor: Proračun autora primenom alata Statistica

Srbija:	$Y = 0,0270 + 221,4813 * X;$	$r = 0,0511;$	$p = 0,79630;$	$r^2 = 0,0026$
Mađarska:	$Y = 24,4349 - 7239,1438 * X;$	$r = -0,6330;$	$p = 0,00030;$	$r^2 = 0,4006$
Rumunija:	$Y = 50,7426 - 225,6237 * X;$	$r = -0,6960;$	$p = 0,00004;$	$r^2 = 0,4844$
Velika Britanija:	$Y = 9,9516 - 7,1182 * X;$	$r = -0,6862;$	$p = 0,00006;$	$r^2 = 0,4709$
Kanada:	$Y = 1,7752 - 0,3030 * X;$	$r = -0,0113;$	$p = 0,95450;$	$r^2 = 0,0001$
Novi Zeland:	$Y = 5,3318 - 6,6589 * X;$	$r = -0,3304;$	$p = 0,08600;$	$r^2 = 0,1092$

U svim posmatranim zemljama osim u Srbiji postoji obrnuta proporcionalnost između kretanja nominalnog deviznog kursa i stope inflacije, tj. sa rastom nominalnog deviznog kursa stopa inflacije opada. Treba uzeti u obzir činjenicu da su nominalni devizni kursevi svih analiziranih valuta izraženi u evrima, te da rast nominalnog deviznog kursa označava depresijaciju evra, tj. apresijaciju nacionalne valute. Apresijacija nacionalne valute vodi ka padu stope inflacije. U Srbiji je prisutna direktna proporcionalnost, te sa rastom kursa izraženog u evrima (depresijacija evra – apresijacija srpskog dinara), dolazi do rasta stope inflacije. Dobijeni podaci nisu statistički značajno različiti od nule na primeru Srbije, Kanade i Novog Zelanda i upravo ove zemlje imaju najniži koeficijent determinacije.

Radi utvrđivanja uticaja volatilnosti nominalnog deviznog kursa na stopu inflacije u posmatranim zemljama, prikupljeni kvartalni podaci su obrađeni primenom programa STATA. Zemlje su označene brojevima od 1 do 6 (Srbija, Mađarska, Rumunija, Velika Britanija, Kanada i Novi Zeland respektivno) i podaci su balansirani (za svaku posmatranu zemlju se analizira isti broj podataka u vremenskoj seriji). U Tabeli 3 je prikazana osnovna deskriptivna statistika za obe promenljive, ne uzimajući u obzir različite zemlje.

Tabela 3. Osnovna deskriptivna statistika za promenljive stopu inflacije i nominalni devizni kurs

Variable	Obs	Mean	Std. Dev.	Min	Max
Zemlja	168	3,5	1,712931	1	6
Vreme	168	14,5	8,101896	1	28
Stopa inflacije	168	1,582857	1,273472	-2,62	5,34
Nominalni devizni kurs u EUR	168	,4519313	,4281965	,0027735	1,388889

Izvor: Proračun autora primenom alata STATA

Detaljnija deskriptivna statistika je prikazana u Tabeli 4. Ukupan broj analiziranih podataka je 168, a predmet analize je 6 zemalja i 28 vremenskih trenutaka (28 kvartala). Prilikom statističke analize računata su osnovne deskriptivne statistike za obe posmatrane promenljive (nominalni devizni kurs i stopa inflacije): prosek (Mean), standardna devijacija, minimum i maksimum. Izračunate su standardne devijacije za obe varijable posmatrajući samo zemlje i ne uzimajući u obzir vremenski period ("Between"), kao i standardne devijacije za 28 posmatranih vremenskih trenutaka, ne uzimajući u obzir zemlje ("Within").

Tabela 4. Detaljnija deskriptivna statistika za promenljive stopu inflacije i nominalni devizni kurs

Variable		Mean	Std. Dev.	Min	Max	Observations
Stopa inflacije	Overall	1,582857	1,273472	-2,62	5,34	168
	Between		,2119819	1,278571	1,881786	6
	Within		1,258595	-2,663929	5,296071	28
Nominalni devizni kurs u EUR	Overall	,4519313	,4281965	,0027735	1,388889	168
	Between		,4655582	,0031389	1,197458	6
	Within		,0406237	,3533743	,6433621	28

Izvor: Proračun autora primenom alata STATA

Kada je u pitanju stopa inflacije, "between" standardna devijacija je manja od "within" standardne devijacije, što ukazuje na veću varijaciju stope inflacije tokom vremenskog perioda, nego među zemljama, dok je za promenljivu nominalni devizni kurs veća varijacija među zemljama nego tokom vremenskog perioda. U nastavku istraživanja, predmet analize je povezanost nominalnog deviznog kursa, kao nezavisne promenljive i stope inflacije kao zavisne promenljive analizom panel podataka. Ocena uticaja nezavisne promenljive na zavisnu promenljivu merena je primenom sledećih modela:

1. Model običnih najmanjih kvadrata (Ordinary Last Squares Model - OLS) – prikazan u Tabeli 5.
2. Model fiksnih efekata – prikazan u Tabeli 6.
3. Model slučajnih efekata – prikazan u Tabeli 7.

Prvi model panel podataka je model običnih najmanjih kvadrata. Model posmatra sve vrednosti varijabli, ali ne uzima u obzir različite zemlje.

Tabela 5. Model običnih najmanjih kvadrata

Source	SS	df	MS	Number of obs		168
Model	5,02994455	1	5,02994455	F (1,166)	3,14	
Residual	265,799284	166	1,60120051	Prob > F	0,0782	
Total	270,829229	167	1,62173191	R-squared	0,0186	
				Adj R-squared	0,0127	
				Root MSE	1,2654	
Stopa inflacije	Koeficijent	Standardna greška	t	P > t	95% Conf. Interval	
Nominalni devizni kurs	-,4053034	,2286765	-1,77	0,078	-,8567926	,461858
Konstanta	1,766026	,1421667	12,42	0,000	1,485339	2,046714

Izvor: Proračun autora primenom alata STATA

Dobijeni rezultati upućuju na koeficijent determinacije $R^2=0,0186$ – što ukazuje na slabu objašnjenost varijacija stope inflacije kretanjem nominalnog deviznog kursa – samo 1,86%. Rezultati F testa $F(1,166)=3,14$; $p>0,05$ pokazuju da OLS model nije dobar. Rezidualna standardna greška (1,2654) prikazuje koliko u proseku odstupaju stvarne vrednosti stope inflacije od prave regresione linije. Na osnovu prikazanih podataka dobija se model:

$$\text{Stopa inflacije} = 1,766026 - 0,4053034 * \text{Nominalni devizni kurs}$$

Model ukazuje na obrnutu proporcionalnost stope inflacije i nominalnog deviznog kursa i da rast nominalnog deviznog kursa za jednu jedinicu, dovodi do smanjenja stope inflacije za 0,4053034 jedinica. Kako OLS model ne uzima u obzir različite zemlje, potrebno je utvrditi i model fiksnih i slučajnih efekata i odabrati najbolji model od navedena tri.

Tabela 6. Model fiksnih efekata

R-sq		Within	0,0628	Number of Obs		168	
				Number of groups		6	
Between		0,5526	Obs per group:		Min	28	
					Avg	28	
Overall		0,0186			Max	28	
			F (1,161)		10,79		
Corr(u_i, Xb)			-0,9947	Prob > F		0,0013	
Stopa inflacije	Koeficijent	Standardna greška	t	P > t	95% Conf. Interval		
Nominalni devizni kurs	-7,76397	2,363793	-3,28	0,001	-12,43201	-3,095932	
Konstanta	5,091638	1,072554	4,75	0,000	2,97355	7,209726	
Sigma_u	3,4599099						
Sigma_e	1,2409306						
Rho	,88602458						
F (5,161)=2,32			Prob > F = 0,0455				

Izvor: Proračun autora primenom alata STATA

Dobijeni koeficijent determinacije R²=0,0186 ukazuje na niski procenat objašnjenosti varijacija stope inflacije kretanjem nominalnog deviznog kursa kao nezavisne promenljive. Model koji se dobija glasi:

Stopa inflacije = 5,091638 – 7,76397 * Nominalni devizni kurs

Model potvrđuje obrnutu proporcionalnost kretanja stope inflacije i nominalnog deviznog kursa i ukazuje da rast nominalnog deviznog kursa za jednu jedinicu vodi ka smanjenju stope inflacije za 7,76397 jedinica. Vrednost F testa F (1,161)=10,79 i dobijena vrednost p=0,0013, ukazuju da je model fiksni efekata dobar.

Tabela 7. Model slučajnih efekata

R-sq		Within	0,0628		Number of Obs		168
					Number of groups		6
Between		0,5526	Obs per group:		Min	28	
					Avg	28	
Overall		0,0186	Wald chi2 (1)		Max	28	
					3,14		
Corr(u_i, X)		0	Prob > chi2		0,0763		
Thea		0					
Stopa inflacije	Koeficijent	Standardna greška	z	P > z	95% Conf. Interval		
Nominalni devizni kurs	-,4053034	,2286765	-1,77	0,076	-,8535011	,0428943	
Konstanta	1,766026	,1421667	12,42	0,000	1,487385	2,044668	
Sigma_u	0						
Sigma_e	1,2409306						
Rho	0						

Izvor: Proračun autora primenom alata STATA

Model koji se dobija glasi:

Stopa inflacije = 1,766026 – 0,4053034 * Nominalni devizni kurs

i pokazuje obrnutu proporcionalnost između stope inflacije i nominalnog deviznog kursa, kao i da rast nominalnog deviznog kursa za jednu jedinicu vodi ka smanjenju inflacije za 0,4053034 jedinice. Dobijeni rezultati Wald testa Wald chi² (1) = 3,14; p=0,0763>0,05, dovode do zaključka da model slučajnih efekata nije dobar.

Nakon sprovođenja OLS modela, modela fiksni efekata i modela slučajnih efekata, potrebno je utvrditi koji je model najbolji, što se dobija sprovođenjem F-testa za model fiksni efekata i Breusch-Pagan LM testa za model slučajni efekata (prikazan u Tabeli 8). Vrednost F testa se očitava iz rezultata dobijenih u program STATA i iznosi F(5,161)=2,32, p = 0,0455 < 0,05 – što ukazuje na odbacivanje H₀.

Tabela 8. Breusch-Pagan test

Stopa inflacije	Var	Sd=sqrt (Var)
	1,621732	1,273472
e	1,539909	1,240931
u	0	0
Test: Var(u) = 0		
Chibar2 (01) = 0,00		
Prob > chibar2 = 1,0000		

Izvor: Proračun autora primenom alata STATA

Dobijeni rezultati prikazuju odbacivanje H₀ kod F-testa, dok to nije slučaj kod Breusch-Paganovog testa, te se zaključuje da je model fiksni efekata najpogodniji. Konačan model glasi:

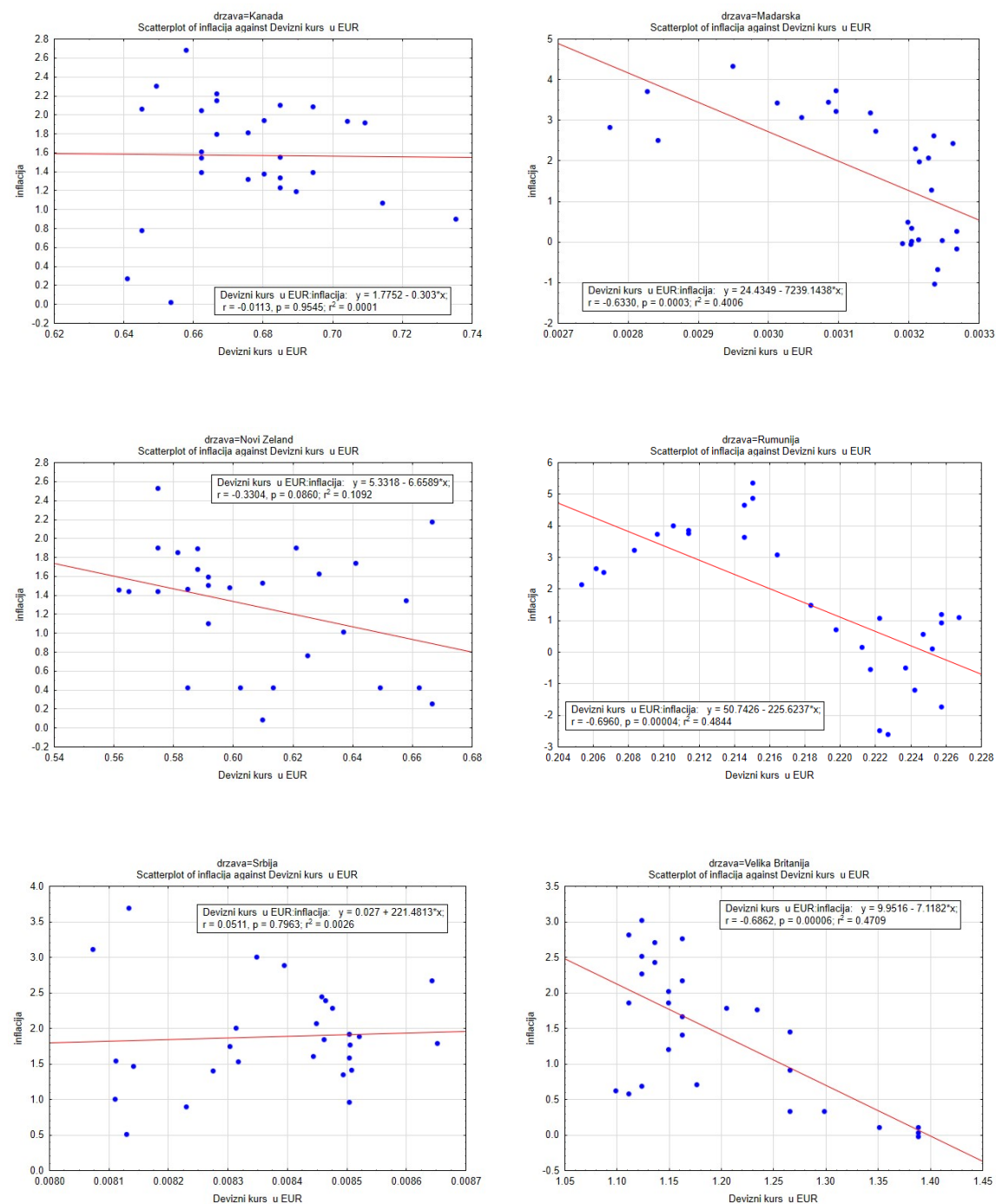
Stopa inflacije = 5,091638 – 7,76397 * Nominalni devizni kurs

Dobijeni rezultati istraživanja podudaraju se sa rezultatima istraživanja sprovedenog od strane Honoham & Lane (2004) – koji su utvrdili da je uticaj nominalnog deviznog kursa na kretanje stope inflacije u Evrozoni prisutan i u periodima apresijacije evra (2002-2003) i u periodima depresijacije u odnosu na američki dolar (1999-2001). Istraživanja sprovedena na azijskim državama takođe su u korelaciji sa dobijenim rezultatima: Monfared & Akin (2017) dokazali su na primeru Irana primenom VAR modela i analizom kvartalnih podataka (Q3 1997- Q4 2011) da rast ponude novca i promena realnog deviznog kursa utiču na rast stope inflacije, sa značajnijim uticajem ponude novca na promenu stope inflacije.

„Pass-through“ efekat: odabrane zemlje u regionu nasuprot odabranim razvijenim zemljama

Kako se u panel analizi posmatraju sve zemlje istovremeno i dobija se jedan model koji objašnjava sve promenljive za sve zemlje, radi detaljnije obrade podataka na nivou pojedinačnih zemalja prikazani su dijagrami rasipanja za sve posmatrane zemlje pojedinačno.

Slika 2. Dijagrami rasipanja nominalnog deviznog kursa u odnosu na inflaciju – pojedinačno prikazane zemlje



Izvor: Proračun autora primenom alata Statistica

Ukoliko se vrši poređenje smera kretanja proporcionalnosti između nominalnog deviznog kursa i stope inflacije, značajnih razlika između zemalja regiona i razvijenih zemalja nema – sa izuzetkom Srbije. Prisutna je obrnuta proporcionalnost - pad stope inflacije nakon nominalne apresijacije nacionalne valute u odnosu na evro.

Kao značajan faktor prilikom poređenja ove dve grupe zemalja javlja se koeficijent uz nezavisnu promenljivu nominalni devizni kurs. U razvijenim zemljama je vrednost ovog koeficijenta na znatno nižem nivou (-7,1182 ; -0,3030 ; -6,6589 za Veliku Britaniju, Kanadu i Novi Zeland respektivno) u odnosu na koeficijente koji stoje uz nominalni devizni kurs u zemljama u regionu (221,4813; -7239,1438; -225,6237 za Srbiju, Mađarsku i Rumuniju respektivno). Kako ovaj koeficijent ukazuje koliko se menja stopa inflacije nakon promene nominalnog deviznog kursa za jednu jedinicu, može se zaključiti da je u zemljama u regionu ovaj koeficijent mnogo viši, te je i uticaj nominalnog deviznog kursa na stopu inflacije viši. U Kanadi je koeficijent bliži nuli (-0,3030) što znači da je uticaj koji nominalni devizni kurs ima na stopu inflacije veoma mali.

Ukoliko Srbiju, Mađarsku i Rumuniju grupišemo i posmatramo kao zemlje u razvoju, sledeće pravilnosti se uočavaju u toku posmatranog perioda: dinar, forinta i lej su depresirali na kraju posmatranog perioda u odnosu na početak 2014. godine i inflacija je na kraju posmatranog perioda bila viša u Mađarskoj i Rumuniji u odnosu na početak perioda (u Srbiji je inflacija na nižem nivou krajem 2020. godine). Uočava se da je inflaciji potrebno oko godinu dana da počne da raste, nakon što nacionalna valuta nominalno depresira (Srbija: srpski dinar beleži najniže vrednosti od Q3 2015 – Q1 2017, a rast stope inflacije se primećuje u periodu Q3 2016 – Q2 2017; Mađarska: depresijacija forinte u periodu od Q3 2017 – Q4 2018, a rast inflacije Q2 2018 - Q3 2018; Rumunija: lej od Q3 2015 beleži konstantan pad vrednosti, a stopa inflacije raste u periodu Q3 2016 – Q2 2018).

U radu Siljković & Milanović (2015) sprovode analizu ERPT efekta na primeru Srbije, gde je depresijacija nominalnog deviznog kursa primećena od 2003. godine i glavni je uzročnik rasta stope inflacije od 2004. godine. Privatizacija sprovedena nakon 2005. godine vodi ka povećanju priliva stranog kapitala, što je iniciralo apresijaciju dinara, što je potom uticalo na smanjenje stope inflacije. Upravo su značajne oscilacije kursa dinara uticale na postavljanje targetirane stope inflacije kao osnovnog cilja monetarne politike. Podaci dobijeni na osnovu istraživanja Josifidis i saradnici (2009), ukazuju na veliki pass-through efekat deviznog kursa na inflaciju, bez obzira na vrstu deviznog kursa (period 01/2001 – 01/2003 - politika targetiranja deviznog kursa i njegova uloga kao nominalnog sidra; period 01/2003 - 09/2006 – „crawling peg“ režim deviznog kursa; period 09/2006 – danas – politika ciljane inflacije kao režim monetarne politike i rukovođeno fluktuirajućeg deviznog kursa kao komplementarnog režima deviznog kursa). Značajan uticaj deviznog kursa na stopu inflacije u Srbiji ne iznenađuje, uzimajući u obzir da smo mala otvorena ekonomija, sa velikom zavisnošću od uvoza i velikim trgovinskim deficitom (Vilaret & Palić, 2006).

Velika Britanija, Kanada i Novi Zeland čine grupu razvijenih zemalja čije sve nacionalne valute beleže nominalnu depresijaciju u odnosu na evro. Oscilacije nominalnih deviznih kurseva su bile niske, ali je zato stopa inflacije značajno oscilirala. Ne uočava se direktna korelacija između kretanja nominalnog deviznog kursa i stope inflacije, jer su vrednosti valuta bile relativno stabilne, što nije slučaj sa stopom inflacije.

Ovim se potvrđuje manji pass-through efekat nominalnog deviznog kursa na stopu inflacije u razvijenim zemljama u odnosu na nerazvijene zemlje, do kakvog se zaključka došlo i istraživanjem podataka prikupljenim iz 29 razvijenih zemalja i 26 zemalja u razvoju u periodu od 1970-2017. godine.

Potvrđena je teza da značajne depresijacije nacionalnih valuta veći uticaj imaju na stopu inflacije u zemljama u razvoju nego u razvijenim zemljama i da je u zemljama sa fleksibilnijim nominalnim deviznim kursovima i ciljanom inflacijom kao osnovnim targetom monetarnih vlasti manji „pass-through“ nominalnog deviznog kursa na inflaciju (Ha i saradnici, 2019). Smanjenje pass-through efekta je pozitivan indikator, jer utiče na smanjenje inflatornih pritisaka koji dolaze izvan okvira državnih granica (Edwards, 2006).

Zaključak

Rezultati istraživanja potvrđuju dosadašnje empirijske rezultate koji govore o obrnutoj proporcionalnosti između nominalnog deviznog kursa i stope inflacije, tj. da depresijacija nacionalne valute vodi ka rastu stope inflacije. Navedena teza je potvrđena u svim analiziranim zemljama osim u Srbiji, gde je prisutna direktna proporcionalnost.

Panel analizom se utvrđuje da je model fiksnih efekata najadekvatniji i dobijeni model (Stopa inflacije = 5,091638 – 7,76397 * Nominalni devizni kurs) govori o padu stope inflacije za 7,76397 jedinica prilikom apresijacije nominalnog deviznog kursa za jednu jedinicu.

Osim Srbije, nema razlika među zemljama regiona i razvijenih zemalja u pogledu obrnute proporcionalnosti nominalnog deviznog kursa i stope inflacije, ali se uočavaju viši koeficijenti uz nezavisnu promenljivu nominalni devizni kurs kod zemalja u regionu, što potvrđuje dosadašnje rezultate o većem pass-through efektu u zemljama u razvoju u odnosu na razvijene zemlje. Pravilnost koja je uočena kod zemalja u razvoju (da nominalna depresijacija nacionalne valute rezultira rastom stope inflacije nakon godinu dana – period od godinu dana je okvirnog karaktera) ne uočava se kod razvijenih zemalja, što takođe potvrđuje manji ERPT efekat u razvijenim zemljama.

Dobijeni rezultati istraživanja predstavljaju dobru osnovu za dalje istraživanje korišćenjem ekonometrijskih modela, koji bi obuhvatili širi vremenski period i veći broj zemalja kod kojih je osnovni cilj monetarnih vlasti targetirana stopa inflacije i gde je prisutan rukovođeno-fluktuirajući devizni kurs. Osim većeg obuhvata zemalja, kako zemalja u razvoju, tako i razvijenih zemalja, značajno bi bilo izvršiti analizu povratnog pass-through efekta koji realni efektivni devizni kurs ima na stopu inflacije

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ANALYSIS OF NOMINAL EXCHANGE RATE PASS-THROUGH EFFECT ON INFLATION RATE IN SELECTED COUNTRIES

Aleksandra Živković, PhD student, University of Novi Sad,
Faculty of Economics in Subotica
email: zivkovicc.aleksandra@gmail.com
Prof. Ivan Milenković, PhD, Faculty of Economics in Subotica,
University of Novi Sad, tenured professor
email : ivan.milenkovic@gmail.com

Summary

Inflation rate is one of the essential macroeconomics variables and it represents the main goal of monetary policy. It is determined by a great number of factors, so it is necessary to analyse the impact their changes have on inflation rate. The purpose of this research is the analysis of the nominal exchange rate pass-through effect on inflation rate in selected emerging and developed countries in the period 2014-2020, which share the same characteristics of inflation targeting, as main monetary policy regime, and managed floating exchange rate, as exchange rate type. Inverse proportion between volatility of nominal exchange rate and inflation rate is proven (depreciation of nominal exchange rate of national currency leads towards the growth of inflation rate), as well as higher pass-through effect in emerging countries compared to developed countries.

Keywords: exchange rate pass-through; exchange rate; inflation rate

JEL classification: E42, E52, E58, C33

Introduction

In order to implement adequate monetary policy, it is necessary to have accurate information about important macroeconomics aggregates, but also about the interdependence between them, in order to precisely determine the impact that change of one macroeconomics aggregate has on others, as well as on monetary and economic policy goals. Important variables in monetary policy are, firstly, the inflation rate, as well as exchange rate and their interdependence. The subject of this research is the pass-through effect of nominal exchange rate on inflation rate in Serbia, Hungary and Romania (emerging countries) and Great Britain, Canada and New Zealand (developed countries). Analysed period of nominal exchange rate and inflation rate is 2014-2020 and the acquired data is analysed on a quarterly level.

The aim of this research is to empirically confirm the inverse proportionality of changes of nominal exchange rate and inflation rate – to confirm that the nominal exchange rate depreciation of national currency leads to the inflation rate growth, as well as to prove the higher pass-through effect in emerging countries compared to developed countries.

The methodology of this research contains descriptive statistics of analysed data, creating panel data and establishing the corresponding panel model, determination of scatter plot of nominal exchange rate and inflation rate for each individual country, comparative analysis which enables to determine similarities and differences between pass-through effect of nominal exchange rate changes on inflation rate in emerging and developed countries. The analysis of panel data is performed by statistical software STATA, whereas for the creating of scatter plot software Statistica is used. Statistically significant values are considered when p-value < 0.05.

First part of the paper is a literature review, the second part presents empirical data about nominal exchange rate and inflation rate. The third part of the paper analyses the scatter plot of nominal exchange rate and inflation rate and includes the descriptive statistics (for variables inflation rate and nominal exchange rate), as well as results of panel analysis and selection of corresponding model. The last part of the research features a comparison of selected countries in our region (including Serbia) and developed countries.

Literature Review

Estimation of impact that economic shocks have on nominal exchange rates of foreign currencies and overflow of inflation on domestic market is known as “pass-through” effect. It is essential for monetary authorities, because it causes a rise in domestic prices. It can be defined as percentage change on inflation rate caused by 1% change of nominal exchange rate (Ristanović & Tasić, 2018). ERPT (Exchange rate pass-through) can vary between countries with different economic structure, regarding the openness of economics, importance of import etc. (Ortega & Osbat, 2020). Decrease of ERPT is connected with price stability, which is a product of credible monetary policy (Allem & Lahiani, 2014). According to IMF research, performed on all members in period 1960-1990, countries that have different regime of exchange rate have a different impact on inflation rate. If regimes of exchange rates are split in 3 groups: fixed, managed floating and floating regimes, countries with fixed exchange rate often have low inflation rate and less exchange rate variations (Ghosh & associates, 1997).

By analysing the effect of real exchange rate change on inflation rate in Asian countries (ASEAN + Japan, China, South Korea) in period 1991-2005 and comparing obtained results with results from European Union and North America, Achsani & associates (2010) came to the conclusion that in analysed Asian countries there is a strong correlation between exchange rate and inflation rate and that the depreciation of nominal (and real) exchange rate has an impact on inflation growth, whereas the correlation between exchange rate and inflation is negligible in EU and North America, but there is a significant impact of inflation rate on exchange rate.

In favour of decreasing pass-through effect after introduction of inflation targeting as main goal of monetary policy, there is an analysis conducted in 27 emerging countries, 15 of which have inflation targeting, and 12 do not, by using the VAR method. It has been determined that pass-through effect has decreased with three following indices: CPI (Consumer Price Index), PPI (Producer Price Index), IMP (Import Price Index) (Coulibaly & Kempf, 2010). Thesis that the ERPT is lower within floating exchange rate regimes was confirmed by Kara & Ogunc (2005), on the example of Turkish lira. Since the exchange rate is floating based on the supply and demand on the market, the ERPT effect has decreased.

The impact of nominal exchange rate change on inflation rate was analysed in selected African countries in period 1978-1989 – the analysed countries were: The Gambia, Ghana, Kenia, Nigeria, Sierra Leone, Somalia, Tanzania, Uganda, Kongo and Zambia. By using the bivariate (involving (1) monetary aggregate and consumer prices as variables or (2) exchange rate variable and consumer prices) and trivariate Granger causality tests (monetary aggregate, consumer prices and exchange rate as variables), high impact of exchange rate change on inflation rate was confirmed in Sierra Leone, Tanzania and Kongo, and same correlation was confirmed by bivariate test in Kenia and by trivariate test in The Gambia (Canetti & Greene, 1991). Imimole & Enoma (2011) have proven (by using the ADRL model in Nigeria) that depreciation of nominal exchange rate of Nigerian naira effects the rise of inflation rate by analysing data from 1986-2008. By using monthly data on the inflation rate and exchange rate of Nigerian naira in period January 2006 - December 2015 and the GARCH model (Generalised Auto Conditional Heteroscedastic model), negative correlation between volatility of exchange rate and inflation rate in short term is proven – increase of exchange rate for 1% leads to decrease of inflation rate for 0.003% (Osabuohien and associates, 2018).

Overview of Nominal Exchange Rates and Inflation Rates in Selected Countries

Countries that have adopted inflation targeting as a main goal of monetary policy, have recorded a decrease in the pass-through effect of nominal exchange rate on inflation rate (Edwards, 2006), and those countries are the subject of this research (countries that have inflation targeting as a monetary policy regime + managed floating exchange rate as an exchange rate regime). This research includes New Zealand and Canada, as first two countries that have adopted inflation targeting as main goal of monetary authorities, after whom other developed countries and emerging countries have adopted this monetary policy regime (Stevanović & Milenković, 2020).

For statistical processing of the data, all nominal exchange rates are expressed in euros (so all national currencies are expressed in same units). Data about quarterly value of euro expressed in Serbian Dinars was taken from the website of National Bank of Serbia, and data for all other currencies was

taken from the website of the European Central Bank. Table 1 features the nominal exchange rates for each of the national currencies, as well as percentage changes on quarterly basis. For each national currency, the value of nominal exchange rate is presented in column (1), whereas percentage changes are presented in column (2).

Table 1. Nominal Exchange Rates of Selected National Currencies in the Period Q1 2014 – Q4 2020

Quarter	Serbian dinar RSD/EUR		Hungarian forint HUF/EUR		Romanian leu RON/EUR		British pound GBP/EUR		Canadian dollar CAD/EUR		New Zealand dollar NZD/EUR	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Q1 2014	0.00864	/	0.00325	/	0.22222	/	1.20482	/	0.66225	/	0.60976	/
Q2 2014	0.00865	0.12	0.00327	0.62	0.22573	1.58	1.23457	2.47	0.66667	0.67	0.62893	3.14
Q3 2014	0.00852	-1.50	0.00320	-2.14	0.22676	0.46	1.26582	2.53	0.69444	4.17	0.63694	1.27
Q4 2014	0.00831	-2.46	0.00324	1.25	0.22573	-0.45	1.26582	0.00	0.70423	1.41	0.62500	-1.87
Q1 2015	0.00823	-0.96	0.00324	0.00	0.22472	-0.45	1.35135	6.76	0.71429	1.43	0.66667	6.67
Q2 2015	0.00830	0.85	0.00327	0.93	0.22523	0.23	1.38889	2.78	0.73529	2.94	0.66225	-0.66
Q3 2015	0.00832	0.24	0.00320	-2.14	0.22573	0.22	1.38889	0.00	0.68966	-6.21	0.58480	-11.69
Q4 2015	0.00828	-0.48	0.00320	0.00	0.22422	-0.67	1.38889	0.00	0.68493	-0.69	0.60976	4.27
Q1 2016	0.00814	-1.69	0.00320	0.00	0.22272	-0.67	1.29870	-6.49	0.66225	-3.31	0.60241	-1.21
Q2 2016	0.00813	-0.12	0.00319	-0.31	0.22222	-0.22	1.26582	-2.53	0.68493	3.42	0.61350	1.84
Q3 2016	0.00811	-0.25	0.00321	0.63	0.22371	0.67	1.17647	-7.06	0.68493	0.00	0.64935	5.84
Q4 2016	0.00811	0.00	0.00323	0.62	0.22173	-0.89	1.14943	-2.30	0.69444	1.39	0.65789	1.32
Q1 2017	0.00807	-0.49	0.00324	0.31	0.22124	-0.22	1.16279	1.16	0.70922	2.13	0.66667	1.33
Q2 2017	0.00813	0.74	0.00323	-0.31	0.21978	-0.66	1.16279	0.00	0.67568	-4.73	0.64103	-3.85
Q3 2017	0.00835	2.71	0.00326	0.93	0.21834	-0.66	1.11111	-4.44	0.68027	0.68	0.62112	-3.11
Q4 2017	0.00840	0.60	0.00321	-1.53	0.21645	-0.87	1.12360	1.12	0.66667	-2.00	0.59172	-4.73
Q1 2018	0.00844	0.48	0.00322	0.31	0.21459	-0.86	1.13636	1.14	0.64516	-3.23	0.59172	0.00
Q2 2018	0.00846	0.24	0.00315	-2.17	0.21505	0.21	1.13636	0.00	0.64935	0.65	0.59172	0.00
Q3 2018	0.00846	0.00	0.00309	-1.90	0.21505	0.00	1.12360	-1.12	0.65789	1.32	0.57471	-2.87
Q4 2018	0.00845	-0.12	0.00310	0.32	0.21459	-0.21	1.12360	0.00	0.66225	0.66	0.58824	2.35
Q1 2019	0.00846	0.12	0.00315	1.61	0.21142	-1.48	1.14943	2.30	0.66225	0.00	0.59880	1.80
Q2 2019	0.00848	0.24	0.00310	-1.59	0.21053	-0.42	1.14943	0.00	0.66667	0.67	0.58824	-1.76
Q3 2019	0.00849	0.12	0.00305	-1.61	0.21142	0.42	1.11111	-3.33	0.68027	2.04	0.58480	-0.58
Q4 2019	0.00851	0.24	0.00301	-1.31	0.20964	-0.84	1.16279	4.65	0.68493	0.69	0.58140	-0.58
Q1 2020	0.00851	0.00	0.00295	-1.99	0.20833	-0.62	1.16279	0.00	0.67568	-1.35	0.57471	-1.15
Q2 2020	0.00850	-0.12	0.00284	-3.73	0.20661	-0.83	1.12360	-3.37	0.65359	-3.27	0.56180	-2.25
Q3 2020	0.00850	0.00	0.00283	-0.35	0.20619	-0.20	1.09890	-2.20	0.64103	-1.92	0.56497	0.56
Q4 2020	0.00850	0.00	0.00277	-2.12	0.20534	-0.41	1.11111	1.11	0.64516	0.64	0.57471	1.72

Source: www.ecb.europa.eu

Based on Table 1 we can conclude that all selected national currencies have recorded nominal depreciation towards the euro in the analysed period. During the analysed period, there were oscillations in nominal exchange rates – highest oscillations are noted with Canadian and New Zealand dollar. Highest percentage depreciation towards the euro is marked with Hungarian forint, whereas lowest oscillations are noticed with British pound.

Quarterly data about the inflation rate for analysed countries are taken from BIS bank (Bank for International Settlements) and they are presented in Table 2.

Table 2. Inflation Rate in Selected Countries in the Period Q1 2014 – Q4 2020

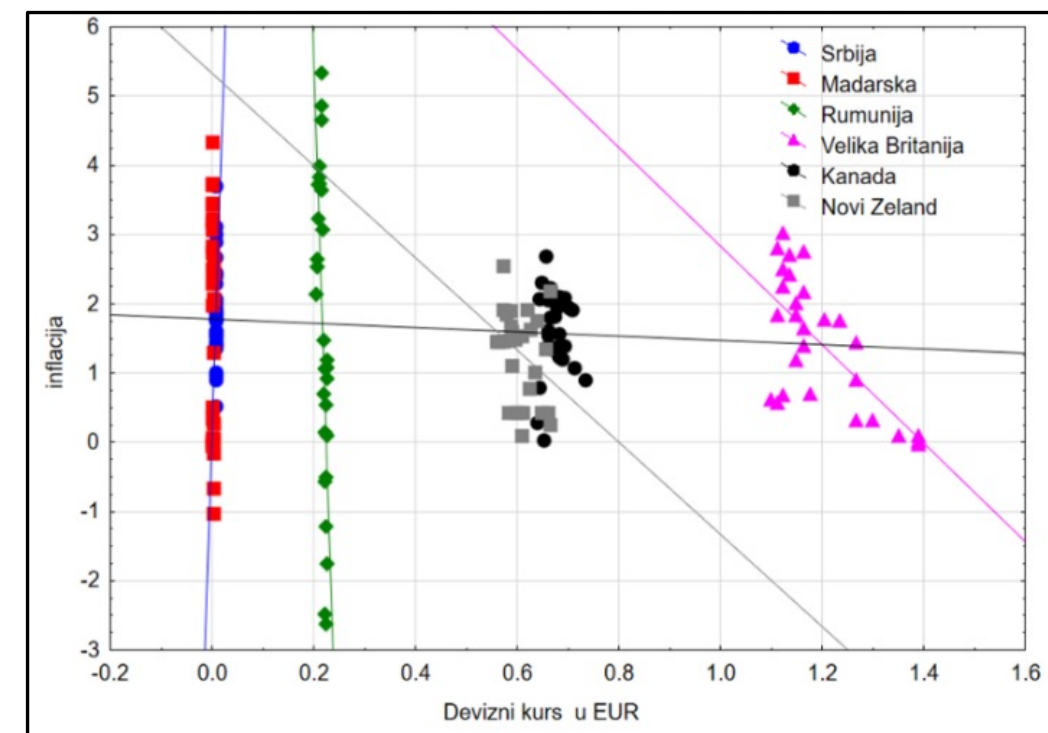
Quarter	Serbia	Hungary	Romania	Great Britain	Canada	New Zealand
Q1 2014	2.67	0.04	1.06	1.78	1.39	1.53
Q2 2014	1.79	-0.17	0.93	1.76	2.22	1.62
Q3 2014	1.88	-0.06	1.08	1.45	2.08	1.01
Q4 2014	2.00	-0.68	1.19	0.91	1.93	0.76
Q1 2015	0.89	-1.04	0.55	0.10	1.07	0.25
Q2 2015	1.74	0.26	0.10	-0.03	0.90	0.42
Q3 2015	1.53	0.01	-1.75	0.03	1.19	0.42
Q4 2015	1.40	0.49	-1.21	0.10	1.33	0.08
Q1 2016	1.46	0.33	-2.62	0.33	1.54	0.42
Q2 2016	0.51	-0.05	-2.48	0.33	1.55	0.42
Q3 2016	1.00	0.06	-0.50	0.70	1.23	0.42
Q4 2016	1.54	1.28	-0.56	1.20	1.39	1.34
Q1 2017	3.11	2.61	0.15	2.17	1.91	2.17
Q2 2017	3.69	2.06	0.71	2.76	1.32	1.74
Q3 2017	3.00	2.42	1.47	2.81	1.37	1.90
Q4 2017	2.88	2.29	3.08	3.02	1.79	1.59
Q1 2018	1.60	1.97	4.65	2.71	2.06	1.10
Q2 2018	1.84	2.73	5.34	2.42	2.30	1.50
Q3 2018	2.39	3.44	4.86	2.51	2.68	1.90
Q4 2018	2.07	3.22	3.64	2.26	2.04	1.89
Q1 2019	2.44	3.17	3.74	1.85	1.61	1.48
Q2 2019	2.28	3.73	4.00	2.02	2.15	1.67
Q3 2019	1.35	3.06	3.84	1.85	1.94	1.46
Q4 2019	1.41	3.42	3.73	1.40	2.10	1.85
Q1 2020	1.76	4.32	3.23	1.66	1.81	2.53
Q2 2020	0.96	2.49	2.53	0.68	0.02	1.45
Q3 2020	1.92	3.71	2.65	0.62	0.27	1.44
Q4 2020	1.58	2.82	2.14	0.58	0.78	1.44

Source: www.bis.org

Inflation rate movements in analysed countries have noted oscillations during the observed period, but a common trend of movement was recorded in all countries. From the beginning of the observed period until the first half of 2016, inflation rate has mostly negative trend (Romania had deflation for 6 quarters), after which inflation rate started to rise and this trend changed in 2020, when the corona virus pandemic started, which affected the decline in economic activity, which led to a inflation rate decrease.

“Pass-Through” Effect of the Nominal Exchange Rate on the Inflation Rate

The beginning of empirical analysis is presented by scatter plot of nominal exchange rate and inflation rate. For each individual country there is an equation that represents correlation between nominal exchange rate and inflation rate. Nominal exchange rate in euros is an independent variable, whereas the inflation rate is a dependent variable. What scatter plot is missing are different time periods, which will be included in the panel analysis.

Picture 1. Scatter Plot of the Nominal Exchange Rate and the Inflation Rate

Source: Authors' calculation by using the statistical software Statistica

Serbia:	$Y = 0.0270 + 221.4813 * X;$	$r = 0.0511;$	$p = 0.79630;$	$r^2 = 0.0026$
Hungary:	$Y = 24.4349 - 7239.1438 * X;$	$r = -0.6330;$	$p = 0.00030;$	$r^2 = 0.4006$
Romania:	$Y = 50.7426 - 225.6237 * X;$	$r = -0.6960;$	$p = 0.00004;$	$r^2 = 0.4844$
Great Britain:	$Y = 9.9516 - 7.1182 * X;$	$r = -0.6862;$	$p = 0.00006;$	$r^2 = 0.4709$
Canada:	$Y = 1.7752 - 0.3030 * X;$	$r = -0.0113;$	$p = 0.95450;$	$r^2 = 0.0001$
New Zealand:	$Y = 5.3318 - 6.6589 * X;$	$r = -0.3304;$	$p = 0.08600;$	$r^2 = 0.1092$

In all analysed countries except in Serbia, there is an inverse proportion between the movement of nominal exchange rate and inflation rate – when nominal exchange rate increases, inflation rate decreases. What should be taken into account is that all nominal exchange rates are nominated in euros, so when nominal exchange rates increase, this means the depreciation of the euro and the appreciation of the national currency. Appreciation of national currency leads to inflation rate decrease. In Serbia, there is direct proportionality, so when the exchange rate in euros increases (depreciation of the euro = appreciation of Serbian dinar), there will be a rise in inflation rate. Obtained results are not statistically significant for Serbia, Canada and New Zealand, and these countries have lowest coefficients of determination.

In order to establish the effect that volatility of nominal exchange rate has on inflation rate in selected countries, obtained quarterly data is processed in statistical software STATA. Countries are marked with numbers 1 to 6 (Serbia, Hungary, Romania, Great Britain, Canada and New Zealand respectively) and data is balanced (all countries have the same number of analysed data in the time series).

In Table 3 presents the basic descriptive statistics for both variables, not taking into account different countries.

Table 3. Basic Descriptive Statistics for Inflation Rate and Nominal Exchange Rate Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Country	168	3.5	1.712931	1	6
Period	168	14.5	8.101896	1	28
Inflation rate	168	1.582857	1.273472	-2.62	5.34
Nominal exchange rate (EUR)	168	.4519313	.4281965	.0027735	1.388889

Source: Authors' calculation by using statistical software STATA

Detailed descriptive statistics is presented in Table 4. Total number of analysed data is 168, and the analysis subjects are 6 countries and 28 time periods (28 quarters). During the statistical analysis, basic descriptive statistics were performed for both variables (nominal exchange rate and inflation rate): Mean, Standard Deviation, minimum and maximum. Standard deviations are calculated for both variables taking into account only countries and now the different period ("Between"), as well as standard deviations for 28 different time periods, and not taking into account the country ("Within").

Table 4. Detailed Descriptive Statistics for Inflation Rate and Nominal Exchange Rate Variables

Variable		Mean	Std. Dev.	Min	Max	Observations
Inflation rate	Overall	1.582857	1.273472	-2.62	5.34	168
	Between		.2119819	1.278571	1.881786	6
	Within		1.258595	-2.663929	5.296071	28
Nominal exchange rate (EUR)	Overall	.4519313	.4281965	.0027735	1.388889	168
	Between		.4655582	.0031389	1.197458	6
	Within		.0406237	.3533743	.6433621	28

Source: Authors' calculation by using statistical software STATA

When it comes to inflation rate, "between" standard deviation is lower than "within" standard deviation, which means that inflation rate has higher variations during the time period than between countries, whereas for variable nominal exchange rate variations are higher between countries than during the time period.

The following part of the research consists of analysis of corellation between nominal exchange rate, as independent variable, and inflation rate, as dependant variable, by using the panel data. To determine the impact independent variable has on the dependant variable, following models will be presented:

1. Ordinary Last Squares Model – OLS – presented in Table 5.
- 2.Fixed effects model –presented in Table 6.
- 3.Random effects model – presented in Table 7.

First model of panel data is the Ordinary Last Square Model. It analyses all values of variables, but it does not take into account different countries.

Table 5. Ordinary Last Squares Model

Source	SS	df	MS	Number of obs		
Model	5.02994455	1	5.02994455	F (1.166)	3.14	
Residual	265.799284	166	1.60120051	Prob> F	0.0782	
Total	270.829229	167	1.62173191	R-squared	0.0186	
				Adj R-squared	0.0127	
				Root MSE	1.2654	
Inflation rate	Coefficient	Standard deviation	t	P > t	95 % Conf. Interval	
Nominal exchange rate (EUR)	-.4053034	.2286765	-1.77	0.078	-.8567926	.461858
Constant	1.766026	.1421667	12.42	0.000	1.485339	2.046714

Source: Authors' calculation by using statistical software STATA

Obtained results show that the coefficient of determination is $R^2=0.0186$ – which means that differences of inflation rate are poorly explained by nominal exchange rate changes – only 1.86%. Results of F-test $F(1.166) = 3.14$; $p>0.05$ are showing that the OLS model is not adequate. The root-mean-square deviation (1.2654) shows the average deviation of real values of inflation rate from linear regression line. Obtained results created the following model:

$$\text{Inflation rate} = 1.766026 - 0.4053034 * \text{Nominal exchange rate}$$

This model indicates an inverse proportionality between inflation rate and nominal exchange rate, and that the increase of nominal exchange rate for one unit leads to the decrease of inflation rate for 0.4053034 units. Since the OLS model is not taking into account different countries, it is necessary to determine the fixed effects and random effects models and to choose the corresponding one.

Table 6. Fixed Effects Model

Source	SS	df	MS	Number of obs		168
Model	5.02994455	1	5.02994455	F (1.166)		3.14
Residual	265.799284	166	1.60120051	Prob> F		0.0782
Total	270.829229	167	1.62173191	R-squared		0.0186
				Adj R-squared		0.0127
				Root MSE		1.2654
Inflation rate	Coefficient	Standard deviation	t	P > t	95% Conf. Interval	
Nominal exchange rate (EUR)	-.4053034	.2286765	-1.77	0.078	-.8567926	.461858
Constant	1.766026	.1421667	12.42	0.000	1.485339	2.046714

Source: Authors' calculation by using statistical software STATA

Coefficient of determination $R^2=0.0186$ signifies the low percentage of inflation rate variations caused by nominal exchange rate change as independent variable. Following model is defined:

$$\text{Inflation rate} = 5.091638 - 7.76397 * \text{Nominal exchange rate}$$

This model confirms the inverse proportionality of inflation rate and nominal exchange rate changes, and it shows that the increase of nominal exchange rate by 1 unit leads to inflation rate decrease by 7.76397 units. Results of the F-test $F(1.161)=10.79$ and $p=0.0013$, confirm that the fixed effects model is corresponding.

Table 7. Random Effects Model

R-sq		Within	0.0628		Number of Obs		168	
					Number of groups		6	
Between			0.5526		Obs per group:	Min	28	
							Avg	28
							Max	28
Overall			0.0186		Wald chi2 (1)		3.14	
					Prob> chi2		0.0763	
Corr(u_i, X)		0						
Thea		0						
Inflation rate	Coefficient	Standard deviation	z	P > z	95% Conf. Interval			
Nominal exchange rate	-.4053034	.2286765	-1.77	0.076	-.8535011	.0428943		
Constant	1.766026	.1421667	12.42	0.000	1.487385	2.044668		
Sigma_u	0							
Sigma_e	1.2409306							
Rho	0							

Source: Authors' calculation by using statistical software STATA

Obtained results create the following model:

$$\text{Inflation rate} = 1.766026 - 0.4053034 * \text{Nominal exchange rate}$$

And it confirms the inverse proportionality between inflation rate and nominal exchange rate, as well as that the increase in nominal exchange rate by one unit leads to a decrease of inflation rate by 0.4053034 units. Results of Wald test $\text{Wald chi2 (1)} = 3.14$; $p=0.0763>0.05$, lead to the conclusion that the random effects model is not corresponding.

The following step after performing the OLS model, fixed and random effects model is to determine the corresponding model, which can be done by conducting the F-test for fixed effects model and the Breusch-Pagan LM test for random effects model (presented in Table 8). The results of the F-test can be found in the report from STATA and they are $F(5.161)=2.32$, $p = 0.0455 < 0.05$ – which points to the rejection of Hypothesis H_0 .

Table 8. Breusch-Pagan Test

Inflation rate	Var	Sd=sqrt (Var)
	1.621732	1.273472
e	1.539909	1.240931
u	0	0
Test: Var(u) = 0		
Chibar2 (01) = 0.00		
Prob>chibar2 = 1.0000		

Source: Authors' calculation by using statistical software STATA

Obtained results point to rejection of H_0 within the F-test, while this is not the case with the Breusch-Pagan test, so the conclusion is that the fixed effects model is the most corresponding model. The final model is:

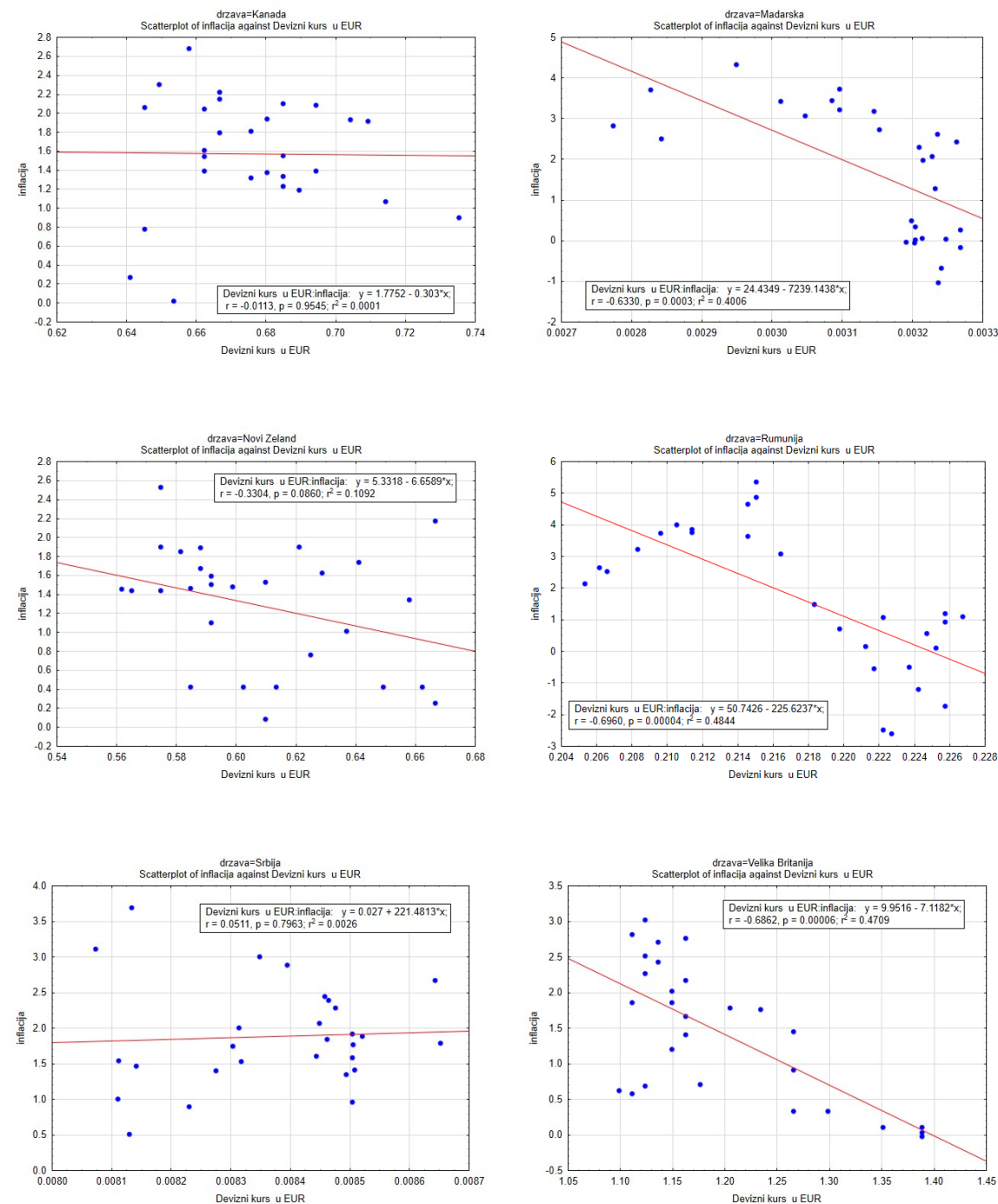
$$\text{Inflation rate} = 5.091638 - 7.76397 * \text{Nominal exchange rate}$$

These results are in correlation with results of Honoham & Lane (2004) research – which have determined that the nominal exchange rate impact on inflation rate in the Eurozone is present in periods of euro appreciation (2002-2003) and euro depreciation towards the American dollar (1999-2001). Research based on Asian countries also prove the results of this research: Monfared & Akin (2017) have proven on the example of Iran by using the VAR model and analysing quarterly data (Q3 1997- Q4 2011) that the growth of money supply and exchange rate change have impact on inflation rate growth, with more significant impact of money supply on inflation rate change.

“Pass-Through” Effect: Selected Countries in the Region Versus Selected Developed Countries

Since panel analysis is taking into account all selected countries at the same time, one model is obtained for all variables for all countries, in order to have more detailed data processing for each country, scatter plot is created for each country individually.

Picture 2. Scatter Plot of Nominal Exchange Rate and Inflation Rate – Presented by Each Country



Source: Authors' calculation by using statistical software Statistica

If we make a comparison of direction of proportionality between nominal exchange rate and inflation rate, there are no significant differences between countries from our region and developed countries – with the exception of Serbia. Inverse proportionality is observed – decrease of inflation rate follows the appreciation of national currency regarding the euro.

As factor of importance when comparing these two groups of countries, the coefficient next to the independent variable nominal exchange rate occurs. In developed countries the value of this coefficient is on a lower level (-7.1182 ; -0.3030 ; -6.6589 for Great Britain, Canada and New Zealand respectively) compared to coefficients next to the nominal exchange rate in countries in our region (221.4813; -7239.1438; -225.6237 for Serbia, Hungary and Romania respectively).

Since this coefficient signifies how much the inflation rate is changing after the nominal exchange rate changes by one unit, we can conclude that in countries in our region this coefficient is higher, so the pass-through effect of nominal exchange rate on inflation rate is higher. In Canada this coefficient is close to zero (-0.3030) which means that the effect of nominal exchange rate on inflation rate is weak.

If we group Serbia, Hungary and Romania and observe them as emerging countries, the following regularity can be noticed during the analysed period: dinar, forint and leu depreciated at the end of the analysed period compared to the beginning of 2014 and inflation rate was higher at the end of the analysed period compared to the beginning of analysed period in Hungary and Romania (in Serbia the inflation rate was lower at the end of 2020). It takes around one year for the inflation rate to start with the increase, after the national currency nominally depreciates (Serbia: Serbian dinar had lowest values in the period Q3 2015 – Q1 2017, and inflation rate can be noted in the period Q3 2016 – Q2 2017; Hungary: depreciation of Hungarian forint in the period Q3 2017 – Q4 2018, and inflation rate increased in the period Q2 2018 – Q3 2018; Romania: as of Q3 2015 leu is depreciating, and inflation rate was increasing in the period Q3 2016 – Q2 2018).

Siljković & Milanović (2015) have performed the ERPT effect analysis in Serbia, where there is depreciation of nominal exchange rate from 2003, which has led to the inflation rate increase as from 2004. Conducted privatisations after 2005 led to the increase of foreign capital inflow, which initiated appreciation of dinar, which led to the decrease of inflation rate. These significant oscillations in dinar exchange rate are exactly what influenced the setting of inflation targeting as main goal of monetary policy. Results from Josifidis and associates research (2009), point to high pass-through effect of exchange rate on inflation, regardless of the type of exchange rate regime (in the period 01/2001 – 01/2003 – monetary policy of exchange rate targeting and its role as nominal anchor; period 01/2003 – 09/2006 – “crawling peg” exchange rate regime; 09/2006 – until today – policy of inflation targeting as monetary policy regime and managed floating exchange rate as exchange rate regime). High impact of exchange rate on inflation rate in Serbia is not surprising, considering the fact that this is a small open country, with a high level of import dependence and high trade deficit (Vilaret & Palić, 2006).

Great Britain, Canada and New Zealand make the group of developed countries which national currencies noted nominal depreciation towards the euro. Oscillations of nominal exchange rates were low, but inflation rates oscillations were significant. Direct correlation between nominal exchange rate movement and inflation rate cannot be noticed, because values of currencies were relatively stable, which is not the case with the inflation rate.

This confirms a lower pass-through effect of nominal exchange rate on inflation rate in developed

countries compared to emerging countries, which was the conclusion obtained in research of 29 developed countries and 26 emerging countries in the period 1970-2017. The thesis that the significant depreciations of national currencies have higher impact on inflation rate in emerging countries than in developed countries is confirmed, and that countries with more flexible nominal exchange rate and inflation targeting as main goal of monetary policies have lower pass-through effect of nominal exchange rate on inflation rate (Ha & associates, 2019). Decreasing the pass-through effect is a positive indicator, because it leads to the lowering of inflation pressures that arise from outside of country's borders (Edwards, 2006).

Conclusion

Results of this research confirm so far the empirical results about inverse proportion between nominal exchange rate and inflation rate, meaning that the depreciation of national currency leads to an increase in the inflation rate. This thesis is confirmed in all analysed countries except in Serbia, where direct proportionality is present.

Panel analysis determines that the fixed effects model is the most corresponding model, and it signifies (Inflation rate = 5.091638 – 7.76397 * Nominal exchange rate) a decrease of inflation rate by 7.76397 units for of the nominal exchange rate appreciation by one unit.

Aside from Serbia, there are no differences between countries from our region and developed countries concerning inverse proportionality between nominal exchange rate and inflation rate, but higher coefficients next to the independent variable nominal exchange rate in countries in our region can be noticed, which confirms so far the results about the higher pass-through effect in emerging countries compared to developed countries. The regularity that has been observed with emerging countries (nominal exchange rate depreciation of national currency results with inflation rate growth after one year – period of one year roughly determined) is not present within developed countries, which confirms a lower ERPT effect in developed countries, as well.

Results obtained from this research are an adequate basis for further research by using econometric models, which would include longer time periods and a larger number of countries that share the same main goal of monetary policy – inflation targeting and managed floating exchange rate. Besides including a higher number of countries, emerging as well as developed, it would be significant to conduct the analysis of the pass-through effect that the real exchange rate has on the inflation rate.

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EFEKTI BANKARSKE REGULACIJE NA PERFORMANSE POSLOVANJA BANKARSKOG SEKTORA: EVIDENCIJA BANAKA ZEMALJA ZAPADNOG BALKANA

Prof. dr Almir Alihodžić Ekonomski fakultet u Zenici,
Univerzitet u Zenici, redovan profesor
email: almir.dr2@gmail.com

Rezime

Osnovni cilj ove kvantitativne studije je da ispita odnos između sledećih nezavisnih varijabli: stope adekvatnosti kapitala (CAR), likvidne aktive prema ukupnoj aktivi (LATA) i veličine banke (BS) i zavisnih varijabli: povrat na aktivu (ROA), indikator kreditnog boniteta (Zscore) i povrata na vlasničku glavnica (ROE) za odabrane zemlje banaka Zapadnog Balkana. Navedeni model procenjen je pomoću metodologije podataka panela zasnovane na pretpostavci fiksnog i slučajnog efekta kako je odlučeno u Hausmanovom testu. Rezultati su pokazali da promenljiva veličina banke (BS) pozitivno utiče na povrat na aktivu banaka zemalja Zapadnog Balkana, dok varijable likvidna aktiva prema ukupnoj aktivi (LATA) i stopa adekvatnosti kapitala (CAR) imaju negativan uticaj. Rezultati su takođe pokazali da promenljiva udeo likvidne aktive prema ukupnoj aktivi ima pozitivan uticaj na indikator kreditne sposobnosti banaka zemalja Zapadnog Balkana (ZScore). Treći rezultat je promenljiva povrat na vlasničku glavnica (ROE) i imala je najjači pozitivni uticaj sa nezavisnom promenljivom veličina banke.

Ključne reči: bankarska regulacija; supervizija; povrat na aktivu; povrat na vlasničku glavnica; Z-Score

JEL klasifikacija: G21, G28, C51

Uvod

Bankarsko poslovanje nije puka aktivnost za koje sve poslovne odluke treba predati vlasnicima ili upravi takvih kompanija. Priroda bankarstva i prateći rizici za operatore i celi sistem ekonomista zahtevaju određene stepene jedinstvene operativne prakse. Bankarska regulacija se može definisati kao okvir koji kontroliše stvaranje, rad i likvidaciju banaka u jednoj ekonomiji. Potreba za regulisanjem aktivnosti banaka postaje pitanje krajnje neophodno nakon globalnih trendova kolapsa, te loše uprave finansijskih institucija. Poslednjih godina bankarski sistem širom sveta bio je predmet žestokih kritika i nadzora. Globalna finansijska kriza nakon neuspeha velikih banaka poput braće Lehman i drugih istakla je važnost adekvatne regulacije i nadzora banaka. Odobrenje Bazelskog odbora za bankarsku regulativu za jačanje globalnih propisa o kapitalu i likvidnosti u cilju promovisanja bankarskog sektora od strane G20 pozitivan je signal u ovom pravcu (Klomp i De Haans, 2011).

Mnogi delimično veruju da je nedostatak regulacije i nadzornih struktura doveo svet na ivicu finansijskog kolapsa, dok na drugoj strani mnogi veruju da su godine prosperiteta koje je svet doživeo neposredno pre kolapsa u velikoj meri bile posledica delimične deregulacije, slobodno gotovo slobodno tržište u kontekstu finansijskog sektora. Barth i ostali (2012) tvrde da su slabi regulatorni i nadzorni okviri doprineli krizi i da bi se smanjili krizni uticaji neophodno je preduzeti mere poput jačanja podsticaja privatnog praćenja. I pored toga što se bankarska regulativa i nadzor prepisuju i restrukturiraju kao odgovor na globalnu finansijsku krizu, njihova primena zahteva složene korake u zavisnosti od nacionalne politike svake zemlje, što bi moglo imati različite efekte na preuzimanje rizika u bankama u zavisnosti od finansijskog i institucionalnog okruženja u kojem banke posluju (Bouheni, 2013).

Veći broj tržišta podleže određenom stepenu regulacije iz različitih razloga (Heffernan, 2005):

- Potrebno je zaštititi potrošača („neka se kupac čuva“) smatra se nedovoljnim stavljanjem prevelike odgovornosti na potrošača za mnoga dobra i usluge kojima nedostaje transparentnost.
- Da bi se proverila zloupotreba oligopolističke i monopolističke moći: postoji mnogo tržišta na kojima posluje samo jedna ili nekoliko preduzeća. Stepenn monopolske moći preduzeća utiče na cene njihovih proizvoda.
- Da zaštiti javnost od kriminalnih aktivnosti.
- Suočavanje sa efektima eksternalija: efekti delovanja jednog agenta u ekonomiji na druge, što se ne odražava kroz mehanizam cena.

Najosnovniji razlog za uvođenje bankarske regulacije je pre svega zaštita deponenata od neprimernog rizika za njihove depozite. Preduzeća i pojedinci drže značajan deo svojih sredstava u bankama, gde postoji osnovna zabrinutost zbog zaštite njihovih sredstava. Kao rezultat toga, bankarske agencije odgovaraju na takve zabrinutosti propisima kojima se nastoje zaštititi štediša banaka. Agencija za osiguranje depozita u Bosni i Hercegovini osigurava male deponente, odnosno klijente do 50.000 BAM od januara 2014. godine tako da nemaju brige oko kvaliteta i boniteta banke (Plakalović & Alihodžić, 2015).

Odabrane Balkanske ekonomije (kao što su ekonomije Srbije, Hrvatske i Bosne i Hercegovine) imale su veoma slične promene u ekonomskom i političkom sistemu što znači da su morale uspostaviti tržišnu ekonomiju iz početka sa povratom političke i državničke nezavisnosti (Kubiszewska, 2016). Jedan od

razloga zbog kojeg se istražuju ove zemlje je taj što ove zemlje imaju prilično sličnu modernu istoriju i iskustva u kontekstu sa bankarskim aplikacijama. Bankarski sektor u ovim zemljama karakteriše visok udeo stranih banaka, gde strane banke od 1990-tih igraju ulogu zemlje domaćina (Karkowska and Pawłowska, 2017). Bankarski sektor u zemljama Zapadnog Balkana doživio je značajne promene u kontekstu privatizacije, zakonodavnih, finansijskih i strukturnih reformi, kao i liberalizacije i priliva kapitala, što je dovelo do diversifikacije bankarskih proizvoda i usluga, povećanja kredibiliteta, te performansi bankarskog sektora (Onofrei i ostali, 2018).

Osnovni cilj ovog rada je da se istraži uticaj bankarske regulacije i supervizije na efikasnost poslovanja banaka u Srbiji, Hrvatskoj i Bosni i Hercegovini za period od 2010 do 2019. god. U radu ćemo koristiti tri indikatora u svojstvu zavisnih varijabli, i to povrat na aktivu (ROA), povrat na akcijski kapital (ROE) kao i indikator kreditnog skora (Z-score). Objašnjavajuće varijable u modelu uključuju performanse bankarskih varijabli i varijable finansijske strukture. Preostali dio istraživanja je organizovan na sledeći način: Deo 2 se sastoji iz pregleda literature, te dimenzija različitih studija koje se sprovode na temu bankarske regulacije i supervizije banaka. U delu 3 - metodološkom pristupu razmatra se uzorak, prikupljeni podaci i model istraživanja. Empirijski nalazi ove studije predstavljeni su u delu 4. Deo 5 sastoji se od zaključaka i preporuka.

Pregled relevantne literature i istraživačke hipoteze

Tradicionalni pristupi bankarskoj regulaciji ističu pozitivne karakteristike zahtjeva za adekvatnošću kapitala. Kapital služi kao zaštita od gubitaka, te konsekvantno tome i od neuspeha. Dalje uz ograničenu odgovornost, sklonost banaka da se bave rizičnim aktivnostima umanjena je sa većim iznosima rizičnog kapitala. Zahtjevi za adekvatnošću kapitala, posebno kod osiguranja depozita, igraju presudnu ulogu u usklađivanju podsticaja vlasnika banaka sa deponentima i drugim poveriocima (Berger i ostali, 1995).

Ekonomska teorija daje oprečna gledišta o potrebi i efektu propisa za ulazak banaka. Neki tvrde da efikasan pregled ulaska banaka može promovisati stabilnost. Drugi naglašavaju da banke sa monopolističkom moći imaju veću vrednost franšize što pojačava razborito ponašanje pri preuzimanju rizika (Keeley, 1990).

Kasimidou i ostali (2006) u svojoj studiji testirali su efikasnost banaka u Velikoj Britaniji koristeći veličinu banke kao ključni faktor. Takođe, su kategorizirali banke u dve vrste i to velike i male banke prema obimu aktive. Rezultati njihove studije zaključili su da su male banke pokazale veće performanse u poređenju sa velikim bankama. Dalje, dokazano je da veličina banke utiče na profitabilnost pored ostalih faktora kao što je likvidnost.

Uprkos teorijskim i empirijskim interesima koji se generišu već nekoliko decenija, i dalje postoji kontradikcija oko tačnog uticaja regulatornog kapitala na bankarske ishode. Na primjer, mnoge studije otkrivaju da veći ili strožiji kapitalni zahtevi smanjuju profitabilnost budućih zajmova, odnosno bankarsku efikasnost (Repullo i Suarez, 2008). Drugi autori smatraju da strožiji kapitalni zahtevi poboljšavaju troškovnu efikasnost i imaju značajan uticaj na efikasnost alokacije banaka (Fare i ostali, 2004).

Pasiouras i ostali (2009) su koristili model Stohastičke analize granica (SFA) kako bi pružili međunarodne dokaze o uticaju regulatornog i nadzornog okvira na efikasnost poslovanja banaka. Istražili su uticaj

propisa koji se odnose na tri stuba Bazela II (dakle, zahtev za adekvatnošću kapitala, supervizorsku moć i tržišnu disciplinu) na troškove i efikasnost banaka. Njihova otkrića sugerišu da strožiji kapitalni zahtevi poboljšavaju ekonomičnost, ali smanjuju profitnu efikasnost, dok ograničenja na bankarske aktivnosti imaju suprotan efekat, smanjuju troškovnu efikasnost, ali poboljšavaju profitnu efikasnost.

Berger i Bouwman (2011) istraživali su kako bankarski kapital utiče na opstanak, profitabilnost i tržišni udeo banaka tokom kriznih i normalnih vremenskih ciklusa koristeći regresiju logit panela. Rezultati studije pokazali su da veći kapital povećava opstanak, tržišne udele i profitabilnost banaka i u normalnim i u kriznim vremenima. Dati rezultati su postignuti u odvojenim regresijama panela. Važno je napomenuti da je ova studija prepoznala postojanje potencijalne endogenosti između profita i tržišnih udela, i to je rešeno korišćenjem njihovih zaostalnih vrednosti.

Goddard i ostali (2014) testirali su profitabilnost banaka kroz veličinu banke, rizik, diversifikaciju i vrstu vlasništva. Došli su do zaključka da je veza između veličine banke i profitabilnosti slaba, dok je sa druge strane korelacija između stope adekvatnosti kapitala i profitabilnosti bila pozitivna.

Tran i ostali (2016) istraživali su međusobnu vezu između regulatornog kapitala, formiranja likvidnosti i profitabilnosti u američkom bankarskom sektoru. Studija je pokazala da se regulatorni kapital pozitivno odnosi na stvaranje likvidnosti, te održavanje profitabilnosti banaka konstantnim u slučaju malih banaka u nekriznim periodima. Banke koje pokazuju visok rizik nelikvidnosti rezultiraju niskom profitabilnošću, gde je odnos između regulatornog kapitala i profitabilnosti banaka nelinearan i zavisi od nivoa kapitala.

Arıcan i ostali (2019) sproveli su analizu kointegracije u periodu između 2002. i 2016. godine u svom članku koji je ispitivao uticaj Bazelskih kriterijuma na profitabilnost banaka u Turskoj. Prema dobijenim rezultatima, zaključeno je da kreditni rizik, rizik likvidnosti i adekvatnost kapitala negativno utiču na profitabilnost banaka, odnosno na prinos na imovinu i prinos na kapital.

Kilci (2019) je ispitivao odnos između adekvatnosti kapitala i profitabilnosti u periodu između 1980. i 2017. godine, pomoću Fourierevog pristupa i prema dobijenim rezultatima utvrđena je kointegracija između odnosa kapitala/ukupne imovine, kapitala/(depoziti + nedepozitni resursi) i ROE i NFM varijabli izabranih kao promenljive profitabilnosti.

U cilju osiguranja efikasne transmisije jedinstvene monetarne politike, bolje diversifikacije rizika, kroz države članice i adekvatno finansiranje privrede Evropskoj monetarnoj uniji potrebna je Bankarska unija. S tim u vezi, kompletiranje i dalje jačanje Bankarske unije će uticati na jačanje finansijske stabilnosti u kontekstu vraćanja poverenja u bankarski sektor kroz arsenal mera čiji je cilj prevashodno smanjenje rizika (Ristić i Živković, 2020).

Na osnovu cilja postavljenog u uvodnom delu rada biće testirane sledeće hipoteze uz pomoć modela slučajnih i modela fiksnih efekata:

Prva hipoteza

H_0): Ne postoji signifikantni statistički uticaj sledećih varijabli (stope adekvatnosti kapitala - CAR, likvidne aktive prema ukupnoj aktivi - LATA i veličine banke - BS na povrat na aktivu pri nivou značajnosti $p \leq 0.05$). Prva hipoteza se sastoji iz sledećih pod-hipoteza:

$H_0/I-1$ - Ne postoji signifikantni statistički uticaj stope adekvatnosti kapitala na povrat na aktivu (ROA) pri nivou značajnosti $p \leq 0.05$.

$H_0/I-2$ - Ne postoji signifikantni statistički uticaj likvidne aktive prema ukupnoj aktivi na povrat na aktivu (ROA) pri nivou značajnosti $p \leq 0.05$.

$H_0/I-3$ - Ne postoji signifikantni statistički uticaj veličine banke na povrat na aktivu (ROA) pri nivou značajnosti $p \leq 0.05$.

Druga hipoteza

H_0/II): Ne postoji signifikantni statistički uticaj sledećih varijabli (stope adekvatnosti kapitala - CAR, likvidne aktive prema ukupnoj aktivi - LATA i veličine banke – BS na indikator kreditnog boniteta (Zscore) pri nivou značajnosti $p \leq 0.05$. Druga hipoteza se sastoji iz sledećih pod-hipoteza:

$H_0/II-1$ - Ne postoji signifikantni statistički uticaj stope adekvatnosti kapitala na indikator kreditnog boniteta (Zscore) pri nivou značajnosti $p \leq 0.05$.

$H_0/II-2$ - Ne postoji signifikantni statistički uticaj likvidne aktive prema ukupnoj aktivi na indikator kreditnog boniteta (Zscore) pri nivou značajnosti $p \leq 0.05$.

$H_0/II-3$ - Ne postoji signifikantni statistički uticaj veličine banke na indikator kreditnog boniteta (Zscore) pri nivou značajnosti $p \leq 0.05$.

Treća hipoteza

H_0/III): Ne postoji signifikantni statistički uticaj sledećih varijabli (stope adekvatnosti kapitala - CAR, likvidne aktive prema ukupnoj aktivi - LATA i veličine banke – BS na povrat na vlasničku glavnicu (ROE) pri nivou značajnosti $p \leq 0.05$. Treća hipoteza se sastoji iz sledećih pod-hipoteza:

$H_0/III-1$ - Ne postoji signifikantni statistički uticaj stope adekvatnosti kapitala na povrat na vlasničku glavnicu (ROE) pri nivou značajnosti $p \leq 0.05$.

$H_0/III-2$ - Ne postoji signifikantni statistički uticaj likvidne aktive prema ukupnoj aktivi na povrat na vlasničku glavnicu (ROE) pri nivou značajnosti $p \leq 0.05$.

$H_0/III-3$ - Ne postoji signifikantni statistički uticaj veličine banke na povrat na vlasničku glavnicu (ROE) pri nivou značajnosti $p \leq 0.05$.

Bankarski sektor zemalja Zapadnog Balkana u svetlu analize indikatora regulatornog poslovanja

Finansijski model u zemljama Zapadnog Balkana je banko-centričan i karakteriše ga vrlo visok nivo konkurencije. Posmatrano sa druge strane, osim konkurencije u bankarskom sistemu posmatranih zemalja izražena je i umerena koncentracija. Tabela 1. prikazuje linearni trend kretanja pokazatelja stope adekvatnosti kapitala odabranih zemalja Zapadnog Balkana (Srbija, Hrvatska i Bosna i Hercegovina) za period: 2010:Q4 – 2020:Q4.

Tabela 1: Tendencija kretanja stope adekvatnosti kapitala (CAR) Srbije, Hrvatske i Bosne i Hercegovine za period:2010:Q4 -2020:Q4 (u %)

	2010:Q4	2011:Q4	2012:Q4	2013:Q4	2014:Q4	2015:Q4	2016:Q4	2017:Q4	2018:Q4	2019:Q4	2020:Q4	Prosek
Srbija	19,9%	19,1%	19,87%	20,9%	19,96%	20,89%	21,83%	22,61%	22,26%	23,39%	22,40%	21,19%
Hrvatska	18,8%	20,5%	20,9%	20,9%	21,8%	21,0%	22,5%	23,2%	22,9%	23,2%	24,9%	21,87%
BiH	16,2%	17,1%	17,0%	17,8%	16,3%	14,9%	15,8%	15,7%	17,5%	18,0%	19,2%	16,86%

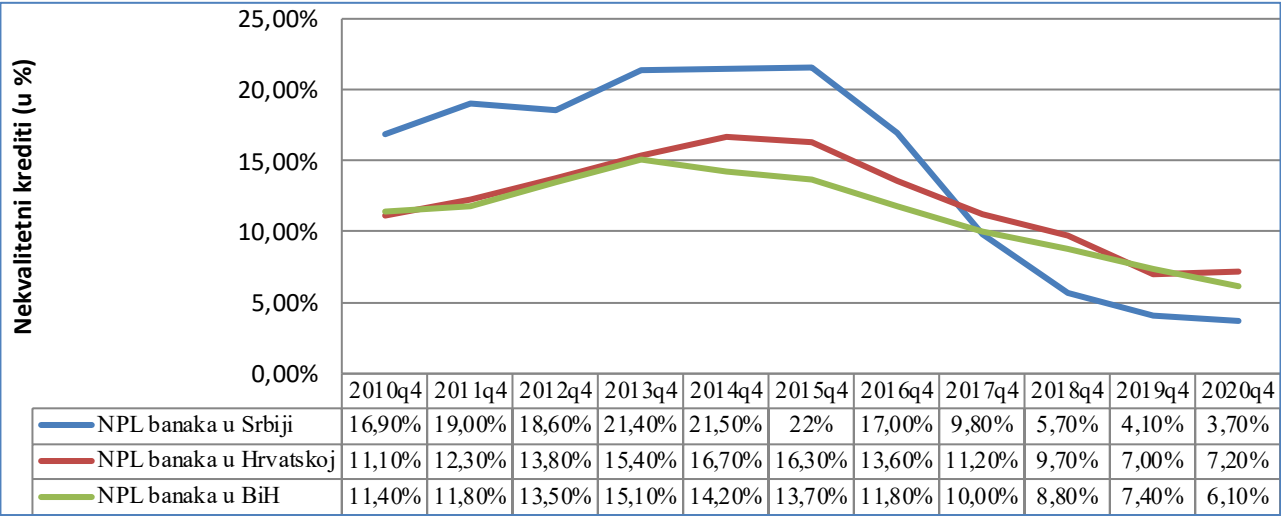
Izvor: <https://data.imf.org> i https://nbs.rs/sr_RS/drugi-nivo-navigacije/statistika/ (Prilagođeno od strane autora)

Najniža vrednost stope adekvatnosti kapitala za banke u Srbiji zabeležena je u četvrtom kvartalu 2011. godine (19.1%), dok je s druge strane najviša vrednost zabeležena u četvrtom kvartalu 2019. godine (23.39%) i prosečna vrednost od 21.19%. Najniža vrednost stope adekvatnosti kapitala za banke u Hrvatskoj zabeležena je u četvrtom kvartalu 2010. godine (18.8%), dok je s druge strane najviša vrednost zabeležena u četvrtom kvartalu 2020. godine (24.9%) i prosečna vrednost od 21.87%. Najniža vrednost stope adekvatnosti kapitala za banke u Bosni i Hercegovini zabeležena je u četvrtom kvartalu 2015. godine (14.9%), dok je s druge strane najviša vrednost zabeležena u četvrtom kvartalu 2020. godine (19.2%) i prosečna vrednost od 16.86%. Pokazatelj adekvatnosti kapitala za bankarski sektor odabranih zemalja Zapadnog Balkana (Srbija, Hrvatska, Bosna i Hercegovina) je daleko iznad regulatornog minimuma, kako prema domaćoj regulativi od 12%, tako i prema Bazelskim standardima od 8%. Dakle, banke u Srbiji, Hrvatskoj i Bosni i Hercegovini su adekvatno kapitalizirane i u kontekstu ostvarenog nivoa pokazatelja adekvatnosti kapitala, te i u pogledu strukture regulatornog kapitala. Stopa adekvatnosti kapitala je u određenim vremenskim intervalima imala blagu tendenciju smanjenja kao rezultat povećanja kreditnog rizika i rizične aktive. Održavanje zaštitnog praga kapitala iznad propisanog regulatornog minimuma povećava otpornost banaka na gubitke, te smanjuje prekomerne izloženosti i ograničava raspodelu kapitala u cilju ograničenja sistematskih rizika u finansijskom sistemu (Narodna banka Srbije, 2019).

Rezultati mrežne analize koji su sprovedeni s kraja 2019. godine ne ukazuju na veće pretnje po kapitalizovanost drugih banaka po osnovu međubankarske izloženosti. Dakle, ako se pođe od pretpostavke da zbog neizmirenja obaveza jedne banke druga banka bi eventualno imala gubitak u iznosu 100% svojih potraživanja prema nesolventnoj banci, ali u konačnici ni jednoj banci ne bi bila ugrožena adekvatnost kapitala. Isto tako, rezultati analize pokazuju da se adekvatnost kapitala ne bi ugrozila i pod pretpostavkom da pored kreditnog šoka egzistira i šok finansiranja. Ovo je sve rezultat visoke kapitaliziranosti svih banaka u sistemu na kraju 2019. godine (Centralna banka BiH, 2019).

Najniža stopa toksičnih kredita za banke u Srbiji zabeležena je u poslednjem kvartalu 2020. godine (3.70%), dok je s druge strane najveća vrednost ostvarena u četvrtom kvartalu 2014. godine od oko 21.50%, i prosečna vrednost od oko 14.48%. Banke u Hrvatskoj najnižu stopu nekvalitetnih kredita su ostvarile u četvrtom kvartalu 2019. godine od oko 7.0%, najveću stopu u četvrtom kvartalu 2014. godine od oko 16.70% i prosečnu stopu od oko 12.21%. Banke u Bosni i Hercegovini najnižu stopu nekvalitetnih kredita su ostvarile u četvrtom kvartalu 2020. godine od oko 6.10%, najvišu stopu u četvrtom kvartalu 2013. godine od oko 15.10% i prosečnu stopu od oko 11.25%. Evidentno je da su banke u sve tri zemlje imale od 2016. godine opadajući trend u kretanju toksičnih kredita, i to posebno banke u Srbiji koje su zabeležile značajno smanjenje toksičnih kredita. U cilju sprečavanja nastanka novih problematičnih kredita Vlada Republike Srbije je u decembru 2018. godine, usvojila Program za rešavanje problematičnih kredita za period: 2018-2020. god. (Narodna banka Srbije, 2019). Osim

Grafik 1: Linearni trend kretanja nekvalitetnih kredita banaka u Srbiji, Hrvatskoj i Bosni i Hercegovini za period: 2010:q4 – 2020:q4 (u%)



Izvor: Proračun autora na osnovu podataka Međunarodnog monetarnog fonda, Narodne banke Srbije, Narodne banke Hrvatske i Centralne banke BiH

programa na pad nivoa toksičnih kredita kao esencijalni faktori uticali su pored otpisa nekvalitetnih kredita i ostalih mera monitoringa i rast kreditne aktivnosti.

Regresioni model

Da bi se procenio uticaj bankarskih, specifičnih, tržišnih i makroekonomskih varijabli na profitabilnost i kreditnu sposobnost banaka zemalja Zapadnog Balkana korišćen je sledeći opšti regresioni model:

$$Y_{it} = \alpha + \beta'X_{it} + \mu_{it} \tag{1}$$

gde je: Y_{it} – zavisna varijabla, α – predstavlja konstantu, odnosno srednju vrednost od Y , β – je a kx1 vektor parametra koji se procenjuju na objašnjavajućim promenljivama i μ je slučajna greška (Brooks, 2008). Uključivanjem svih nezavisnih i zavisnih promenljivih u jednačinu (1) model 1 se formuliše na sledeći način:

$$ROA_{i,t} = \alpha + \beta_{it}(CAR_{i,t} + LATA_{i,t} + AB_{i,t}) + \mu_{it} \tag{Model 1}$$

Uključivanjem druge zavisne (ZScore) i nezavisnih promenljivih u jednačinu 1 model 2 se formuliše na sledeći način:

$$ZScore_{i,t} = \alpha + \beta_{it}(CAR_{i,t} + LATA_{i,t} + AB_{i,t}) + \mu_{it} \tag{Model 2}$$

Na kraju, uključivanjem treće zavisne promenljive (ROE) i nezavisnih promenljivih u jednačinu 1, model 3 se formuliše na sledeći način:

$$ROE_{i,t} = \alpha + \beta_{it}(CAR_{i,t} + LATA_{i,t} + AB_{i,t}) + \mu_{it} \tag{Model 3}$$

Ukoliko je p - vrednost statistički značajna treba koristiti model fiksnog efekta. S druge strane, ako p – vrednost nije statistički značajna treba koristiti model slučajnog efekta. Test značajnosti je izveden za sve promenljive korišćenjem t – testa na nivou značajnosti od 95% (Chmelarova, 2007). Nulta i prva alternativna hipoteza će biti testirane uz pomoć Hausmanovog testa.

Tabela 2: Kratak opis zavisnih i nezavisnih varijabli u modelu

PROMENLJIVA	KRATKA DEFINICIJA	OČEKIVANI ZNAK
ROA	Odnos dobiti i ukupne aktive	
ZScore		
ROE	Ovaj odnos se dobija deljenjem neto dobiti banke sa kapitalom	
CAR	Predstavlja odnos između neto iznosa kapitala i aktive koja je izložena riziku.	+or-
LATA	Predstavlja odnos ukupno likvidne aktive prema ukupnoj aktivi	-
BS	Dobija se kao logaritam ukupnih sredstava banaka, odnosno kao proxy varijabla a u cilju bolje komparacije	+

Izvor: Kalkulacija autora

Povrat na aktivu (ROA) - smatra se najprikladnijom merom za procenu učinka poslovanja banke. ROA se dobija deljenjem prihoda banke pre kamata sa njenom imovinom. Dakle, ROA meri efikasnost menadžmenta u korišćenju resursa banke za ostvarivanje profita. Takođe, procenjuje efikasnost banke u korišćenju i stvarnih investicija za zarade od kamata i drugih naknada. Ova mera profitabilnosti banaka je posebno značajna kada se upoređuje operativna efikasnost banaka (Sinkey,1989).

Povrat na vlasničku glavicu (ROE) – izražava koliko banka zaradi po osnovu knjigovodstvene vrednosti svojih ulaganja. Ovaj odnos se dobija deljenjem neto dobiti banke sa kapitalom, koji odražava stvaranje prihoda, operativnu efikasnost, finansijsku polugu i poresko planiranje. Za neke banke ROE može biti visok jer banke nemaju odgovarajući odnos kapitala. Banke sa niskim povratom sredstava mogu povećati svoj povrat ulaganja, korišćenjem dodatne poluge, odnosno povećanjem odnosa imovine i kapitala (Koch & MacDonald, 2009).

ZScore - indeks predstavlja meru kreditnih performansi preduzeća. Razvijen od strane Edwarda Altmana koji je koristio višestruku diskriminacionu analizu za predviđanje bankrotstva. Kod Zscore modela ako je Z skor veći od 2,99 preduzeće ima dobre kreditne performanse i njegovo poslovanje je ocenjeno kao zdravo. S druge strane ako je Z skor manji od 1,81 preduzeće nema kreditne performanse i njegovo poslovanje je pred bankrotstvom. Korišćenjem ovog modela stečaj preduzeća za period od godinu dana moguće je predvideti sa verovatnoćom od 96%, dok za period od 5 godina stečaj je moguće predvideti sa verovatnoćom od 70% (Rodić i ostali, 2011).

Stopa adekvatnosti kapitala (CAR) – se utvrđuje na osnovu upoređivanja neto iznosa kapitala sa aktivom koja je izložena riziku. To se odnosi ne samo na aktivu bilansa banke već i na vanbilansne stavke banke. Dakle, stopa adekvatnosti kapitala se izračunava na osnovu stope neto kapitala (usklađeni kapital) čiji se iznos utvrđuje kao razlika između iznosa kapitala i odbitnih stavki (Plakalović i Alihodžić, 2015).

Likvidna aktiva prema ukupnoj aktivi (LATA) - odnosi se na udeo visoko likvidne imovine koju poseduju finansijske institucije kako bi se osigurala njihova stalna sposobnost da ispune kratkoročne obaveze. Ovaj odnos je u stvari generički stres test koji ima za cilj da predvidi šokove na celom tržištu i osigura da finansijska institucija poseduje odgovarajuće očuvanje kapitala, da bi otklonila bilo kakav kratkoročni poremećaj likvidnosti (www.investopedia.com).

Veličina banke (BS) - U literaturi se koriste različite metode za određivanje veličine preduzeća. Bateni i ostali (2014) su rasporedili logaritam knjigovodstvene vrednosti imovine da bi utvrdili veličinu banke. Mnogi drugi naučnici su koristili vrednost kapitalizacije ili tržišnu vrednost kapitala za određivanje veličine preduzeća, dok su drugi koristili veličinu filijala i kreditnog portfolija kao odrednice veličine banke (De Jonghe i ostali, 2015, Laeven i ostali, 2016). U ovom istraživanju je korišćen logaritam ukupnih sredstava kao proxy varijabla da bi se približio veličini drugih promenljivih u cilju lakšeg poređenja.

Rezultati

Pre testiranja postavljenih hipoteza rezultati korelacije i regresije prikazani su u tabelama 3 – 10. Ukupan broj observacija iznosi 530, što predstavlja jako reprezentativan uzorak kako u kontekstu bankarskog sektora izabranih zemalja Zapadnog Balkana, tako i u kontekstu vremenskog okvira.

Tabela 3: Korelaciona matrica (Pearson koeficijent korelacije) između zavisnih i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019.

		ROA	ZS	ROE	CAR	LATA	BS
ROA	Pearson Correlation	1,000	0,065	0,659	-0,320	-0,107	0,210
	Sig. (2-tailed)	-	0,137	0,000	0,000	0,013	0,000
	N	530	530	530	530	530	530
ZS	Pearson Correlation	0,065	1,000	0,074	0,010	0,398	-0,070
	Sig. (2-tailed)	0,137	-	0,091	0,822	0,000	0,105
	N	530	530	530	530	530	530
ROE	Pearson Correlation	0,659	0,074	1,000	-0,333	-0,114	0,235
	Sig. (2-tailed)	0,000	0,091	-	0,000	0,009	0,000
	N	530	530	530	530	530	530
CAR	Pearson Correlation	-0,320	0,010	-0,333	1,000	0,130	-0,214
	Sig. (2-tailed)	0,000	0,822	0,000	-	0,003	0,000
	N	530	530	530	530	530	530
LATA	Pearson Correlation	-0,107	0,398	-0,114	0,130	1,000	-0,079
	Sig. (2-tailed)	0,013	0,000	0,009	0,003	-	0,070
	N	530	530	530	530	530	530
BS	Pearson Correlation	0,210	-0,070	0,235	-0,214	-0,079	1,000
	Sig. (2-tailed)	0,000	0,105	0,000	0,000	0,070	-
	N	530	530	530	530	530	530

Izvor: kalkulacija autora

Snažna pozitivna korelacija između prve zavisne promenljive u modelu (ROA) zabeležena je sa nezavisnom promenljivom veličinom banke (0.210) pri signifikantnošću ($p < 0.05$). Najjača negativna korelacija zabeležena je između promenljive ROA i stope adekvatnosti kapitala (-0.320) pri signifikantnošću od $p < 5\%$, kao i odnosa likvidne aktive prema ukupnoj aktivi (-0.107) pri signifikantnošću od 0.01. Velike banke imaju tendenciju da održavaju visok nivo likvidnosti u odnosu na verovatnoću neuspeha ili nedostatka likvidnosti da bi prevazišle bilo kakve probleme nesolventnosti. Naprotiv, male banke teže da ulože sve raspoloživa likvidna sredstva u cilju povećanja prinosa.

Tabela 4: Sumarna korelaciona statistika između zavisne i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019.

Zavisne varijable	R	R ²	Prilagođen R ²	Standardna greška procene	Durbin - Watson
ROA	0,356	0,127	0,122	3,496	1,888
ROE	0,378	0,143	0,138	14,339	1,812
ZS	0,404	0,163	0,158	2,674	1,938

Izvor: kalkulacija autora

Prema Cohen-u (1988) dobijene vrednosti koeficijenata korelacije mogu se tumačiti na sledeći način:

- Kada je $r = 0,10$ do $0,29$ onda je korelacija mala.
- Kada je $r = 0,30$ do $0,49$ onda je korelacija srednja.
- Kada je $r = 0,50$ do $1,0$ onda je korelacija velika.

Ako su vrednosti Durbin-Watson statistike manje od 2 tada postoji pozitivna serijska korelacija. Dobijene vrednosti u pogledu Durbin-Watson korelacije su različite. Sve tri zavisne promenljive u modelu (ROA, ROE i Zscore) su imale vrednosti veće od 1 i manje od 2 što navodi na zaključak da je riječ o pozitivnoj serijskoj korelaciji. Ovo istraživanje usmereno je na analizu regulatornih i specifičnih varijabli na efikasnost i kreditnu sposobnost poslovanja banaka u regionu (Srbija, Bosna i Hercegovina i Hrvatska). Rezultati regresije za Model 1 predstavljeni su u tabelama 5 i 6.

Tabela 5: Regresioni model fiksnih efekata između zavisne (ROA) i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019. (Model 1)

Fiksni efekti (unutar) regresije				Broj opservacija = 530	
R ² : unutar = 0,1264				Broj grupa = 4	
između = 0,6749					
ukupno = 0,1266				Opservacije po grupi: min =132,5	
avg =132 max =134 F(7,523) =25,23 Prob > F = 0,000					
ROA (zavisna)	Koef.	St. greška	t	P>[t]	[95% Conf . Interval]
CAR	-0,07035	0,10592	-6,64	0,000	-0,09116 -0,04954
LATA	-0,02727	0,01819	-1,50	0,135	-0,06302 0,00847
BS	0,68735	0,19873	3,46	0,001	0,29695 1,07776
_cons	-1,62613	1,24382	-1,31	0,192	-4,06962 0,81736
sigma_u	0,214450				
sigma_e	3,50123				
rho	0,00373				

Izvor: Proračun autora

Ukupan broj opservacija je 530 što čini model jako reprezentativnim. Empirijska vrednost F – testa za 7 stepena slobode u numeraciji i 523 u apoenu iznosila je 25.23. Takođe, verovatnoća zasnovana na regresiji fiksnih efekata je 0.000 što objašnjava da je model veoma značajan. Testiranjem prve tri podhipoteze može se zaključiti da najjaču kauzalnost odnosno korelaciju sa stopom povrata na aktivu su zabeležile sledeće varijable: regulatorni kapital (0.000) i veličina banke (0.001) pri nivou značajnosti manjem od 0.05. Dobijeni rezultati dovode do zaključka da se odbacuje nulta hipoteza i prihvata alternativna hipoteza. Nezavisna varijabla udeo likvidne aktive prema ukupnoj aktivu nema signifikatni uticaj na povrat na aktivu kod banaka zemalja Zapadnog Balkana. Kod druge podhipoteze prihvata se nulta hipoteza i odbacuje alternativna hipoteza.

Tabela 6: Regresija slučajnih efekata (GLS) između zavisne i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019 (Model 1)

Nasumični efekti GLS regresije					Broj opservacija = 530	
R ² : unutar = 0.1264					Broj grupa = 4	
između =0.6936						
ukupno =0.1266					Opservacije po grupi: min = 132.5	
avg = 132						
max = 134						
Wald chi2 (3) =76.28						
Prob > chi2 = 0.000						
ROA (zavisna)	Koef.	St. greška	z	P>[z]	[95% Conf . Interval]	
CAR	-0,07066	0,10573	-6,68	0,000	-0,09139	-0,04994
LATA	-0,02626	0,01813	-1,45	0,148	-0,06181	0,00928
BS	0,69034	0,19840	3,48	0,000	0,30148	1,07920
_cons	-1,65277	1,241733	-1,33	0,183	-4,08653	0,78097
sigma_u	0					
sigma_e	3,501233					
rho	0					

Izvor: Proračun autora

Rezultati su pokazali da generalizovana regresija najmanjih kvadrata (GLS) na bolji način opisuje uticaj nezavisnih varijabli na povrat sredstava (ROA). Rezultati Hausmanovog testa pokazali su da je Pro>chi2 = 0.8948, odnosno model slučajnog efekta (GLS) daje veći značaj od regresije fiksnog efekta iz jednostavnog razloga što je vrednost Pro>chi2>0.00. Najjači pozitivni uticaj na zavisnu varijablu (ROA) je ostvarila nezavisna varijabla veličina banke – BS (0.690) pri signifikantnošću od 0.000, dok je sa druge strane najslabiji uticaj na zavisnu promenljivu ostvarila varijabla stopa adekvatnosti kapitala – CAR (-0.070) pri značajnošću od 0.000. U kontekstu testiranja prve tri podhipoteze dobijeni rezultati su isti kao i kod modela fiksnih efekata sa jedinom razlikom koja se ogleda u boljoj predikciji varijable veličine banke na povrat na aktivu. U literaturi mnogih istraživanja postoji tvrdnja da je profitabilnost banaka pozitivno povezana sa veličinom aktive banaka. Halkos i Salamouris (2004) istraživali su uticaj veličine banke na njenu efikasnost za grčke banke. Došli su do zaključka da što su veća bankarska sredstva, time je veća i efikasnost poslovanja banaka. Sa povećanjem bankarske aktive raste i učešće kako kreditnih plasmana, tako i hartija od vrednosti koji se mogu konvertovati u zarade što opet zavisi od efektivnosti i efikasnosti menadžmenta banaka.

Indikator Z-Score se široko koristi u empirijskoj bankarskoj literaturi da bi se odrazila verovatnoća bankarske nesolventnosti. Takođe, to je jedan od pokazatelja koje koristi Svetska banka u svojoj bazi podataka o globalnom finansijskom razvoju za merenje stabilnosti finansijskih institucija. Tradicionalni Z-Score zasnovan na povratu koji se trenutno koristi može biti dizajniran kao pokazatelj verovatnoće da kapital banke može biti smanjen ili uništen zbog ostvarenih gubitaka. Ukupan broj opservacija je 530 što čini model jako reprezentativnim. Empirijska vrednost F- testa za 7 stepena slobode u numeraciji i 523 u apoenu je 33.86. Verovatnoća zasnovana na regresiji fiksnih efekata je 0.00 što objašnjava da je model veoma značajan.

Tabela 7: Regresioni model fiksnih efekata između zavisne (ZScore) i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019. (Model 2)

Fiksni efekti (unutar) regresije				Broj opservacija = 530		
R ² : unutar =0,1626				Broj grupa =4		
između = 0,2521						
ukupno = 0,1630				Opservacije po grupi: min =132.5		
avg =132						
max =134						
F(7,523) = 33,86						
Prob > F = 0,000						
ZScore (zavisna)	Koef.	St. greška	t	P>[t]	[95% Conf . Interval]	
CAR	-0,01017	0,00808	-1,26	0,209	-0,02606	0,005707
LATA	0,13775	0,01388	9,92	0,000	0,11046	0,165039
BS	-0,18938	0,15170	-1,25	0,212	-0,48740	0,108636
_cons	0,73458	0,94947	0,77	0,439	-1,13067	2,599846
sigma_u	0,24729					
sigma_e	2,67269					
rho	0,00848					

Izvor: Proračun autora

Iz prethodne tabele je vidljivo da nezavisna varijabla koja značajno utiče na zavisnu varijablu je udeo likvidne aktive u ukupnoj aktivi ($p < 5\%$). Testiranjem druge tri podhipoteze može se zaključiti da najjaču kauzalnost odnosno korelaciju sa indikatorom kreditnog boniteta je zabeležila sledeća varijabla: udeo likvidne aktive prema ukupnoj aktivi pri nivou značajnosti manjem od 0.05. Dobijeni rezultat dovode do zaključka da se odbacuje nulta hipoteza i prihvata alternativna hipoteza. Nezavisne varijable stopa adekvatnosti kapitala i veličina banke nemaju signifikatni uticaj na indikator kreditnog boniteta banaka zemalja Zapadnog Balkana. Kod prve i treće podhipoteze prihvata se nulta hipoteza i odbacuje alternativna hipoteza. Sa povećanjem likvidne aktive prema ukupnoj aktivi za jednu jedinicu uz uslov da ostali faktori ostanu konstantni dovodi do povećanja ZScore indikatora za oko 0.137 jedinica. Dakle, sa povećanjem likvidne aktive banaka dolazi i po povećanja ZScore indikatora i kreditne sposobnosti banaka.

Posmatrano sa druge strane rizici ulaganja u realni sektor kod banaka zemalja Zapadnog Balkana u komparaciji sa iznosima novca bankarskih grupacija stvorili su neku vrstu cash drag-a, odnosno likvidnosti koja se kratkoročno i sigurno ne može plasirati da bi se pokrili troškovi. Kao rezultat date situacije banke su vraćale pozajmljena sredstva stranim kreditorima (Plakalović i Alihodžić, 2015). F statistika i Wald chi2 test su značajni na nivou značajnosti manjem od 5% za posmatrane skupove podataka, što ukazuje na to da predloženi model dobro odgovara podacima. Takođe, pokazuje da se 16.30% promjene u ZScore indikatoru odabranih banaka zemalja Zapadnog Balkana objašnjava nezavisnim varijablama koje se koriste u ovom modelu (Tabela 7).

Tabela 8: Regresija slučajnih efekata (GLS) između zavisne (ZScore) i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019. (Model 2)

Nasumični efekti GLS regresije	Broj opservacija = 530
R^2 : unutar = 0.1626	Broj grupa = 4
između = 0.2532	
ukupno = 0.1630	Opservacije po grupi: min = 132.5

avg = 132
max = 134
Wald chi2 (3) = 102.41
Prob > chi2 = 0.000

ZScore (zavisna)	Koef.	St. greška	z	P>[z]	[95% Conf . Interval]	
CAR	-0,01043	0,0080	-1,29	0,197	-0,02628	0,00541
LATA	0,13818	0,0138	9,96	0,000	0,11100	0,16536
BS	-0,18614	0,1517	-1,23	0,220	-0,48351	0,11123
_cons	0,71489	0,9496	0,75	0,452	-1,1463	2,57608
sigma_u	0					
sigma_e	2,67269					
rho	0					

Izvor: Proračun autora

Mere Z-scora zasnovane na povratu i regulatornom kapitalu mogu se povezati sa bezuslovnom verovatnoćom bankrota, odnosno veza između Z-scora i verovatnoće bankrota može biti uslovljena vidljivim karakteristikama banke (npr. veličina banke) te makroekonomskim okruženjem (smanjenje kapitala moglo bi predstavljati veći izazov za banku tokom perioda finansijske krize nego u toku uobičajenog vremena). U kontekstu testiranja hipoteza isti rezultati su zabeleženi kao i kod modela fiksnih efekata, gde od tri posmatrane nezavisne varijable najjaču signifikantnost je ostvarila varijabla udeo likvidne aktive prema ukupnoj aktivi.

Tabela 9: Regresioni model fiksnih efekata između zavisne (ROE) i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019. (Model 3)

Fiksni efekti (unutar) regresije	Broj opservacija = 530
R^2 : unutar = 0.1426	Broj grupa = 4
između = 0.9112	
ukupno = 0.1429	Obs per group: min = 132.5

avg = 132
max = 134
F(7,523) = 29.0
Prob > F = 0.000

ROE (zavisna)	Koef.	St. greška	t	P>[t]	[95% Conf . Interval]	
CAR	-0,3007	0,43427	-6,93	0,000	-0,38606	-0,215442
LATA	-0,1144	0,74600	-1,53	0,125	-0,26104	0,032068
BS	3,28539	0,81477	4,03	0,000	1,68475	4,886036
_cons	-5,06249	5,09957	-0,99	0,321	-15,0806	4,955659
sigma_u	0,97240					
sigma_e	14,3548					
rho	0,00456					

Izvor: Proračun autora

F statistika i Wald chi2 test su signifikantni na nivou od 5% za posmatrane skupine podataka, što pokazuje na to da predloženi model dobro odgovara podacima. Takođe, pokazuje da se 14.29% promena profitabilnosti svih banaka zemalja Zapadnog Balkana objašnjava varijablama koje se koriste u ovom modelu.

Testiranjem treće tri podhipoteze može se zaključiti da su najjaču kauzalnost, odnosno korelaciju sa indikatorom povrat na vlasničku glavnica zabeležile sledeće varijable: stopa adekvatnosti kapitala i veličina banke pri nivou značajnosti manjem od 0.05. Dobijeni rezultat dovodi do zaključka da se odbacuje nulta hipoteza i prihvata alternativna hipoteza. Nezavisna varijabla udeo likvidne aktive prema ukupnoj aktivi nema signifikatni uticaj na indikator povrata na vlasničku glavnica banaka zemalja Zapadnog Balkana. Kod druge podhipoteze prihvata se nulta hipoteza i odbacuje alternativna hipoteza.

Tabela 10: Regresija slučajnih efekata (GLS) između zavisne i nezavisnih varijabli banaka zemalja Zapadnog Balkana za period: 2010 – 2019. (Model 3)

Nasumični efekti GLS regresije					Broj opservacija = 530	
R²: unutar = 0.1426					Broj grupa = 4	
između =0.9117						
ukupno =0.1429					Opservacije po grupi: min = 132.5	
avg = 132						
max = 134						
Wald chi2 (3) =87,73						
Prob > chi2 = 0,000						
ROE (zavisna)	Koef,	St, greška	z	P>[z]	[95% Conf , Interval]	
CAR	-0,30125	0,43364	-6,95	0,000	-0,386248	-0,2162641
LATA	-0,11505	0,74375	-1,55	0,122	-0,260822	0,0307233
BS	3,30279	0,81368	4,06	0,000	1,708003	4,897584
_cons	-5,14001	5,09262	-1,01	0,313	-15,12149	4,841239
sigma_u	0					
sigma_e	14,354					
rho	0					

Izvor: Proračun autora

U kontekstu testiranja hipoteza isti rezultati su zabeleženi kao i kod modela fiksnih efekata, gde od tri posmatrane nezavisne varijable najjaču signifikantnost su ostvarile sledeće varijable: stopa adekvatnosti kapitala i veličina banke. Spathis i ostali (2002) su testirali finansijska tržišta kroz studiju sprovedenu za istraživanje grčkih banaka. Njihova studija se fokusirala na efekat veličine imovine banaka, gde je cilj studije bio da se istraži efikasnost velikih i malih grčkih banaka testiranjem pokazatelja ROE kao mere profitabilnosti i njen odnos sa nekim faktorima klasifikacije kao što su obim imovine, likvidnost i rizik. Podaci od 1990. do 1999. god., korišćeni su za otkrivanje faktora uspeha ovih banaka. Rezultati studije su pokazali da su velike banke efikasnije od malih banaka, da male banke karakteriše visok iznos kapitala, dok velike banke takođe karakteriše visok prinos aktive.

Zaključak

U ovom radu je testiran uticaj bankarske regulacije i supervizije na efikasnost poslovanja banaka u Srbiji, Hrvatskoj i Bosni i Hercegovini na uzorku od ukupno 53 banke i 530 opservacija tokom perioda: 2010 - 2019. godine. U istraživanju su korišćeni efekti nezavisnih promenljivih na zavisnu promenljivu korišćenjem objedinjenog OLS regresionog modela (FE), te regresionog modela slučajnih efekata GLS uz pomoć Hausmanovog testa. Najznačajniji uticaj preko OLS i GLS regresionog modela su imale sledeće varijable: veličina banke i stopa adekvatnosti kapitala. Snažni regulatorni zahtevi za kapitalom unapređuju razvoj banaka i povećavaju efikasnost banaka.

Dakle, nalazi ove studije indiciraju da su u okviru prve hipoteze potvrđene sledeće podhipoteze: prva i treća podhipoteza, odnosno najjači uticaj na povrat na aktivu su zabeležile sledeće nezavisne varijable: veličina banke sa pozitivnom korelacijom i stopa adekvatnosti kapitala sa

negativnom korelacijom. U okviru druge hipoteze potvrđene su sledeće podhipoteze: druga podhipoteza, a odbačene prva i treća podhipoteza. Najjači uticaj na indikator kreditnog boniteta je ostvarila varijabla udeo likvidne aktive prema ukupnoj aktivi. Sa povećavanjem likvidne aktive konsekvntno dolazi do povećanja vrednosti Z-Score indikatora i kreditne sposobnosti banaka.

U okviru treće hipoteze potvrđene su sledeće podhipoteze: prva i treća podhipoteza, a druga je odbačena. Najjači uticaj na povrat na vlasničku glavnici je ostvarila varijabla veličine banke zemalja Zapadnog Balkana. Dakle, sa povećanjem bankarske aktive povećava se i učešće, kako kreditnih plasmana, tako i hartija od vrednosti koji se mogu konvertovati u zarade što opet zavisi od efektivnosti i efikasnosti menadžmenta banaka.

Iako se bankarska regulacija i nadzor prepisuju i restrukturiraju kao odgovor na globalnu finansijsku krizu, njihova primena zahteva složene korake u zavisnosti od nacionalne politike svake zemlje, što bi moglo imati različite efekte na preuzimanje rizika u bankama, a sve u zavisnosti od finansijskog i institucionalnog okruženja u kojem banke posluju. Kontraverze o tačnom uticaju regulatornog kapitala na rezultate bankarskog poslovanja i dalje ostaju uprkos teoretskim i empirijskim interesima koje se stvaraju već nekoliko decenija. Mnoge empirijske studije koje povezuju ove promenljive su mešovitnog karaktera i još više su u sukobu nego u teoriji. Veći skup podataka o poslovanju banaka zemalja Zapadnog Balkana, kao i veći broj determinanti koje bi se uvrstile u model dali bi bolje razumevanje o uticaju bankarske regulacije i supervizije na samu efikasnost poslovanja banaka. Nova istraživanja autora o datoj problematici svakako se mogu proširiti u zavisnosti od izbora i uključivanja velikog broja nezavisnih varijabli. Dakle, upotreba odgovarajućih varijabli mogla bi pružiti osnovu za bolju analizu.

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Dodatak teksta

Dodatak 1: Rezultati dobijeni korišćenjem Hausman testa za prvu zavisnu varijablu (ROA) – Model 1

Variables	b(fixed)	B(random)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
CAR	-0.070349	-0.0706628	0.0003138	0.0006301
LATA	-0.027272	-0.0262629	-0.0010092	0.0014835
BS	0.6873564	0.6903442	-0.0029878	0.0114387

Izvor: Proračun autora

$$\chi^2(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 0.61$$

Prob>chi2 =0.8948

Dodatak 2: Rezultati dobijeni korišćenjem Hausman testa za prvu zavisnu varijablu (ZScore) – Model 2

Variables	b(fixed)	B(random)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
CAR	-0.0104348	-0.101768	-0.000258	0.0000689
LATA	0.1381819	0.137753	0.0004289	-
BS	-0.1861414	-0.1893839	0.0032425	0.0026254

Izvor: Proračun autora

$$\chi^2(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 4.51$$

Prob>chi2 =0.2117

Dodatak 3: Rezultati dobijeni korišćenjem Hausman testa za prvu zavisnu varijablu (ROA) – Model 3

Variables	b(fixed)	B(random)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
CAR	-0.3007562	-0.3012563	0.0005001	0.0023439
LATA	-0.1144843	-0.1150495	0.0005652	0.0057898
BS	3.285395	3.302793	-0.0173983	0.042234

Izvor: Proračun autora

$$\chi^2(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 0.30$$

Prob>chi2 =0.9600

EFFECTS OF BANKING REGULATION ON THE PERFORMANCE OF THE BANKING SECTOR: EVIDENCE OF BANKS IN THE WESTERN BALKANS

Prof. Almir Alihodžić Faculty of Economics in Zenica,
University of Zenica, tenured professor
email: almir.dr2@gmail.com

Summary

The main objective of this quantitative study is to examine the relationship between the following independent variables: capital adequacy ratio (CAR), liquid assets to total assets (LATA) and bank size (BS) and dependent variables: return on assets (ROA), credit worthiness indicator (Zscore) and return on equity (ROE) for selected Western Balkan bank countries. This model was estimated using a panel data methodology based on the assumption of a fixed and a random effect as decided in the Hausman test. The results showed that the variable size of the bank (BS) has a positive effect on the return on assets of banks in the Western Balkans, while the variable liquid assets to total assets (LATA) and capital adequacy ratio (CAR) have a negative impact. The results also showed that the variable share of liquid assets in total assets has a positive impact on the creditworthiness indicator of banks in the Western Balkans (ZScore). The third result is the variable return on equity (ROE) and it had the strongest positive impact with the independent variable size of the bank.

Keywords: banking regulation; supervision; return on assets; return on equity; Z-Score.

JEL classification: G21, G28, C51

Introduction

Banking is not a mere activity for which all business decisions should be handed over to the owners or management of such companies. The nature of banking and the accompanying risks for operators and the whole system of economists require certain degrees of uniform operational practice. Banking regulation can be defined as a framework that controls the creation, operation and liquidation of banks in an economy. The need to regulate the activities of the banks becomes an extremely necessary issue after the global trends of collapse and poor management of financial institutions. In recent years, the banking system around the world has been the subject of fierce criticism and supervision. The global financial crisis after the failure of large banks such as the Lehman brothers and others has highlighted the importance of adequate regulation and supervision of banks. The approval of the Basel Committee on Banking Regulation to strengthen global regulations on capital and liquidity in order to promote the banking sector by the G20 is a positive signal in this direction (Klomps and De Haans, 2011). Many partly believe that the lack of regulation and supervisory structures has brought the world to the brink of financial collapse, while many believe that the years of prosperity the world experienced just before the collapse were largely due to partial deregulation, a free almost free market in the financial sector context.

Barth et al (2012) argue that weak regulatory and supervisory frameworks have contributed to the crisis and to reduce crisis impacts it is necessary to take measures such as strengthening incentives for private monitoring. Although banking regulations and supervision are being rewritten and restructured in response to the global financial crisis, their implementation requires complex steps depending on the national policy of each country, which could have different effects on bank risk-taking depending on the financial and institutional environment in which banks operate (Bouheni, 2013).

A number of markets are subject to some degree of regulation for various reasons (Heffernan, 2005):

- The need to protect the consumer ("keep the customer safe") is considered insufficient to place too much responsibility on the consumer for many goods and services that lack transparency.
- To check the abuse of oligopolistic and monopolistic power: there are many markets in which only one or a few companies operate. The degree of monopoly power of companies affects the prices of their products.
- To protect the public from criminal activity.
- Dealing with the effects of externalities: the effects of the action of one agent in the economy on others, which is not reflected through the price mechanism.

The most basic reason for the introduction of banking regulation is primarily the protection of depositors from inappropriate risk for their deposits. Businesses and individuals hold a significant portion of their assets in banks, where there are fundamental concerns about the protection of their assets. As a result, banking agencies are responding to such concerns with regulations that seek to protect bank depositors. The Deposit Insurance Agency in Bosnia and Herzegovina has been insuring small depositors or clients up to BAM 50.000 since January 2014, they do not have to worry about the quality and the creditworthiness of the bank (Plakalović & Alihodžić, 2015).

Selected Balkan economies (such as the economies of Serbia, Croatia and Bosnia and Herzegovina) had very similar changes in the economic and political system, which means that they had to establish a market economy from the beginning with the return of political and state independence (Kubiszewska, 2016). One of the reasons these countries are being explored is that these countries have a fairly similar modern history and experience in terms of banking applications. The banking sector in these countries is characterized by a high share of foreign banks, where foreign banks have played the role of host country since the 1990s (Karkowska and Pawłowska, 2017). The banking sector in the Western Balkans has undergone significant changes in the context of privatization, legislative, financial and structural reforms, as well as liberalization and capital inflows, which has led to diversification of banking products and services, increased credibility and banking sector performance (Onofrei et al., 2018).

The main goal of this paper is to investigate the impact of banking regulation and supervision on the efficiency of banks in Serbia, Croatia and Bosnia and Herzegovina in the period from 2010 to 2019. In this paper, we will use three indicators as dependent variables, return on assets (ROA), return on equity (ROE) as well as the credit score indicator (Z-score). Explanatory variables in the model include the performance of banking variables and financial structure variables. The rest of the research is organized as follows: Part 2 consists of a review of the literature and the dimensions of various studies conducted on the topic of banking regulation and banking supervision. In part 3 - methodological approach, the sample, collected data and research model are considered. The empirical findings of this study are presented in Part 4. Part 5 consists of conclusions and recommendations.

Review of Relevant Literature and Research Hypotheses

Traditional approaches to banking regulation highlight the positive characteristics of capital adequacy requirements. Capital serves as protection against losses, and consequently against failure. Further, with limited liability, banks propensity to engage in risky activities is reduced with higher amounts of venture capital. Capital adequacy requirements, especially in deposit insurance, play a crucial role in aligning bank owner incentives with depositors and other creditors (Berger et al. 1995).

Economic theory provides conflicting views on the need and effect of bank entry regulations. Some argue that an effective bank entry review can promote stability. Others emphasize that banks with monopolistic power have a higher franchise value which reinforces prudent risk-taking behavior (Keeley, 1990).

Kasimidou et al. (2006) in their study tested the efficiency of banks in the UK using bank size as a key factor. Also, they categorized banks into two types, large and small banks according to the volume of assets. The results of their study concluded that small banks showed higher performance compared to large banks. Furthermore, it has been proven that the size of a bank affects profitability among other factors such as liquidity. Despite theoretical and empirical interests that have been generated for several decades, there is still controversy about the stagnant impact of regulatory capital on banking outcomes. For example, many studies reveal that higher or stricter capital requirements reduce the profitability of future loans, i.e., banking efficiency (Repullo and Suarez, 2008). Other authors believe that stricter capital requirements improve cost efficiency and have a significant impact on the efficiency of bank allocation (Fare et al. 2004).

Pasiouras et al. (2009) used the Stochastic Boundary Analysis (SFA) model to provide international

evidence on the impact of the regulatory and supervisory framework on bank performance. They investigated the impact of regulations relating to the three pillars of Basel II (i.e., capital adequacy requirements, supervisory power and market discipline) on the costs and efficiency of banks. Their findings suggest that tighter capital requirements improve efficiency but reduce profit efficiency, while restrictions on banking activities have the opposite effect, reducing cost efficiency but improving profit efficiency.

Berger and Bouwman (2011) investigated how bank capital affects the survival, profitability, and market share of banks during crisis and normal time cycles using logit panel regression. The results of the study showed that higher capital increases the survival, market shares and profitability of banks in both normal and crisis times. The given results were achieved in separate panel regressions. It is important to note that this study recognized the existence of potential endogeneity between profits and market shares, and this was resolved using their residual values.

Goddard et al. (2014) tested bank profitability through bank size, risk, diversification, and type of ownership. They concluded that the relationship between bank size and profitability was weak, while on the other hand the correlation between capital adequacy ratio and profitability was positive.

Tran et al. (2016) explored the relationship between regulatory capital, liquidity formation, and profitability in the U.S. banking sector. The study showed that regulatory capital has a positive effect on creating liquidity, and keeping banks profitability constant in the case of small banks in non-crisis periods. Banks that show a high illiquidity risk result in low profitability, where the relationship between regulatory capital and bank profitability is nonlinear and depends on the level of capital.

Arıcan et al. (2019) conducted a cointegration analysis between 2002 and 2016 in their article examining the effect of Basel criteria on banking profitability in Turkey. According to the findings obtained, they concluded that Credit Risk, Liquidity Risk and Capital Adequacy negatively affect banking profitability, namely Return on Assets and Return on Equity.

Kılıcı (2019) examined the relationship between Capital Adequacy and Profitability between 1980 and 2017 with the Fourier approach and according to the results obtained, cointegration was determined between the equity/total assets and equity/(deposit + non-deposit resources) ratios and the ROE and NFM variables selected as profitability variables has been done.

In order to ensure the efficient transmission of the single monetary policy, better risk diversification, through the member states and adequate financing of the economy, the European Monetary Union needs a Banking Union. In this regard, the completion and further strengthening of the Banking Union will affect the strengthening of financial stability in terms of restoring confidence in the banking sector through an arsenal of measures aimed primarily at reducing risk (Ristić and Živković, 2020).

Based on the goal set in the introductory part of the paper, the following hypotheses will be tested with the help of random and fixed effect models:

First hypothesis

H_{0/I}): There is no significant statistical impact of the factors (capital adequacy ratios - CAR, liquid assets to total assets - LATA and bank size - BS) on the return on assets at p≤0.05. The first hypothesis consists of the following sub-hypotheses:

H_{0/I-1}- There is no significant statistical impact of capital adequacy ratios on the return on assets (ROA) at p≤0.05.

H_{0/I-2}- There is no significant statistical impact of liquid assets to total assets on the return on assets (ROA) at p≤0.05.

H_{0/I-3}- There is no significant statistical impact of bank size on the return on assets (ROA) at p≤0.05.

Second hypothesis

H_{0/II}): There is no significant statistical impact of the factors (capital adequacy ratios - CAR, liquid assets to total assets - LATA and bank size - BS) on the credit worthiness indicator (Zscore) at p≤0.05. The second hypothesis consists of the following sub-hypotheses:

H_{0/II-1}- There is no significant statistical impact of capital adequacy ratios on the credit worthiness indicator (Zscore) at p≤0.05.

H_{0/II-2}- There is no significant statistical impact of liquid assets to total assets on the credit worthiness indicator (Zscore) at p≤0.05.

H_{0/II-3}- There is no significant statistical impact of bank size on the credit worthiness indicator (Zscore) at p≤0.05.

Third hypothesis

H_{0/III}): There is no significant statistical impact of the factors (capital adequacy ratios - CAR, liquid assets to total assets - LATA and bank size - BS) on the return on equity at p≤0.05. The third hypothesis consists of the following sub-hypotheses:

H_{0/III-1}- There is no significant statistical impact of capital adequacy ratios on the return on equity (ROE) at p≤0.05.

H_{0/III-2}- There is no significant statistical impact of liquid assets to total assets on the return on equity (ROE) at p≤0.05.

H_{0/III-3}- There is no significant statistical impact of bank size on the return on equity (ROE) at p≤0.05.

The Banking Sector of the Western Balkans in Light of the Analysis of Regulatory Business Indicators

The financial model in the Western Balkans is bank-centric and is characterized by a very high level of competition. Observed on the other hand, in addition to competition in the banking system of the observed countries, there is a moderate concentration. Table 1 shows the linear trend of the capital adequacy ratio of selected countries in the Western Balkans (Serbia, Croatia and Bosnia and Herzegovina) for the period: 2010: Q4 - 2020: Q4.

Table 1: Tendency of Capital Adequacy Ratio (CAR) of Serbia, Croatia and Bosnia and Herzegovina for the Period: 2010: Q4 -2020: Q4 (in%)

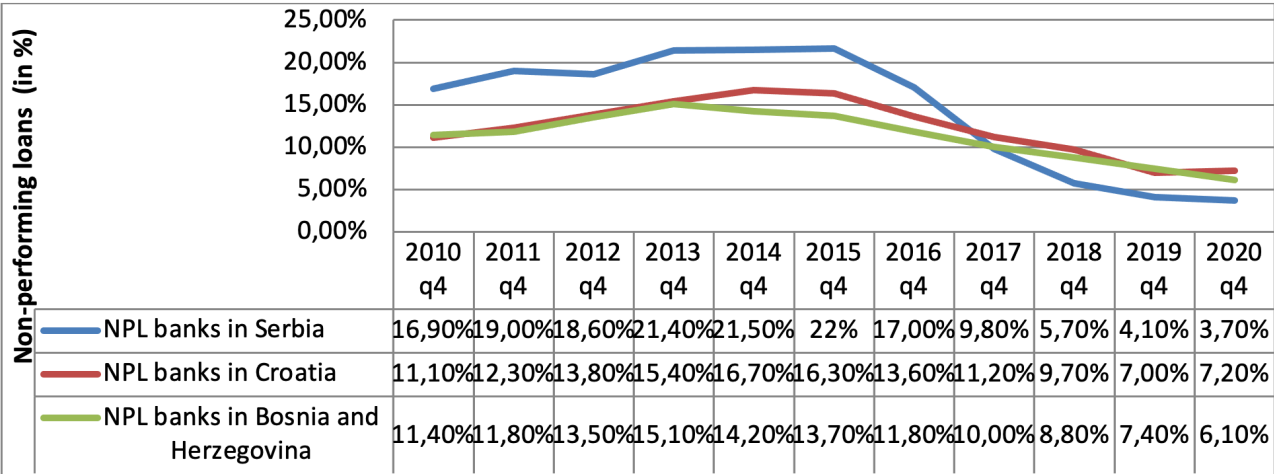
	2010:Q4	2011:Q4	2012:Q4	2013:Q4	2014:Q4	2015:Q4	2016:Q4	2017:Q4	2018:Q4	2019:Q4	2020:Q4	Average
Serbia	19.9%	19.1%	19.87%	20.9%	19.96%	20.89%	21.83%	22.61%	22.26%	23.39%	22.40%	21.19%
Croatia	18.8%	20.5%	20.9%	20.9%	21.8%	21.0%	22.5%	23.2%	22.9%	23.2%	24.9%	21.87%
Bosnia and Herzegovina	16.2%	17.1%	17.0%	17.8%	16.3%	14.9%	15.8%	15.7%	17.5%	18.0%	19.2%	16.86%

Source: <https://data.imf.org> and https://nbs.rs/sr_RS/drugi-nivo-navigacije/statistika/ (Adapted by the author)

The lowest value of the capital adequacy ratio for banks in Serbia was recorded in the fourth quarter of 2011 (19.1%), while on the other hand the highest value was recorded in the fourth quarter of 2019 (23.39%) and the average value of 21.19%. The lowest value of the capital adequacy ratio for banks in Croatia was recorded in the fourth quarter of 2010 (18.8%), while on the other hand the highest value was recorded in the fourth quarter of 2020 (24.9%) and the average value of 21.87%. The lowest value of the capital adequacy ratio for banks in Bosnia and Herzegovina was recorded in the fourth quarter of 2015 (14.9%), while on the other hand the highest value was recorded in the fourth quarter of 2020 (19.2%) with the average value of 16.86%. The capital adequacy ratio for the banking sector of selected Western Balkan countries (Serbia, Croatia, Bosnia and Herzegovina) is far above the regulatory minimum, both according to domestic regulations of 12% and according to Basel standards of 8%. Therefore, banks in Serbia, Croatia and Bosnia and Herzegovina are adequately capitalized both in terms of the achieved level of capital adequacy indicators, and in terms of the structure of regulatory capital. The capital adequacy ratio tended to decrease slightly at certain time intervals as a result of increased credit risk and risky assets. Maintaining the capital protection threshold above the prescribed regulatory minimum increases banks resilience to losses, reduces excessive exposures and limits the distribution of capital in order to limit systemic risks in the financial system (National Bank of Serbia, 2019).

The results of the network analysis conducted from the end of 2019 do not indicate greater threats to the capitalization of other banks based on interbank exposure. Therefore, if we start from the assumption that due to non-settlement of obligations of one bank, another bank would eventually have a loss in the amount of 100% of its claims against the insolvent bank, but ultimately no bank would have endangered capital adequacy. Also, the results of the analysis show that capital adequacy would not be jeopardized even under the assumption that in addition to the credit shock, there is also a financing shock. This is all the result of the high capitalization of all banks in the system at the end of 2019 (Central Bank of BH, 2019).

Graph 1: Linear Trend of Non-Performing Bank Loans in Serbia, Croatia and Bosnia and Herzegovina for the Period: 2010: q4 - 2020: q4 (in%)



Source: Calculation by the author based on data from the International Monetary Fund, the National Bank of Serbia, the National Bank of Croatia and the Central Bank of BH

The lowest rate of toxic loans for banks in Serbia was recorded in the last quarter of 2020 (3.70%), while on the other hand the highest value was achieved in the fourth quarter of 2014 of about 21.50%, with the average value of about 14.48%. Banks in Croatia achieved the lowest rate of non-performing loans in the fourth quarter of 2019 of about 7.0%, the highest rate in the fourth quarter of 2014 of about 16.70%, with the average rate of about 12.21%. Banks in Bosnia and Herzegovina achieved the lowest rate of non-performing loans in the fourth quarter of 2020 of about 6.10%, the highest rate in the fourth quarter of 2013 of about 15.10% and an average rate of about 11.25%. It is evident that banks in all three countries have had a declining trend in the movement of toxic loans since 2016, especially banks in Serbia, which recorded a significant decrease in toxic loans. In order to prevent the emergence of new problem loans, the Government of the Republic of Serbia in December 2018, adopted the Program for solving problem loans for the period: 2018-2020 (National Bank of Serbia, 2019). In addition to the program, the decline in the level of toxic loans as essential factors was influenced by the write-off of non-performing loans and other monitoring measures and the growth of lending activity

Regression Model

The following general regression model was used to assess the impact of banking, specific, market and macroeconomic variables on the profitability and creditworthiness of banks in the Western Balkans:

$$Y_{it} = \alpha + \beta'X_{it} + \mu_{it} \tag{1}$$

Where in: Y_{it} – dependent variable , α – represents a constant, i.e., the mean value of Y , β – is a $k \times 1$ vector parameters that are estimated on explanatory variables and μ is random error (Brooks, 2008). By including all independent and dependent variables in equation (1), model 1 is formulated as follows:

$$ROA_{i,t} = \alpha + \beta_{it}(CAR_{i,t} + LATA_{i,t} + AB_{i,t}) + \mu_{it} \tag{Model 1}$$

By including the second dependent (ZScore) and independent variables in equation 1, model 2 is formulated as follows:

$$ZScore_{i,t} = \alpha + \beta_{it}(CAR_{i,t} + LATA_{i,t} + AB_{i,t}) + \mu_{it} \tag{Model 2}$$

Finally, by including the third dependent variable (ROE) and independent variables in Equation 1, Model 3 is formulated as follows:

$$ROE_{i,t} = \alpha + \beta_{it}(CAR_{i,t} + LATA_{i,t} + AB_{i,t}) + \mu_{it} \tag{Model 3}$$

If the p - value is statistically significant, the fixed effect model should be used. On the other hand, if the p - value is not statistically significant, a random effect model should be used. The significance test was performed for all variables using the t - test at the significance level of 95% (Chmelarova, 2007). The null and the first alternative hypotheses will be tested using the Hausman test.

Data and Variables

The sample of this survey consists of 10 banks in Bosnia and Herzegovina, then 26 banks in Serbia and 17 banks in Croatia, which is a total sample of 53 banks. Data on banks were collected from the websites of the Banking Agency of the Federation of B&H, the Banking Agency of the Republika Srpska, the Central Bank of B&H, the Croatian National Bank and the National Bank of Serbia. This empirical research uses annual data for a selected (available) group of banks in Bosnia and Herzegovina, Serbia and Croatia. The following were used as dependent variables in this study: return on assets (ROA), return on equity (ROE) and creditworthiness index (ZScore). The following were used as independent variables in the model: capital adequacy ratio (CAR), share of liquid assets in total assets (LATA) and total bank assets (AB). The table shows the variables and the expected effects of the dependent and independent variables.

Table 2: A Brief Description of the Dependent and Independent Variables in the Model

VARIABLE	SHORT DEFINITION	EXPECTED SIGN
ROA	Profit to total assets	
ZScore	ZScore is a creditworthiness variable that describes the ratio of value to the mean value of a value group	
ROE	This ratio is obtained by dividing the net profit of the bank by the capital	
CAR	It represents the ratio between the net amount of capital and the assets that are exposed to risk.	+or-
LATA	It represents the ratio of total liquid assets to total assets	-
BS	It is obtained as the logarithm of total bank assets, i.e., as a proxy variable in order to better compare	+

Source: Calculation by the author

Return on assets (ROA) - is considered the most appropriate measure to assess the performance of the bank. ROA is obtained by sharing the banks income before interest with its assets. Therefore, ROA measures the efficiency of management in using the banks resources to make a profit. It also assesses the banks efficiency in using actual investments for interest and other fees. This measure of bank profitability is especially important when comparing the operational efficiency of banks (Sinkey, 1989).

Return on Equity (ROE) - expresses how much a bank earns based on book value of its investments. This ratio is obtained by dividing the banks net profit by capital, which reflects revenue generation, operational efficiency, leverage and tax planning. For some banks the ROE may be high because the banks do not have an adequate capital ratio. Banks with low returns can increase their return on investment, by using additional leverage, i.e., by increasing the ratio of assets and capital (Koch & MacDonald, 2009).

ZScore - index is a measure of a company credit performance. Developed by Edward Altman who used multiple discriminant analysis to predict bankruptcy. With the Zscore model, if the Z score is higher than 2.99, the company has good credit performance and its business is rated as healthy. On the other hand, if the Z score is less than 1.81, the company has no credit performance and its business is on the verge of bankruptcy. Using this model, the bankruptcy of a company for a period of one year can be predicted with a probability of 96%, while for a period of 5 years, bankruptcy can be predicted with a probability of 70% (Rodić et al. 2011).

Capital adequacy ratio (CAR) - is determined by comparing the net amount of capital with the asset that is exposed to risk. This applies not only to the banks’ balance sheet assets but also to the banks’ off-balance sheet items. Therefore, the capital adequacy ratio is calculated based on the net capital ratio (adjusted capital) whose amount is determined as the difference between the amount of capital and deductible items (Plakalović and Alihodžić, 2015).

Liquid assets to total assets (LATA) - refers to the share of highly liquid assets held by financial institutions to ensure their continued ability to meet short-term liabilities. This relationship is in fact a generic stress test that aims to predict shocks throughout the market and ensure that the financial institution possesses adequate capital preservation, in order to eliminate any short-term liquidity disruption (www.investopedia.com).

Bank size (BS) - Different methods are used in the literature to determine the size of a company. Bateni et al. (2014) distributed the logarithm of the book value of assets to determine the size of the bank. Many other scholars have used the value of capitalization or market value of capital to determine the size of a firm, while others have used the size of branches and loan portfolios as determinants of bank size (De Jonghe et al., 2015; Laeven et al., 2016). In this study, the logarithm of total assets was used as a proxy variable to approximate the size of other variables for ease of comparison.

Results

Before testing the hypotheses, the results of correlation and regression are shown in Tables 3-10. The total number of observations is 530, which is a very representative sample both in terms of the banking sector of selected Western Balkan countries and in the time frame.

Table 3: Correlation Matrix (Pearson coefficient of correlation) Between Dependent and Independent Variables of Western Balkan Banks for the Period: 2010 - 2019

		ROA	ZS	ROE	CAR	LATA	BS
ROA	Pearson Correlation	1.000	0.065	0.659	-0.320	-0.107	0.210
	Sig. (2-tailed)	-	0.137	0.000	0.000	0.013	0.000
	N	530	530	530	530	530	530
ZS	Pearson Correlation	0.065	1.000	0.074	0.010	0.398	-0.070
	Sig. (2-tailed)	0.137	-	0.091	0.822	0.000	0.105
	N	530	530	530	530	530	530
ROE	Pearson Correlation	0.659	0.074	1.000	-0.333	-0.114	0.235
	Sig. (2-tailed)	0.000	0.091	-	0.000	0.009	0.000
	N	530	530	530	530	530	530
CAR	Pearson Correlation	-0.320	0.010	-0.333	1.000	0.130	-0.214
	Sig. (2-tailed)	0.000	0.822	0.000	-	0.003	0.000
	N	530	530	530	530	530	530
LATA	Pearson Correlation	-0.107	0.398	-0.114	0.130	1.000	-0.079
	Sig. (2-tailed)	0.013	0.000	0.009	0.003	-	0.070
	N	530	530	530	530	530	530
BS	Pearson Correlation	0.210	-0.070	0.235	-0.214	-0.079	1.000
	Sig. (2-tailed)	0.000	0.105	0.000	0.000	0.070	-
	N	530	530	530	530	530	530

Source: Calculation by the author

A strong positive correlation between the first dependent variable in the model (ROA) was observed with the independent variable bank size (0.210) at significance (p <0.05). The strongest negative correlation was recorded between the variable ROA and the capital adequacy ratio (-0.320) at a significance of p<5%, as well as the ratio of liquid assets to total assets (-0.107) at a significance of 0.01. Large banks tend to maintain a high level of liquidity relative to the likelihood of failure or lack of liquidity to overcome any insolvency problems. On the contrary, small banks tend to invest all available liquid assets in order to increase yields.

Table 4: Summary Correlation Statistics Between Dependent and Independent Variables of Banks in the Western Balkans for the Period: 2010 – 2019

Dependent variables	R	R Square	Adjusted R Square	Std Error of the Estimate	Durbin - Watson
ROA	0.356	0.127	0.122	3.496	1.888
ROE	0.378	0.143	0.138	14.339	1.812
ZS	0.404	0.163	0.158	2.674	1.938

Source: Calculation by the author

According to Cohen (1988), the obtained values of coefficients of correlation can be interpreted as follows:

- When r = 0.10 to 0.29 then the correlation is small.
- When r = 0.30 to 0.49 then the correlation is medium.
- When r = 0.50 to 1.0 then the correlation is large.

If the Durbin-Watson statistics values are less than 2 then there is a positive serial correlation. The values obtained with respect to the Durbin-Watson correlation are different. All three dependent variables in the model (ROA, ROE and Zscore) had values greater than 1 and less than 2, which leads to the conclusion that this is a positive serial correlation. This research is focused on the analysis of regulatory and specific variables on the efficiency and creditworthiness of banks in the region (Serbia, Bosnia and Herzegovina and Croatia). The regression results for Model 1 are presented in Tables 5 and 6.

Table 5: Regression Model of Fixed Effects Between Dependent (ROA) and Independent Variables of Banks in the Western Balkans for the Period: 2010 - 2019 (Model 1)

Fixed-effects (within) regression					Number of obs	= 530
R-sq: within = 0.1264					Number of groups =4	
between = 0.6749						
overall = 0.1266					Obs per group: min =132.5	
avg =132						
max =134						
F(7,523) =25.23						
Prob > F = 0.000						
ROA (dependent)	Coef.	Std. Err.	t	P>[t]	[95% Conf . Interval]	
CAR	-0.07035	0.10592	-6.64	0.000	-0.09116	-0.04954
LATA	-0.02727	0.01819	-1.50	0.135	-0.06302	0.00847
BS	0.68735	0.19873	3.46	0.001	0.29695	1.07776
_cons	-1.62613	1.24382	-1.31	0.192	-4.06962	0.81736
sigma_u	0.214450					
sigma_e	3.50123					
rho	0.00373					

Source: Calculation by the author

The total number of observations is 530 which makes the model very representative. The empirical value of the F - test for 7 degrees of freedom in numerator and 523 in denominator was 25.23. Also, the probability based on the regression of fixed effects is 0.000, which explains that the model is very significant. By testing the first three sub-hypotheses, it can be concluded that the strongest causality or correlation with the rate of return on assets was recorded by the following variables: regulatory capital (0.000) and bank size (0.001) at p-value less than 0.05. The obtained results lead to the conclusion that the null hypothesis was rejected, and the alternative hypothesis was accepted. The independent variable share of liquid assets to total assets has no significant impact on the return on assets of banks in the Western Balkans. In the second sub-hypothesis, the null hypothesis was accepted, and the alternative hypothesis was rejected.

Table 6: Random Effect Regression (GLS) Between Dependent and Independent Variables of Western Balkan Banks for the Period: 2010 - 2019 (Model 1)

Random-effects GLS regression					Number of obs = 530	
R-sq: within = 0.1264					Number of groups = 4	
between =0.6936						
overall =0.1266					Obs per group: min = 132.5	
avg = 132						
max = 134						
Wald chi2 (3) =76.28						
Prob > chi2 = 0.000						
ROA (dependent)	Coef.	Std. Err.	z	P>[z]	[95% Conf . Interval]	
CAR	-0.07066	0.10573	-6.68	0.000	-0.09139	-0.04994
LATA	-0.02626	0.01813	-1.45	0.148	-0.06181	0.00928
BS	0.69034	0.19840	3.48	0.000	0.30148	1.07920
_cons	-1.65277	1.241733	-1.33	0.183	-4.08653	0.78097
sigma_u	0					
sigma_e	3.501233					
rho	0					

Source: Calculation by the author

The results showed that generalized least squares regression (GLS) better describes the impact of independent variables on return on assets (ROA). The results of the Hausman test showed that $Pro>chi2 = 0.8948$, i.e., the random effect model (GLS) gives greater significance than the regression of the fixed effect for the simple reason that the value of $Pro>chi2>0.00$. The strongest positive impact on the dependent variable (ROA) was achieved by the independent variable bank size - BS (0.690) at a significance of 0.000, while on the other hand the weakest impact on the dependent variable was achieved by the variable capital adequacy ratio - CAR (-0.070) at a significance of 0.000.

In terms of testing the first three sub-hypotheses, the obtained results are the same as in the model of fixed effects with the only difference being reflected in the better prediction of the variable bank size on return on assets. In the literature of many studies, there is a claim that the profitability of banks is positively related to the size of banks assets. Halkos and Salamouris (2004) investigated the impact of bank size on its efficiency for Greek banks. They came to the conclusion that the larger the bank assets, the higher the efficiency of banks operations. With the increase in banking assets the share of both credit placements and securities that can be converted into earnings is growing, which again depends on the effectiveness and efficiency of bank management.

The Z-Score indicator is widely used in the empirical banking literature to reflect the likelihood of banking insolvency. It is also one of the indicators used by the World Bank in its global financial development database to measure the stability of financial institutions.

The traditional Z-Score based on return currently in use can be designed as an indicator of the probability that a bank's capital may be reduced or destroyed due to realized losses. The total number of observations is 530 which makes the model very representative. The empirical value of the F-test for 7 degrees of freedom in numbering and 523 in denomination is 33.86. The probability based on the regression of fixed effects is 0.00, which explains that the model is very significant.

Table 7: Regression Model of Fixed Effects Between Dependent (ZScore) and Independent Variables of Banks in the Western Balkans for the Period: 2010 - 2019 (Model 2)

Fixed-effects (within) regression					Number of obs = 530	
R-sq: within =0.1626					Number of groups =4	
between = 0.2521						
overall = 0.1630					Obs per group: min =132.5	
avg =132						
max =134						
F(7,523) = 33.86						
Prob > F = 0.000						
ZScore (dependent)	Coef.	Std. Err.	t	P>[t]	[95% Conf . Interval]	
CAR	-0.01017	0.00808	-1.26	0.209	-0.02606	0.005707
LATA	0.13775	0.01388	9.92	0.000	0.11046	0.165039
BS	-0.18938	0.15170	-1.25	0.212	-0.48740	0.108636
_cons	0.73458	0.94947	0.77	0.439	-1.13067	2.599846
sigma_u	0.24729					
sigma_e	2.67269					
rho	0.00848					

Source: Calculation by the author

The previous table shows that the independent variable that significantly affects the dependent variable is the share of liquid assets in total assets (p<5%). By testing the other three sub-hypotheses, it can be concluded that the strongest causality or correlation with the creditworthiness indicator was recorded by the following variable: the share of liquid assets in total assets at p-value less than 0.05. The obtained result leads to the conclusion that the null hypothesis was rejected and the alternative hypothesis was accepted. Independent variables of capital adequacy ratios and bank size do not have a significant impact on the creditworthiness indicator of banks in the Western Balkans. In the first and third sub-hypotheses, the null hypothesis was accepted, and the alternative hypothesis was rejected. With the increase of liquid assets to total assets by one unit, provided that other factors remain constant, it leads to an increase in the ZScore indicator by about 0.137 units. Therefore, with the increase in liquid assets of banks comes an increase in ZScore indicators and creditworthiness of banks.

On the other hand, the risks of investing in the real sector with banks in the Western Balkans compared to the amounts of money of banking groups have created a kind of cash drag, i.e., liquidity that cannot be placed in the short term to cover costs. As a result of the given situation, banks returned borrowed funds to foreign creditors (Plakalović & Alihodžić, 2015). F statistics and Wald chi2 test are significant at a significance level of less than 5% for the observed data sets, indicating that the proposed model fits the data well. It also shows that 16.30% of the change in the ZScore indicator of selected banks in the Western Balkans is explained by the independent variables used in this model (Table 7).

Table 8: Random Effect Regression (GLS) Between Dependent (ZScore) and Independent Variables of Western Balkan Banks for the Period: 2010 - 2019 (Model 2)

Random-effects GLS regression					Number of obs = 530	
R-sq: within = 0.1626					Number of groups = 4	
between =0.2532						
overall =0.1630					Obs per group: min = 132.5	
avg = 132						
max = 134						
Wald chi2 (3) =102.41						
Prob > chi2 = 0.000						
ZScore (dependent)	Coef.	Std. Err.	z	P>[z]	[95% Conf . Interval]	
CAR	-0.01043	0.0080	-1.29	0.197	-0.02628	0.00541
LATA	0.13818	0.0138	9.96	0.000	0.11100	0.16536
BS	-0.18614	0.1517	-1.23	0.220	-0.48351	0.11123
_cons	0.71489	0.9496	0.75	0.452	-1.1463	2.57608
sigma_u	0					
sigma_e	2.67269					
rho	0					

Source: Calculation by the author

Z-score measures based on return and regulatory capital may be associated with an unconditional probability of bankruptcy, i.e., the link between Z-score and the probability of bankruptcy may be conditioned by the bank’s visible characteristics (e.g. size of the bank) and macroeconomic environment (a reduction in capital could pose a greater challenge for a bank during a period of financial crisis than during normal times). In terms of hypothesis testing, the same results were recorded as in the model of fixed effects, where of the three observed independent variables, the strongest significance was achieved by the variable share of liquid assets to total assets.

Table 9: Regression Model of Fixed Effects Between Dependent (ROE) and Independent Variables of Banks in the Western Balkans for the Period: 2010 - 2019 (Model 3)

Fixed-effects (within) regression					Number of obs	= 530
R-sq: within = 0.1426					Number of groups	=4
between = 0.9112						
overall = 0.1429					Obs per group: min	=132.5
avg =132						
max =134						
F(7,523) = 29.0						
Prob > F = 0.000						
ROE (dependent)	Coef.	Std. Err.	t	P> t	[95% Conf . Interval]	
CAR	-0.3007	0.43427	-6.93	0.000	-0.38606	-0.215442
LATA	-0.1144	0.74600	-1.53	0.125	-0.26104	0.032068
BS	3.28539	0.81477	4.03	0.000	1.68475	4.886036
_cons	-5.06249	5.09957	-0.99	0.321	-15.0806	4.955659
sigma_u	0.97240					
sigma_e	14.3548					
rho	0.00456					

Source: Calculation by the author

F statistics and Wald chi2 test are significant at the level of 5% for the observed data groups, which indicates that the proposed model corresponds well to the data. It also shows that 14.29% of the changes in the profitability of all banks in the Western Balkans are explained by the variables used in this model. By testing the third three sub-hypotheses, it can be concluded that the strongest causality or correlation with the return on equity indicator was recorded by the following variables: capital adequacy ratio and bank size at the level less than 0.05. The obtained result leads to the conclusion that the null hypothesis was rejected, and the alternative hypothesis was accepted. The independent variable share of liquid assets to total assets has no significant effect on the return on equity of banks in the Western Balkans. In the second sub-hypothesis, the null hypothesis was accepted, and the alternative hypothesis was rejected.

Table 10: Random Effects Regression (GLS) Between Dependent and Independent Variables of Western Balkan Banks for the Period: 2010 - 2019 (Model 3)

Random-effects GLS regression					Number of obs = 530	
R-sq: within = 0.1426					Number of groups = 4	
between =0.9117						
overall =0.1429					Obs per group: min = 132.5	
avg = 132						
max = 134						
Wald chi2 (3) =87.73						
Prob > chi2 = 0.000						
ROE (dependent)	Coef.	Std. Err.	z	P>[z]	[95% Conf . Interval]	
CAR	-0.30125	0.43364	-6.95	0.000	-0.386248	-0.2162641
LATA	-0.11505	0.74375	-1.55	0.122	-0.260822	0.0307233
BS	3.30279	0.81368	4.06	0.000	1.708003	4.897584
_cons	-5.14001	5.09262	-1.01	0.313	-15.12149	4.841239
sigma_u	0					
sigma_e	14.354					
rho	0					

Source: Calculation by the author

F statistics and Wald chi2 test are significant at the level of 5% for the observed data groups, which indicates that the proposed model corresponds well to the data. It also shows that 14.29% of the changes in the profitability of all banks in the Western Balkans are explained by the variables used in this model. By testing the third three sub-hypotheses, it can be concluded that the strongest causality or correlation with the return on equity indicator was recorded by the following variables: capital adequacy ratio and bank size at the level less than 0.05. The obtained result leads to the conclusion that the null hypothesis was rejected, and the alternative hypothesis was accepted. The independent variable share of liquid assets to total assets has no significant effect on the return on equity of banks in the Western Balkans. In the second sub-hypothesis, the null hypothesis was accepted, and the alternative hypothesis was rejected.

In terms of hypothesis testing, the same results were recorded as for the fixed effects model, where of the three observed independent variables, the following variables achieved the strongest significance: capital adequacy ratio and bank size. Spathis et al. (2002) tested financial markets through a study conducted to investigate Greek banks. Their study focused on the effect of bank asset size, where the aim of the study was to investigate the efficiency of large and small Greek banks by testing ROE as a measure of profitability and relationship to some classification factors such as asset volume, liquidity and risk. Data from 1990 to 1999 were used to discover the success factors of these banks. The results of the study showed that large banks are more efficient than small banks, that small banks are characterized by a high amount of capital, while large banks are also characterized by a high return on assets.

Conclusion

This paper tests the impact of banking regulation and supervision on the efficiency of banks in Serbia, Croatia and Bosnia and Herzegovina on a sample of a total of 53 banks and 530 observations during the period: 2010 - 2019. The effects of independent variables on the dependent variable were used in the research by using the unified OLS regression model (FE) and the regression model of random effects of GLS using the Hausman test. The following variables had the most significant impact through the OLS and GLS regression models: bank size and capital adequacy ratio. Strong regulatory capital requirements enhance bank development and increase bank efficiency. Therefore, the findings of this study indicate that the following sub-hypotheses were confirmed within the first hypothesis: the first and third sub-hypotheses, i.e., the strongest impact on return on assets, were recorded by the following independent variables: bank size with positive correlation and capital adequacy ratio with negative correlation.

Within the second hypothesis, the following sub-hypotheses were confirmed: the second sub-hypothesis, and the first and third sub-hypotheses were rejected. The strongest impact on the creditworthiness indicator was achieved by the variable share of liquid assets to total assets. With the increase in liquid assets, the value of Z-Score indicators and the creditworthiness of banks consistently increase. Within the third hypothesis, the following sub-hypotheses were confirmed: the first and third sub-hypotheses, and the second was rejected.

The strongest influence on the return on equity was achieved by the variable size of the bank of the Western Balkan countries. Therefore, with the increase of banking assets, the share of both credit placements and securities increases that can be converted into salaries, which again depends on the effectiveness and efficiency of bank management. Although banking regulation and supervision are being rewritten and restructured in response to the global financial crisis, their implementation requires complex steps depending on each country national policy, which could have different effects on bank risk taking, all depending on the financial and institutional environment which banks operate.

Controversy over the exact impact of regulatory capital on banking performance remains despite theoretical and empirical interests that have been created for decades. Many empirical studies linking these variables are of a mixed character and are even more conflicting than in theory. A larger set of data on the operations of banks in the Western Balkans, as well as a larger number of determinants that would be included in the model, would provide a better understanding of the impact of banking regulation and supervision on the very efficiency of banks. The authors' new research on this issue can certainly be expanded depending on the choice and inclusion of a large number of independent variables. Therefore, the use of appropriate variables could provide a basis for better analysis.

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Appendix

Appendix 1: Results obtained using the Hausman test for the first dependent variable (ROA) - Model 1

Variables	b(fixed)	B(random)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
CAR	-0.070349	-0.0706628	0.0003138	0.0006301
LATA	-0.027272	-0.0262629	-0.0010092	0.0014835
BS	0.6873564	0.6903442	-0.0029878	0.0114387

Source: Calculation by the author

$$\chi^2(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 0.61$$
$$Prob>\chi^2 = 0.8948$$

Appendix 2: Results obtained using the Hausman test for the first dependent variable (ZScore) - Model 2

Variables	b(fixed)	B(random)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
CAR	-0.0104348	-0.101768	-0.000258	0.0000689
LATA	0.1381819	0.137753	0.0004289	-
BS	-0.1861414	-0.1893839	0.0032425	0.0026254

Source: Calculation by the author

$$\chi^2(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 4.51$$
$$Prob>\chi^2 = 0.2117$$

Appendix 3: Results obtained using the Hausman test for the first dependent variable (ROE) - Model 3

Variables	b(fixed)	B(random)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
CAR	-0.3007562	-0.3012563	0.0005001	0.0023439
LATA	-0.1144843	-0.1150495	0.0005652	0.0057898
BS	3.285395	3.302793	-0.0173983	0.042234

Source: Calculation by the author

$$\chi^2(3) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 0.30$$
$$Prob>\chi^2 = 0.9600$$

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UTICAJ STRUKTURE KAPITALA NA PROFITABILNOST BANAKA U FEDERACIJI BOSNE I HERCEGOVINE

Valentina Bošnjak, (Raiffeisen bank dd BiH, Sarajevo), email: valentina.bosnjak@raiffeisengroup.ba i prof. dr Džafer Alibegović, redovan profesor (Ekonomski fakultet Univerziteta u Sarajevu), email: dzafer.alibegovic@efsa.unsa.ba

Rezime

Istraživanja relacije strukture izvora finansiranja i vrednosti kompanije brojna su na razvijenim tržištima i za nefinansijske kompanije. Međutim, na tržištima zemalja u razvoju, a posebno u bankarskom sektoru, spektar istraživanja znatno je uži. U ovom radu smo istražili postojanje, smer i intenzitet relacije strukture kapitala i profitabilnosti banaka u Federaciji BiH. Kao uzorak je poslužila cela populacija banaka u Federaciji BiH, u periodu 2009-2018. godine. Kao nezavisne varijable, parametre strukture izvora finansiranja, odabrali smo odnos duga i imovine, te odnos duga i kapitala, a kao zavisne varijable, pokazatelje vrednosti banke, uzeli smo mere profitabilnosti, odnosno ROA, ROE i neto profitnu maržu. Pored varijabli koje opisuju strukturu kapitala, čija veza je ishodišno tema ovog rada, kao kontrolne varijable upotrijebili smo i dodatne varijable specifične za banke, a koje opisuju bančinu likvidnost, izloženost kreditnom riziku, upravljanje operativnim troškovima, veličinu, te tržišno učešće. Uticaj makroekonomskog okruženja promatran je kroz ocenu inflacije i bruto nacionalnog dohotka per capita, koji ukazuju na smer ekonomskog ciklusa za određenu godinu. Rezultati istraživanja svjedoče o slaboj vezi strukture izvora finansiranja i prinosa na imovinu, odnosno o negativnoj vezi finansijske poluge sa prinosom na kapital. Ovakav ishod, najprije relativizira značaj Modigliani-Millerovog stava o irelevantnosti strukture kapitala, a potom postavlja pitanje i o validnosti tradicionalne teorije. Uspostava i upravljanje strukturom kapitala lokalnih banaka, tako se jedino može objasniti teorijom postupka slaganja.

Ključne reči: struktura kapitala; finansijska poluga; profitabilnost banaka; tradicionalna teorija; Modigliani-Millerov stav; teorija postupka slaganja

JEL klasifikacija: G21, G32

Uvod

Odluka o finansiranju jedna je od tri osnovne odluke finansijskog menadžmenta (pored odluke o investiranju, te odluke o upravljanju imovinom), svih kompanija, pa tako i finansijskih institucija. Kako se struktura izvora finansiranja, u načelu, sastoji od duga i kapitala, te kako se dug smatra jeftinijim izvorom finansiranja (radi manjeg nivoa pridruženog rizika), to je pitanje korištenja finansijske poluge (zapravo, nivoa duga u strukturi izvora finansiranja), pitanje koje zaokuplja pažnju kako akademske, tako i profesionalne zajednice, već više od pola vijeka. I dok se akademsko interesovanje fokusira na relaciju omjera finansijske poluge i vrijednosti kompanije, interes finansijskih menadžera usmjeren je na smanjenje troška finansiranja, te tako povećanje profitabilnosti kompanije kojom upravljaju (naposljetku, ipak, i povećanje vrijednosti kompanije).

Bez obzira na podijeljena mišljenja akademske zajednice u vezi relacije finansijske poluge i vrijednosti kompanije (brojna su istraživanja koja pokazuju pozitivnu vezu, kao što postoje i radovi koji negiraju takvu relaciju), ponašanje finansijskih menadžera kompanija širom svijeta uglavnom je bazirano na ideji da optimalnim korištenjem finansijske poluge mogu uvećati vrijednost kompanije. Međutim, istraživanja bazirana na bankarskom tržištu i bankama znatno su rjeđa, posebno na tržištima tranzicijskih zemalja. Cilj ovog rada upravo je testiranje relacije između strukture izvora finansiranja i profitabilnosti (jednog od osnovnih mjerila vrijednosti) banaka u Federaciji Bosne i Hercegovine.

Teoretske osnove

Razmatranje relacije strukture izvora finansiranja (kapitala, u širem smislu) i vrijednosti kompanije za rezultat ima više različitih pogleda, koji se ipak mogu kategorisati u četiri teoretska pravca:

- Modigliani-Millerova teorija,
- Tradicionalna teorija,
- Agencijski modeli (Teorija izbora), te
- Teorija asimetričnih informacija.

Franco Modigliani i Merton Miller su još 1958. godine postavili kamen temeljac modernim pogledima na strukturu kapitala, postavivši tezu da struktura kapitala uopšte ne utiče na percepciju vrijednosti i vrijednost kompanije. Pod pretpostavkom savršene konkurencije, na vrijednost kompanije utiču samo gotovinski tokovi i visina poslovnog rizika koji kompanija preuzima, dok nivo zaduženosti nije varijabla relevantna za procjenu i određivanje vrijednosti kompanije. Vrijednost zadužene kompanije prije oporezivanja jednaka je vrijednosti nezadužene kompanije, u uslovima savršenog tržišta. Naknadno, autori ipak razmatraju okolnosti u kojem postoji oporezivanje dobiti, te dokazuju da, nakon oporezivanja, postoji razlika između kompanije sa finansijskom polugom i bez poluge (Ross et al, 2013).

Modigliani-Millerova teorija izazvala je akademsku polemiku i iznjedrila nekoliko novih pogleda na problem. Tradicionalna teorija optimalnu strukturu kapitala definiše kao jednakost minimalnog troška finansiranja kompanije i ponderisanog prosječnog troška kapitala i tvrdi da postoji optimalna struktura kapitala (Brealey et al, 2011). Pri malim nivoima duga, rizik kreditora ostaje konstantan, dok

rizik dioničara raste, no ipak, ukupni trošak kapitala je nizak. Nakon određenog nivoa zaduženosti, počinje rasti rizik i kreditora i dioničara. Kreditori svoj rizik ugrađuju u cijenu koštanja duga, a dioničari zahtijevaju veću stopu povrata na kapital. Prema tradicionalnoj teoriji, posao menadžera jeste naći nivo zaduženosti koji minimizira ponderisani prosječni trošak kapitala, a istovremeno maksimizira vrijednost kompanije.

Teorija izbora uvodi dvije nove varijable od kojih zavisi struktura kapitala, a to su agencijski troškovi i troškovi bankrota. Prema ovoj teoriji, optimalna struktura kapitala postoji i ona se nalazi u jednakosti koristi i troškova duga. Koristi duga mogu biti umanjene iznos poreza i smanjenje agencijskih troškova, a iz zaduživanja mogu proizaći troškovi bankrota i agencijski troškovi. Zaključak teorije izbora jeste da finansijska poluga ima pozitivnu vezu s vjerovatnoćom finansijskih stresova koje kompanija može doživjeti, vrijednošću kompanije, nivoom regulisanosti, gotovinskim tokovima, likvidacijskom vrijednošću, nivoom u kojem je kompanija mogući objekt preuzimanja (take-overa) i važnosti reputacije menadžmenta. Negativnu vezu finansijska poluga ima s mogućnostima daljeg razvoja, pokrićem kamata, troškom analize perspektive kompanije i vjerovatnoćom reorganizacije koja nastupa nakon što kompanija doživi finansijski stres (Brealey et al, 2011).

Modeli zasnovani na asimetričnim informacijama zasnivaju se na ideji postojanja asimetričnih informacija između različitih interesnih grupa: menadžera, dioničara, kreditora. U okviru modela ističu se dva teoretska pravca: teorija signalizacije i teorija postupka slaganja (redoslijeda „pakovanja“). Teorija signalizacije polazi od pretpostavke da se menadžeri zadužuju kada ulažu u profitabilnu investiciju, kako ne bi morali dijeliti zaradu s dioničarima. Stoga, javnost smatra da je povećanje finansijske poluge signal očekivane dobre profitabilnosti (Harris, 1991). Teorija postupka slaganja pretpostavlja da postoji redoslijed po kojemu menadžeri izabiru izvor finansiranja. Investicijski projekt će najprije finansirati iz ostvarenog profita, zatim niskorizičnim dužničkim instrumentima, konvertibilnim obveznicama i na kraju običnim dionicama (Vidučić et al, 2018).

Pregled literature

Odluka o finansiranju jedna je od tri osnovne odluke finansijskog menadžmenta (pored odluke o Svaki od kratko opisanih teoretskih pristupa problemu optimalne strukture izvora finansiranja potaknuo je brojne autore na istraživanja, u svrhu potvrđivanja, odnosno opovrgavanja teoretskih koncepata. Istraživanja zasnovana na praksi kompanija razvijenih tržišta razmjerno su brojna, dok je situacija na tranzicijskim (izranjajućim i rubnim) tržištima drugačija. U nastavku ćemo predstaviti neke od radova koje tretiraju relaciju strukture izvora finansiranja i vrijednosti kompanija i banaka (po bilo kojem mjerilu), relevantne za naše istraživanje, kako po korištenoj istraživačkoj metodologiji, tako i prema kriteriju relativne uporedivosti okruženja.

Kada je riječ o razvijenim tržištima, najprije je potrebno istaknuti istraživanje koje je Berger (1995) proveo na američkom bankarskom tržištu. Kao uzorak su poslužili izvještaji svih osiguranih komercijalnih banaka, za period 1983-1989. godine, uključno i trogodišnji lag period za podatke o omjeru kapitala prema imovini (CAR) i povrata na kapital (ROE). Autor prvo utvrđuje kauzalnost relacije između CAR i ROE (Granger-ovim testom), a potom ispituje smjer relacije. Nasuprot očekivanom negativnom znaku, koji je konzistentan i sa teoretskim postavkama, rezultati istraživanja su pokazali pozitivan smjer između udjela kapitala u imovini i prinosa na kapital. U regresijskom modelu koji je korišten upotrijebljene su i brojne kontrolne varijable, poput HH indeksa koncentracije, udjela banke

u ukupnim depozitima, stope rasta depozita, kao i omjera rizikom ponderisane aktive, loših kredita i otpisanih kredita prema ukupnoj imovini banke.

Cooper i drugi (2003) istražuju mogućnost predviđanja prinosa banaka na uzorku od 213 javno trgovanih bankarskih holding grupacija, za period od juna 1986. do decembra 1999.godine. Fokus ovog istraživanja nije usmjeren isključivo na ispitivanje relacije strukture izvora finansiranja i profitabilnosti, nego je spektar nezavisnih varijabli znatno širi i uključuje kretanje: omjera kredita i imovine, omjera rezervi za kredite i kredita, omjera nekamatonosnih i kamatnih prihoda, omjera neiskorištenih odobranih kredita, kreditnih pisama, kamatnih swap-ova i ukupnih kredita, kao i (za nas relevantnog) omjera knjigovodstvene vrijednosti kapitala i ukupne vrijednosti imovine. Zavisnu varijablu predstavlja procentulna promjena tromjesečne zarade po dionici. Istraživanje je usmjereno ispitivanju relacije fundamentalnih pokazatelja poslovne performanse banaka i tržišne performanse njenih dionica. Rezultati istraživanja pokazali su da kretanje nekamatonosnih prihoda, rezervisanja po kreditima, zarade, izdatih kreditnih pisama, te finansijske poluge (omjera kapitala i imovine) imaju prediktorsku moć zarade po dionici. Za testiranje relacija ponovo je upotrijebljen regresijski (ovaj put panelni) model.

Problemom relacije finansijske strukture (ali i znatno šire, obilježja finansijskog sistema) i profitabilnosti banaka, bave se Demircuguc-Kunt i Huizinga. Autori regresijskim modelom testiraju relaciju tri grupe nezavisnih varijabli sa pokazateljima profitabilnosti banaka (neto marža i omjer profita prije poreza i imovine). Nezavisne varijable dijele na: karakteristične za banku (omjer kapitala i imovine, omjer kredita i imovine, omjer nekamatonosnih prihoda i imovine, omjer depozita i imovine, te omjer operativnih troškova i imovine), makroekonomske indikatore (BDP po stanovniku, stopa rasta, stopa inflacije, porezna stopa), te indikatore finansijskog sistema (omjer imovine depozitnih banaka i BDP-a, omjer imovine centralne banke i BDP-a, omjer kredita privatnom sektoru i BDP-a, omjer berzanske kapitalizacije i BDP-a, omjer ukupne vrijednosti trgovanih dionica i BDP-a, omjer kapitalizacije i imovine banaka, omjer vrijednosti trgovanih dionica i kredita privatnom sektoru, proizvod vrijednosti trgovanih dionica i prosječnih operativnih troškova banaka, te složeni pokazatelj strukture bankarskog sektora-prosječna vrijednost omjera kapitalizacije i imovine banaka, prometa na berzi i kredita i proizvoda prometa i operativnih troškova). Istraživanje je napravljeno na podacima banaka iz 44 zemlje (razvijene, zemlje u razvoju i nerazvijene zemlje), za period 1990.-1997. Rezultati ukazuju da banke imaju više profitne stope i veće marže u manje razvijenim finansijskim sistemima, unatoč skupim resursima i operativnoj neefikasnosti. Sa razvojem finansijskog sistema, pojačava se efikasnost banaka, ali i konkurencija među njima, te stoga opadaju pokazatelji profitabilnosti.

Kada je riječ o tržištima tranzicijskih zemalja, istraživanja koja imaju za predmet relaciju strukture izvora finansiranja i profitabilnosti znatno su zastupljenija za privredne kompanije, nego za banke. Na primjer, Gupta i drugi (2011) testiraju vezu između nivoa duga u izvorima finansiranja indijskih kompanija i povrata na investicije (ROI), povrata na kapital (ROE), povrata na udio (RET), odnosa zarade prije poreza i prodaje (EBIT/S) i omjera operativnog prihoda i prodaje (OPR/S). Khan (2012), na uzorku kompanija sa Pakistanske berze, testira vezu ROA, ROE, bruto profitna marža (GPM) i Tobin Q-a, kao zavisnih varijabli, te odnosa kratkoročnog i ukupnog duga (STDTA), odnosa dugoročnog i ukupnog duga (LTDTA), te odnosa ukupnog duga i imovine (TDTA), kao nezavisnih varijabli, reprezenata strukture izvora finansiranja. Adekunle i Sunday (2010) istraživali su efekt strukture kapitala na finansijski učinak kompanija u Nigeriji, gdje je nezavisna varijabla, struktura kapitala mjerena omjerom duga i imovine, a zavisna koeficijentima ROA i ROE. Na Nigerijskoj berzi je fundirano i istraživanje Luper i Isaac (2012), u kojem su kao nezavisne varijable i mjere strukture kapitala korišteni odnos kratkoročnog duga i

ukupne imovine (STDTA), dugoročnog duga i ukupne imovine (LTDTA), te odnos duga i kapitala (TDE), a kao zavisne varijable i pokazatelji učinka povrat na aktivu ROA i profitna marža (PM). Ebaid (2009) je ispitivao vezu između strukture kapitala i učinka nefinansijskih kompanija s Egipatske berze. Poslovni učinak mjerio je računovodstvenim pokazateljima ROA, ROE i bruto profitnom maržom (GPM), a finansijsku polugu mjerio je odnosom kratkoročnog duga i ukupne imovine (STD), dugoročnog duga i ukupne imovine (LTD), te odnosom ukupnog duga i ukupne imovine (TDT). Abu Rub (2012) istražuje efekt strukture kapitala na performanse kompanija na osnovu podataka s Palestinske berze (PSE) za period 2007.-2010. god., koristeći linearnu multiplu regresijsku analizu. Učinak je zavisna varijabla mjerena i računovodstvenim i tržišnim pokazateljima. ROA i ROE su korišteni kao računovodstveni pokazatelji, a Tobinov Q, EPS i odnos tržišne i knjigovodstvene vrijednosti kapitala (MBVR) kao tržišni pokazatelji učinka kompanije. Struktura kapitala je nezavisna varijabla predstavljena odnosom kratkoročnog duga i ukupne imovine (SDTA), dugoročnog duga i ukupne imovine (LDTA), ukupnog duga i ukupne imovine (TDTA), ukupnog duga i ukupnog kapitala (TDTQ).

Pomenuta istraživanja donose različite rezultate veze između strukture kapitala i poslovnog učinka kompanija. Pojedina su istraživanja pokazivala pozitivnu vezu (Gupta i drugi), negativnu vezu (Adekunle i Sunday, Luper i Isaac), ili pak odsustvo veze ili mješovite učinke (Ebaid, Abu Rub, Khan).

Radovi vezani za istraživanje relacije strukture izvora finansiranja i učinaka banaka na tranzicijskim tržištima, nešto su manje zastupljeni. Ipak, istaknućemo nekoliko. Autori Siddiqui i Shoaib (2011) su istraživali teoriju agencijskih troškova u bankarskom sektoru Pakistana koristeći panel podatke od 22 banke u periodu od 2002.-2009. godine. Koristili su efikasnost banke kao zavisnu varijablu, a kao nezavisne varijable su korištene: finansijska poluga, zarada, rizik, veličina, investicije i krediti. Efikasnost banke je mjerena koeficijentom ROE i Tobinovima Q, koji su korišteni kao proxy varijable za mjerenje efikasnosti zarade i tržišne vrijednosti. Rezultati studije su pokazali da se profitabilnost banke signifikantno povećava s porastom poluge. Tokom posmatranog perioda signifikantnu ulogu je imala i veličina banke u efikasnosti zarade i tržišnoj vrijednosti. Na kraju, autori su sugerirali bankama, da bi, u svrhu poboljšanja efikasnosti i kvaliteta menadžmenta, trebali razdvojiti vlasništvo od upravljanja. Također su uočili potrebu za prelaskom s potrošačkog bankarstva na kreditiranje realnog sektora i umjesto kratkoročne zarade od kreditiranja kupovina kuća i auta, staviti fokus na dugoročnije investicije.

Uticaj strukture vlasništva, na poslovni učinak komercijalnih banaka u Etiopiji istraživali su autori Kapur i Gualu (2012). Učinak su mjerili analitičkim mjerama kao što su profitabilnost, kvalitet aktive, efikasnost, likvidnost i upravljanje kapitalom, dok su pod strukturom vlasništva posmatrali državni naspram privatnog kapitala, a ne korištenje finansijske poluge. Objekt istraživanja je 8 komercijalnih banaka, od kojih je 6 privatnih, a 2 banke su u državnom vlasništvu, i njihova performansa u periodu 2001.-2008. godine. Kao pokazatelji profitabilnosti razmatrani su povrat na aktivu (ROA), neto kamatna marža (NII), povrat na kapital (ROE), te nekamatni prihod. Efikasnost su mjerili udjelom nekamatnih rashoda u prosječnom iznosu imovine, udjelom opštih rashoda u aktivu, udjelom troškova zaposlenika u aktivu i udjelom opštih troškova u prihodima. Za pokazatelje kvaliteta aktive ocjenjivani su: rezervacije za nenaplative kredite, rezervacije za ukupne kredite, rezervacije za ukupnu aktivu i iznos nenaplativih kredita (NPL). Likvidnost je mjerena sljedećim pokazateljima: udio kredita u depozitima, udio likvidne aktive u ukupnoj aktivu, te udio likvidne aktive u depozitima. Adekvatnost kapitala mjerena je udjelom kapitala u kreditima, udjelom kapitala u aktivu, udjelom kapitala u neto kreditima i udjelom kapitala u depozitima. Autori su na osnovu studije zaključili da, gledajući profitabilnost, kvalitet aktive i adekvatnost kapitala, privatne banke imaju bolji poslovni učinak od

državnih. No, u upravljanju troškovima prednjače banke u državnom vlasništvu, dok u području upravljanja likvidnošću nema značajnih razlika između privatnih i državnih komercijalnih banaka.

Autor Yaregal (2011) radio je studiju s istom temom i opsegom istraživanja kao i Kappur i Gualu, za period 2005.-2010. godine, s tim da je ovaj autor dobio znatno drugačije rezultate. Studija je pokazala da državne banke imaju bolje performanse u profitabilnosti, likvidnosti i efikasnosti, dok privatne banke ostvaruju bolju adekvatnost kapitala i brži rast.

Studiju veze između strukture kapitala i performanse banaka registrovanih na berzi Gane proveli su autori Awunyo-Vitor i Badu (2011). Koristili su kvalitativni i kvantitativni pristup, te panel regresijskom analizom obradili kvalitativne podatke. Zavisna varijabla – performansa banaka mjerena je ROA i ROE, te Tobinovim Q, a nezavisna varijabla - struktura kapitala, iskazana je udjelom duga u kapitalu. Rezultati studije su pokazali statistički signifikantnu negativnu vezu između strukture kapitala i poslovnog učinka, na osnovu kojih autor zaključuje da banke na tržištu Gane imaju visoku polugu, koja se u većem dijelu sastoji od kratkoročnog duga, što ne ide u korist profitabilnosti.

Za finansijsko tržište Jugoistočne Evrope, posebno su aktuelni radovi Athanasoglou i drugi. U radu Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability (Athanasoglou i drugi, 2005), autori koristeći linearni regresijski model na populaciji grčkih banaka u periodu 1985.-2001. nastoje identifikovati determinante profitabilnosti, i to iz tri odvojene grupe: determinante specifične za banke (omjer kapitala i imovine-EA, omjer rezervacija za kredite i kredita-PL, omjer prihoda i broja zaposlenih-PR, omjer operativnih troškova i imovine-EXP, veličinu banke-S i S2), bankarsku industriju (tip vlasništva banke-zatvoreno-Op ili javno-Om, HHI indeks koncentracija), te makroekonomske determinante (stopa inflacije-CPI ili IR, stadij ekonomskog ciklusa-CO). Kao pokazatelje profitabilnosti koriste ROA i ROE. Rezultati istraživanja ukazuju da je kapital važna determinanta profita, te da povećana izloženost riziku umanjuje profitnu stopu. Također, produktivnost rada ima pozitivni i signifikantnu relaciju sa prinosom. Operativni troškovi imaju negativan uticaj na prinos, dok veličina banke nije signifikantna determinanta. Kada je riječ o makroekonomskim varijablama, utvrđena je signifikantna relacija inflacije i stadija ekonomskog ciklusa, uz naznaku asimetričnosti, obzirom da je pozitivna relacija ekonomskog ciklusa sa prinosom utvrđena samo u fazama nadprosječnog prinosa.

U radu Determinants of Bank Profitability in the South Eastern European Region (Athanasoglou i drugi, 2006), autori primjenjuju sličan metodološki okvir, ali na znatno širem uzorku. Ovaj put istraživanje je bazirano na nebalansiranom uzorku od 71 do 132 banke (različit broj banaka u posmatranim godinama), za period 1998.-2002. godine, i to iz sedam zemalja Jugoistočne Evrope (Albanija, Bosna i Hercegovina, Bugarska, Hrvatska, Sjeverna Makedonija, Rumunija i Srbija). Kao zavisne varijable ponovo su odabrani ROA i ROE, a nezavisne varijable autori, kao i u prethodnom istraživanju, dijele u tri skupine: specifične za pojedinačne banke (omjer kredita i imovine-LA, rezervi za kredite i kredita-LLP, omjer kapitala i imovine-EA, omjer operativnih troškova i imovine-OEA, te veličinu banke-S i S2, porijeklo vlasništva-Dfo i tržišni udio-MS), determinante bankarske industrije (EBRD indeks reforme bankarskog sistema i HHI indeks koncentracije), te makroekonomske varijable (postotak inflacije-INF i realni dohodak po stanovniku-RGC). Podaci su priređeni u panel, a relacije se testiraju u LS modelu sa fiksnim i slučajnim učincima. Rezultati ukazuju na pozitivnu relaciju LA, EA, S, MS, HHI, INF, RGC sa ROA, negativnu relaciju LLP, OEA, S2 sa ROA, te mješovitu relaciju Dfo po posmatranim zemljama. Sa ROE je zabilježena pozitivna relacija varijabli LA, EA, S, S2, MS, HHI, INF i RGC, negativna veza varijabli LLP i OEA, dok je znak relacije varijable Dfo ponovo različit, ovisno o zemlji u kojoj banke

imaju sjedište.

Istraživanja ovog problema na lokalnom bankarskom tržištu nismo pronašli. Mada su autori Kadić (2017) i Milisav (2018) radili svojevrzne analize strukture kapitala banaka u FBiH, one se većinom odnose na uticaj banaka sa većinskim stranim kapitalom na profitabilnost i efikasnost bankarskog sektora. Prema našem saznanju, do momenta pisanja ovog rada nije ispitivana veza između strukture kapitala i profitabilnosti komercijalnih banaka u Federaciji BiH.

Razmatrane empirijske studije donose različite rezultate veze između strukture kapitala i poslovnog učinka, kako kompanija, tako i banaka. Ipak, istraživanja su korisna u metodološkom smislu. Pokazali smo da autori za mjerenje strukture kapitala koriste udio kratkoročnog duga u ukupnoj imovini (STD), udio dugoročnog duga u ukupnoj imovini (LTD), udio ukupnog duga u ukupnoj imovini (TDA) i udio duga u ukupnom kapitalu (TDTQ), dok za mjerenje poslovnog učinka koriste zaradu po dionici (EPS), povrat na imovinu (ROA), povrat na kapital (ROE), Tobinov Q, bruto profitnu maržu (GPM) i odnos tržišne vrijednosti i knjigovodstvene vrijednosti kapitala.

Metodologija istraživanja

Na tržištu Federacije BiH posluje 15 komercijalnih banaka, što je brojka koja je konstantna od 2016. godine. Od tog broja, 14 banaka je u većinskom privatnom vlasništvu, a samo jedna banka je u državnom vlasništvu. U strukturi vlasništva privatnih banaka dominira strano vlasništvo (10 banaka), sa austrijskim, turskim i hrvatskim kapitalom, na čelu. Istraživanje je rađeno na kompletnoj populaciji, u desetogodišnjem periodu 2009.-2018. godine.

Kada je riječ o poslovnim performansama industrije, možemo istaknuti da u 2009. i 2010. godini, koje su prve dvije godine obuhvaćene istraživanjem, profitabilnost mjerena ROA, ROE i neto profitnom maržom je stabilna, ali razmjerno niska, i to: 0,44%, 2,17% i 7,18% u 2009. godini respektivno, te 0,41%, 2,22% i 11,01% u 2010. godini respektivno. Koeficijenti profitabilnosti u ovim godinama odražavaju posljedice krize iz 2008. godine. Već 2011. godine primjetan je porast profitabilnosti, što se osobito vidi kroz neto profitnu maržu koja je porasla za 3,46 pp u odnosu na prethodnu godinu. Glavni pokretači rasta profitabilnosti u 2011. godini jesu rast neto kamatnog prihoda, te smanjenje troškova rizika u vidu ispravki vrijednosti, kao posljedica usporavanja kvarenja kvalitete portfelja kredita.

Trend rasta profitabilnosti koji započinje u 2011. godini ostaje do kraja posmatranog perioda. U posljednoj, 2018. godini, u odnosu na početak perioda, profitabilnost banaka predstavljena kroz koeficijente ROA, ROE i NPM se povećala za 117%, 210% i 214% respektivno. Generalno, može se zaključiti da je bankarski sektor u Federaciji BiH procvjetao u periodu od 2009. do 2018. godine, unatoč velikoj gubitaškoj prtljazi bankarskog sektora, te dodatnom udarcu, prelijevanju globalne ekonomske krize na tržište FBiH.

Svrha ovog istraživanja jeste ispitati vezu između strukture kapitala i profitabilnosti komercijalnih banaka u Federaciji BiH. Kao nezavisne varijable, tj. reprezenti strukture kapitala, odabrani su:

- omjer ukupnih obaveza prema ukupnoj aktivni (u daljem tekstu koeficijent OA),
- omjer ukupnih obaveza prema ukupnom kapitalu (u daljem tekstu koeficijent OK).

Kao zavisne varijable modela, odnosno reprezentanti profitabilnosti, odabrani su:

- povrat na aktivu, odnosno omjer neto dobiti prema ukupnoj aktivu (u daljem tekstu koeficijent ROA),
- povrat na kapital, odnosno omjer neto dobiti i ukupnog kapitala (u daljem tekstu koeficijent ROE),
- neto profitna marža, odnosno udio neto dobiti u ukupnom prihodu (u daljem tekstu NPM).

Pored nezavisnih varijabli koje opisuju strukturu kapitala i čija veza s profitabilnošću banaka je primarni fokus ovoga istraživanja, dodane su i sljedeće varijable specifične za banke, koje imaju kontrolnu ulogu u modelu:

- likvidnost, mjerena omjerom kredita i aktive (u daljem tekstu koeficijent KA),
- kreditni rizik, mjereno omjerom rezervisanja za kreditne gubitke prema kreditima (u daljem tekstu koeficijent RKGK),,
- upravljanje operativnim troškovima, mjereno udjelom operativnih troškova u iznosu aktive (u daljem tekstu koeficijent OTA),
- veličina, mjerena logaritmom iznosa ukupne imovine banke (u daljem tekstu logV),
- tržišno učešće, mjereno udjelom aktive banaka u ukupnoj aktivu za posmatranu godinu (u daljem tekstu TU).

Nezanemarivuticajnaprofitabilnostbanakaimajui makroekonomskiuslovi,tesmjemakroekonomskog ciklusa. Iz tog razloga su u modelu posmatrane i sljedeće markoekonomske varijable:

- inflacija, mjerena prosječnom godišnjom stopom rasta indeksa potrošačkih cijena (u daljem tekstu INF),
- ekonomska aktivnost, mjerena bruto nacionalnim dohotkom per capita (u daljem tekstu BNDpc).

Za varijablu veličine i ekonomske aktivnosti posmatrani su logaritmirani iznosi kako bi se ujednačile varijacije među veličinama aktive različitih banaka, te kako bi deskriptivna analiza statističkih serija podataka bila efikasnija. Istraživanje se u potpunosti oslanja na sekundarne podatke i to na javno dostupne finansijske izvještaje. Za period 2009.-2013. korišten je službeni dokument Agencije za bankarstvo FBiH, pod nazivom Skraćeni izvještaj vanjskih revizora o finansijskim iskazima banaka u Federaciji Bosne i Hercegovine. Obzirom da je zaključno sa 2013. godinom prestalo izdavanje skraćenog izvještaja vanjskih revizora, finansijski izvještaji za period 2014.-2018. su prikupljeni sa web stranice Sarajevske berze.

Za specifikaciju modela korišten je regresijski model po sljedećoj formuli:

$$Y_{it} = a + \sum_{j=1}^J b_j X_{it}^j + \sum_{m=1}^M b_m X_{it}^m + \varepsilon_{it}, \quad (1)$$

gdje je:

Y_{it} – zavisna varijabla za banku i u godini t (ROA, ROE, NPM),

a – odsječak na y-osi,

$\sum_{j=1}^J b_j X_{it}^j$ – nezavisne varijable j specifične za banku za banku i u godini t (OA, OK, KA, RKGK, OTA, logV, TU),

$\sum_{m=1}^M b_m X_{it}^m$ – nezavisne makroekonomske varijable m za banku i u godini t (INF, BND_{pc})

ε_{it} – greška modela, slučajna varijabla koja daje stohastički karakter modelu.

Podaci su priređeni u panel, sa dimenzijama godina posmatranog perioda, odnosno banaka iz uzorka. Nakon deskriptivne statistike, napravljena je analiza korelacije, radi utvrđivanja postojanja, signifikantnosti i intenziteta veze među nezavisnim i zavisnim varijablama. Relacija strukture kapitala i profitabilnosti banaka testirana je primjenom regresijske analize modelom fiksnih efekata (Least-Squares Dummy Variable Regression – LSDV Regression) i modelom slučajnih efekata (Random Effects Model – REM), nakon čega je Hausmanovim testom ocijenjeno koji je model prikladniji. Kao preduslov primjene modela, provedeni su svi predviđeni testovi (test normalnosti, multikolinearnosti, autokorelacije, te test heteroskedastičnosti).

Rezultati istraživanja

Kako bismo sagledali opšte statističke osobine uzorka (veličina, minimum i maksimum, homogenost i rang), najprije predstavljamo rezultate deskriptivne statističke analize:

Tabela 1: Mjere srednje vrijednosti i varijacije (deskriptivna statistika)

Varijabla	N	Minimum	Maksimum	Sredina	St.devijacija
ROA	165	0	0,019212	0,0063259	0,0058264
ROE	165	0	0,1481511	0,0404842	0,0387715
NPM	165	0	0,4090981	0,1315073	0,1163357
OA	165	0,3478953	0,9499514	0,8307712	0,0837217
OK	165	1,2671994	18,980588	6,1733379	3,0896395
logV	165	4,7339512	6,7760019	5,7525849	0,4944672
KA	165	0,0651834	0,9370046	0,6336301	0,1652893
RKGK	165	0	0,160224	0,0177104	0,0274435
OTA	165	0,0043172	0,0965474	0,0355415	0,0147759
TU	165	0,0035802	0,28488	0,0606061	0,072457
INF	165	-0,011	0,037	0,0070061	0,0157079
logBNDpc	165	3,861719	3,978155	3,899965	0,0368263

Izvor: izračuna autora

Predstavljene vrijednosti govore o skromnoj profitabilnosti banaka u posmatranom periodu. Naime, prosječna vrijednost neto profitne marže je 13,15%, dok su prosječne vrijednosti prinosa na imovinu i prinosa na kapital 0,63% i 4,05%, što je znatno ispod prosjeka evropskog finansijskog tržišta u istom periodu (izvor: European Banking Federation – www.ebf.eu). Iz relativno malih vrijednosti standardne devijacije istih pokazatelja, možemo zaključiti da je poslovna performansa posmatranih banaka uravnotežena. Omjer obaveza prema imovini prosječno je 83,08%, odnosno omjer obaveza prema kapitalu 6,17 puta, uz nešto veću heterogenost, mjereno standardnom devijacijom.

Preduslov ispitivanju uticaja strukture kapitala na profitabilnost banaka jeste postojanje, intenzitet i predznak relacije među nezavisnim i zavisnim varijablama, što smo ispitali korelacijskom analizom. U narednoj tabeli predstavljena je matrica vrijednosti Pearsonovog koeficijenta korelacije, među svim varijablama (*-signifikantno na nivou 5%, **-signifikantno na nivou 1%):

Tabela 2: Matrica Pearsonovih koeficijenata korelacije

	OA	OK	ROA	ROE	NPM	logV	KA	RKGK	OTA	TU	INF	logBNDpc
OA	1											
OK	.793**	1										
ROA	-.188*	.280**	1									
ROE	.124	-.022	.901**	1								
NPM	-.109	.207**	.959**	.909**	1							
logV	.511**	.421**	.262**	.556**	.325**	1						
KA	.382**	.176*	-.078	.104	-.025	.243**	1					
RKGK	-.134	-.076	-.128	-.185*	.218**	.009	.016	1				
OTA	.239**	.267**	.291**	.362**	.419**	.432**	.093	.185*	1			
TU	.277**	.224**	.399**	.573**	.393**	.851**	.037	.141	.284**	1		
INF	-.112	-.075	-.039	-.044	-.051	-.043	.036	.211**	.021	.000	1	
logBNDpc	.228**	.170*	.246**	.318**	.359**	.270**	.008	.446**	.399**	.047	.166*	1

Izvor: izračuna autora

Rezultati korelacijske analize ukazuju da ROA ima negativnu vezu sa nezavisnim varijablama OA, OK, KA, RKGK, OTA i INF, a ima pozitivnu vezu s logV, TU, logBNDpc. ROE ima pozitivnu vezu s OA, logV, KA, TU, logBNDpc, a negativnu s OK, RKGK, OTA i INF. NPM ima negativnu vezu s OA, OK, KA, RKGK, OTA, INF, dok s logV, TU i logBNDpc, ima pozitivnu vezu. Navedeni smjerovi korelacije bi značili da profitabilnost uzorka banaka u FBiH, mjerena povratom na aktivu, raste s padom udjela

duga u finansiranju aktive, s padom izloženosti kreditnom riziku, operativnih troškova i inflacije, te rastom likvidnosti odnosno padom udjela kredita u aktivi. Također, povrat na aktivu raste s porastom veličine banke, tržišnog učešća i ekonomske aktivnosti. Povrat na kapital raste s porastom udjela duga u finansiranju aktive, veličine banke, porastom udjela kredita u aktivi, tržišnog učešća, te ekonomske aktivnosti, a opada s porastom odnosa duga i kapitala, kreditnog rizika, operativnih troškova i inflacije, što na prvu daje dvosmislen zaključak o relaciji ROE i varijabli strukture kapitala. Neto profitna marža opada s porastom udjela duga u finansiranju aktive, porastom omjera duga i kapitala, te s porastom udjela kredita u ukupnoj imovini, kreditnog rizika, operativnih troškova i inflacije, dok raste s porastom veličine banke, tržišnog učešća i ekonomske aktivnosti.

Na kraju, relaciju strukture izvora finansiranja i profitabilnosti banaka testirali smo regresijskim modelom fiksnih i slučajnih efekata, prema ranije predstavljenoj formuli. Hausmanovim testom ocijenili smo koji model bolje opisuje vezu između predmetnih varijabli, čiji su rezultati prikazani u tabeli 3.

Tabela 3: Rezultat Hausmanovog testa specifikacije

Model	Rezultat Hausmanovog testa	
	Zavisna varijabla	Prob>chi2
Nezavisna varijabla koja opisuje kapital		
ROA	OA	0,7157
ROA	OK	0,0011
ROE	OA	0,7278
ROE	OK	0,0143
NPM	OA	0,9995
NPM	OK	0,0047

Izvor: izračuna autora

Rezultat testa ukazuje da je za primjer relacije omjera duga i imovine sa mjerama profitabilnosti banaka prikladniji model slučajnih efekata ($p>0,05$), dok je za testiranje relacije omjera kapitala i imovine prikladniji model fiksnih efekata ($p<0,05$).

U tabeli 4 predstavljeni su rezultati regresijske analize veze između strukture kapitala i profitabilnosti mjerene povratom na aktivu – ROA, procijenjeno kroz dva modela. Zavisna varijabla u oba modela je ROA, dok su nezavisne varijable u prvom modelu omjer duga i imovine (OA) kao varijabla koja opisuje strukturu kapitala i ostale varijable specifične za banku, te makroekonomske varijable, a u drugom modelu odnos duga i kapitala (OK) kao varijabla koja opisuje strukturu kapitala, i ostale varijable specifične za banku, te makroekonomske varijable.

Tabela 4: Struktura kapitala i profitabilnost iskazana povratom na aktivu ROA

Estimacija RE modelom (ROA_OA)				
	Coef.	Std. Err.	z	P> z
OA	-0,02	0,0055851	-3,95	0
logV	0,00	0,00	-0,42	0,678
KA	0,00	0,00	1,59	0,112
RKGK	0,0005122	0,0130274	0,04	0,969
OTA	-0,0139369	0,029585	-0,47	0,638
TU	0,0292845	0,0192568	1,52	0,128
INF	-0,0104385	0,0177655	-0,59	0,557
logBNDpc	0,0477477	0,0115084	4,15	0
_cons	-0,1584619	0,0399668	-3,96	0
Wald test	46,32			
R ²	0,3559			
No of obs	165			

Estimacija FE modelom (ROA_OK)				
	Coef.	Std. Err.	t	P> t
OK	0,00	0,0001496	-3,87	0
logV	0,00	0,00	0,65	0,518
KA	0,00	0,00	1,19	0,236
RKGK	0,00912	0,0126585	0,72	0,472
OTA	-0,0180483	0,0333579	-0,54	0,589
TU	-0,0281125	0,0303232	-0,93	0,356
INF	-0,0085205	0,0166598	-0,51	0,61
logBNDpc	0,0371742	0,0128296	2,9	0,004
_cons	-0,1506506	0,0396783	-3,8	0
F test	6,77			
R ²	0,0266			
No of obs	165			

Izvor: izračuna autora

Već na prvi pogled, po negativnom predznaku koeficijenata u prvom modelu, te neutralan koeficijent u drugom modelu, može se zaključiti da struktura kapitala ima slab uticaj na profitabilnost banaka u FBiH, mjerenoj povratom na aktivu. Veličina aktive banke, te omjer kredita i aktive, kao kontrolne varijable, nemaju jasnu vezu s profitabilnošću banaka mjerene povratom na aktivu u oba modela. Od preostalih kontrolnih varijabli, na profitabilnost u oba modela negativno utiču operativni troškovi, te inflacija, dok su rezultati za uticaj tržišnog učešća na profitabilnost dvosmisleni. Bruto nacionalni dohodak per capita ima pozitivan uticaj na profitabilnost banaka u FBiH. Uticaj varijable kreditnog rizika je zanemariv.

U prvom modelu, koeficijent varijable omjera duga i imovine (OA) iznosi -0,02 s p vrijednošću 0,000, što indicira da povećanje udjela duga u imovini za 1% dovodi do smanjenja profitabilnosti mjerene povratom na aktivu za 2%, uz statističku značajnost na nivou 1%. U drugom modelu, koeficijent varijable odnos duga i kapitala (OK) iznosi -0,00 uz p vrijednost 0,000, što indicira da je utjecaj

strukture kapitala mjerene omjerom duga i kapitala neutralan na profitabilnost mjerenu povratom na aktivu.

Od preostalih kontrolnih varijabli, najveći uticaj na profitabilnost mjerenu povratom na aktivu imaju varijabla ekonomskog ciklusa, tržišno učešće i upravljanje operativnim troškovima. Povećanje bruto nacionalnog dohotka per capita za 1% dovodi do povećanja profitabilnosti mjerene povratom na aktivu za 4,77% u prvom modelu, te za 3,71% u drugom modelu. Povećanje tržišnog učešća za 1% dovodi do povećanja profitabilnosti mjerene povratom na aktivu za 2,92% u prvom modelu, te za 2,81% u drugom modelu. Povećanje udjela operativnih troškova u aktivu za 1% dovodi do smanjenja profitabilnosti mjerene povratom na aktivu za 1,39% u prvom modelu, te za 1,80% u drugom modelu.

Nadalje, koeficijent determinacije R2 za prvi model iznosi 0,3559, dok za drugi model iznosi 0,0266, što znači da je varijabilnost povrata na aktivu objašnjena 35,59% i 2,66% varijablama korištenim u prvom i drugom modelu.

Tabela 5 prikazuje rezultate regresijske analize veze između strukture kapitala i profitabilnosti mjerene povratom na kapital – ROE, ponovo kroz dva modela. Zavisna varijabla u oba modela je ROE, dok su

Tabela 5: Struktura kapitala i profitabilnost iskazana povratom na kapital ROE

Estimacija RE modelom (ROE_OA)				
	Coef.	Std. Err.	z	P> z
OA	-0,10	0,0353075	-2,75	0,006
logV	0,01	0,02	0,74	0,461
KA	0,03	0,02	1,99	0,047
RKGK	-0,0758315	0,0835231	-0,91	0,364
OTA	0,0825705	0,1858656	0,44	0,657
TU	0,1708826	0,1144611	1,49	0,135
INF	-0,0029067	0,1146738	-0,03	0,98
logBNDpc	0,301668	0,0727027	4,15	0
_cons	-1,165319	0,2556029	-4,56	0
Wald test	63,94			
R ²	0,4401			
No of obs	165			

Estimacija FE modelom (ROE_OK)				
	Coef.	Std. Err.	t	P> t
OK	0,00	0,0009488	-2,92	0,004
logV	0,04	0,03	1,31	0,191
KA	0,03	0,02	1,82	0,071
RKGK	-0,0130529	0,080291	-0,16	0,871
OTA	0,0164192	0,2115853	0,08	0,938
TU	-0,2903439	0,1923366	-1,51	0,133
INF	-0,0011192	0,1056713	-0,01	0,992
logBNDpc	0,2562459	0,0813768	3,15	0,002
_cons	-1,147472	0,2516744	-4,56	0
F test	8,27			
R ²	0,0057			
No of obs	165			

Izvor: izračuna autora

nezavisne varijable u prvom modelu omjer duga i imovine (OA) kao varijabla koja opisuje strukturu kapitala i ostale varijable specifične za banku, te makroekonomske varijable, a u drugom modelu odnos duga i kapitala (OK) kao varijabla koja opisuje strukturu kapitala, i ostale varijable specifične za banku, te makroekonomske varijable.

Po negativnom predznaku koeficijenata u prvom modelu, te neutralan koeficijent u drugom modelu, može se zaključiti da struktura kapitala mjerena omjerom obaveza u odnosu na aktivu ima negativan uticaj na profitabilnost banaka u FBiH, mjerenoj povratom na kapital. Veličina aktive banke, omjer kredita i aktive, upravljanje operativnim troškovima, te bruto nacionalni dohodak per capita imaju pozitivnu vezu s profitabilnošću banaka mjerene povratom na kapital u oba modela. Negativnu vezu ima varijabla kreditnog rizika i inflacija, dok tržišno učešće ima različit predznak koeficijenta u dva modela.

U prvom modelu, koeficijent varijable omjera duga i imovine (OA) iznosi -0,10 s p – vrijednošću 0,006, što indicira da povećanje duga prema imovini za 1% dovodi do smanjenja profitabilnosti mjerene povratom na kapital za 10% uz statističku značajnost na nivou 1%. U drugom modelu, koeficijent varijable odnos duga i kapitala (OK) iznosi 0,00 uz p – vrijednost 0,004, što indicira da povećanje finansiranja dugom u odnosu na kapital nema uticaj na profitabilnost banaka u FBiH, uz statističku značajnost na nivou 1%.

Od preostalih kontrolnih varijabli, najveći uticaj na profitabilnost mjerenu povratom na kapital imaju varijabla ekonomskog ciklusa, tržišno učešće, upravljanje operativnim troškovima i kreditni rizik. Povećanje bruto nacionalnog dohotka per capita za 1% dovodi do povećanja profitabilnosti mjerene povratom na kapital za 3,01% u prvom modelu, te za 2,56% u drugom modelu. Povećanje tržišnog učešća za 1% dovodi do povećanja profitabilnosti mjerene povratom na kapital za 1,71% u prvom modelu, te za 2,90% u drugom modelu. Povećanje udjela operativnih troškova u aktivu za 1% dovodi do smanjenja profitabilnosti mjerene povratom na kapital za 8,25% u prvom modelu, te za 1,64% u drugom modelu.

Koeficijent determinacije R² za prvi model iznosi 0,4401, dok za drugi model iznosi 0,0057, što znači da je varijabilnost povrata na kapital objašnjena 44% i 0,57% varijablama korištenim u prvom i drugom modelu.

Naposljetku, tabela 6 donosi rezultate regresijske analize relacije strukture kapitala i profitabilnosti mjerene neto profitnom maržom – NPM, kroz dva ranije objašnjena modela. Zavisna varijabla u oba modela je NPM, dok su nezavisne varijable omjer duga i imovine (OA) kao varijabla koja opisuje strukturu kapitala i ostale varijable specifične za banku, te makroekonomske varijable, prvom modelu, a u drugom su to odnos duga i kapitala (OK) kao varijabla koja opisuje strukturu kapitala, i ostale varijable specifične za banku, te makroekonomske varijable.

Tabela 6: Struktura kapitala i profitabilnost iskazana povratom na kapital ROE

Estimacija RE modelom (NPM_OA)				
	Coef.	Std. Err.	z	P> z
OA	-0,44	0,1115482	-3,97	0
logV	-0,04	0,05	-0,71	0,479
KA	0,09	0,05	1,82	0,069
RKGK	-0,2529283	0,2699306	-0,94	0,349
OTA	-1,186878	0,5824963	-2,04	0,042
TU	0,7575806	0,3300018	2,3	0,022
INF	-0,1203507	0,3752372	-0,32	0,748
logBNDpc	1,127895	0,2305959	4,89	0
_cons	-3,744105	0,8240382	-4,54	0
Wald test	80,3			
R ²	0,4433			
No of obs	165			
Estimacija FE modelom (NPM_OK)				
	Coef.	Std. Err.	t	P> t
OK	-0,01	0,0031914	-3,41	0,001
logV	0,06	0,09	0,69	0,489
KA	0,07	0,06	1,25	0,215
RKGK	0,0130541	0,2700536	0,05	0,962
OTA	-0,8454435	0,7116532	-1,19	0,237
TU	-0,3630822	0,6469116	-0,56	0,576
INF	-0,0700308	0,3554185	-0,2	0,844
logBNDpc	0,9452761	0,2737056	3,45	0,001
_cons	-3,841913	0,8464902	-4,54	0
F test	8,81			
R ²	0,2072			
No of obs	165			

Izvor: izračuna autora

Obzirom na negativne predznake koeficijenata u oba modela, možemo zaključiti da struktura kapitala negativno utiče na profitabilnost banaka u FBiH, mjerenoj neto profitnom maržom. Veličina aktive banke, tržišno učešće, te varijabla kreditnog rizika, kao kontrolne varijable, imaju oprečan rezultat smjera veze u dva modela. Operativni troškovi i inflacija imaju negativan uticaj na profitabilnost, dok bruto nacionalni dohodak pc i omjer kredita i aktive imaju pozitivan uticaj na profitabilnost.

U prvom modelu, koeficijent varijable omjera duga i imovine (OA) iznosi -0,44 s p – vrijednošću 0,00, što indicira da povećanje ovog omjera za 1% dovodi do smanjenja profitabilnosti mjerene neto profitnom maržom za 44%, uz statističku značajnost na nivou 1%. U drugom modelu, koeficijent varijable odnosa duga i kapitala (OK) iznosi -0,01 uz p – vrijednost 0,001, što indicira da povećanje odnosa duga i kapitala za 1% smanjuje profitabilnost mjerenu neto profitnom maržom za 1% uz statističku značajnost na nivou 1%.

Od preostalih kontrolnih varijabli, najveći uticaj na profitabilnost mjerenu neto profitnom maržom imaju varijabla ekonomskog ciklusa, inflacija, upravljanje operativnim troškovima i kreditni rizik. Povećanje bruto nacionalnog dohotka per capita za 1% dovodi do povećanja profitabilnosti mjerene

neto profitnom maržom za 112% u prvom modelu, te za 94% u drugom modelu. Povećanje inflacije za 1% dovodi do smanjenja profitabilnosti mjerene neto profitnom maržom za 12% u prvom modelu, te za 7% u drugom modelu. Povećanje udjela operativnih troškova u aktivima za 1% dovodi do smanjenja profitabilnosti mjerene neto profitnom maržom za 118,68% u prvom modelu, te za 84% u drugom modelu. Varijable tržišnog učešća i kreditnog rizika imaju različit smjer veze u modelima.

Koeficijent determinacije R² za prvi model iznosi 0,4433 dok za drugi model iznosi 0,2072, što znači da je varijabilnost neto profitne marže objašnjena 44% i 21% varijablama korištenim u prvom i drugom modelu.

Zaključak

Rezultati istraživanja, u prvom redu, dovode u pitanje upotrebljivost prinosa na imovinu, kao zavisne varijable. Naime, struktura kapitala ima slab uticaj na profitabilnost mjerenu pokazateljem ROA, dok veličina banke i omjer kredita i imovine nemaju jasnu vezu sa ROA. Finansijska poluga, sa druge strane, ima jasnu negativnu vezu sa ROE. Veličina banke, omjer kredita i imovine, te upravljanje operativnim troškovima, kao endogeni parametri poslovne performanse banke imaju pozitivnu vezu sa profitabilnošću. Izloženost kreditnom riziku negativno je povezana sa prinosom na kapital. Egzogene varijable ekonomskog sistema, poput inflacije i dohotka imaju, očekivano, negativnu, odnosno pozitivnu vezu sa pokazateljima profitabilnosti. Sličan uticaj nezavisnih varijabli na profitabilnost ilustruje i neto profitna marža, kao zavisna varijabla modela.

Ovakvi rezultati, ako se fokusiramo na ROE, kao pokazatelj profitabilnosti, najprije relativiziraju primjenjivost Modigliani-Miller-ove teorije strukture kapitala, koja govori o irelevantnosti strukture kapitala za vrijednost kompanije. Rezultati testiranja najbliže odgovaraju teoriji postupka slaganja, u okviru teoretskih pravca asimetričnih informacija. Prema teoriji postupka slaganja, kompanije se najprije finansiraju internim sredstvima, iz generisanog i zadržanog profita, zatim iz različitih pozicija kapitala. Tek kad iscrpe sva sredstva koja se generišu unutar kompanije, posežu za dugom. Stoga, kako opada profitabilnost banke, očekuje se da raste finansijska poluga. Ova teorija je primjenjiva na imperfektna tržišta u razvoju, kojima kolaju asimetrične informacije.

Ipak, negativna veza između povećanja duga i povrata na kapital ne mora nužno biti rezultat direktne povezanosti. Na povrat na kapital može uticati operativna efikasnost i efikasnost same upotrebe imovine, pa bi negativna veza između poluge i povrata na kapital mogla imati i sljedeću putanju: povećanje duga ima negativan uticaj na operativnu i efikasnost upotrebe imovine. Smanjujući efikasnost, smanjuje se i profitabilnost, odnosno povrat na kapital. Pad efikasnosti s porastom udjela duga u finansiranju može imati svoje ishodište u relaciji vlasnik (dioničar) – agent (menadžer), jer vlasnik ne može u potpunosti kontrolisati i predvidjeti operativnu efikasnost i efikasnost korištenja imovine. Osim toga, ako menadžeri teže da smanje izloženost riziku koja dolazi s povećanjem duga, mogu propustiti dobre plasmane, što se može odraziti i na povrat na kapital.

Nadalje, rezultati ukazuju da profitabilnost banaka raste kako raste nivo finansiranja aktive internim izvorima, odnosno dobiti i kapitalom. Negativna veza između poluge i neto profitne marže ukazuje na to da pasiva banaka u FBiH u velikoj mjeri zavisi od depozitne osnove, što je jedina opcija za banku koja posluje na tržištu, na kojem je tržište duga i kapitala još u povojima. U vrijeme negativne kamatne stope, finansiranje depozitima nije skupo, ali u uslovima više kamatne stope efikasniji bi bio pristup finansiranju na domaćem finansijskom tržištu. Finansiranje lokalnih banaka na međunarodnom

finansijskom tržištu, pored upitnog i otežanog pristupa, nedostatka upućenosti i iskustva, visokih troškova, uvijek sadrži u sebi komponentu rizika zemlje, što dodatno poskupljuje sredstva.

Za razliku od finansijske poluge, veličina banke ima značajno pozitivnu vezu s profitabilnošću, mjenom sa sva tri parametra. Postoji više mogućih razloga za ovakav rezultat. Jedan od njih je ekonomija obima koju banka postiže svojim rastom, dok joj pri tome fiksni troškovi ostaju isti ili imaju manju stopu rasta od rasta prihoda. Drugi razlog je da se rastom banke povećava kapacitet zaduživanja, a smanjuje trošak bankrota. Povjerioci više vjeruju velikim bankama za koje se pretpostavlja da imaju manju volatilnost zarade i dobre performanse. Povjerioci će prije dati kredit velikim bankama zbog uvjerenja da su "too big to fail", čak i u uslovima malog i nerazvijenog tržišta, sa skromnim kapacitetima osiguranja depozita. Ovaj nalaz upućuje na tradicionalnu teoriju strukture kapitala, koja upravo ukazuje da veličina kompanije ima pozitivan uticaj na profitabilnost, zbog ekonomije obima i pozitivne percepcije dioničara i drugih interesnih grupa.

Banke u Federaciji Bosne i Hercegovine posluju uz visoku finansijsku polugu i relativni nisku profitabilnost. Odluka o finansiranju, čini se, nije u domenu aktivnog finansijskog menadžmenta, nego se radi, zapravo o pasivnoj rezultanti okolnosti, shodno postavkama teorije postupka slaganja. Step en zaduženosti najprije je određen depozitnom funkcijom banaka, te finansiranjem kapitalom u skladu sa regulatornim zahtjevima. Prinos na kapital, u takvim okolnostima je rezultanta, prije nego ishodište finansijskog menadžmenta.

Sa druge strane, nerazvijenost domaćeg, te limitiran pristup međunarodnim finansijskim tržištima, objektivno ograničavaju menadžment banaka u optimizaciji strukture kapitala i pronalasku adekvatnog nivoa finansijske poluge, koji bi bio u funkciji maksimizacije vrijednosti banaka. Izvor profitabilnosti lokalnih banaka, stoga se može tražiti u veličini, ekonomiji obima, te operativnoj efikasnosti i efikasnosti upotrebe imovine, prije nego u finansijskoj poluzi.

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IMPACT OF CAPITAL STRUCTURE ON BANK PROFITABILITY IN THE FEDERATION OF BOSNIA AND HERZEGOVINA

Valentina Bošnjak, (Raiffeisen bank dd BiH, Sarajevo),
email: valentina.bosnjak@raiffeisengroup.ba i
Prof. Džafer Alibegović, PhD, tenured professor at the Faculty of
Economics, University of Sarajevo
email: dzafer.alibegovic@efsa.unsa.ba

Summary

Research of the relationship between the structure of sources of financing and the value of the company are numerous in developed markets and for non-financial companies. However, in the markets of developing countries, and especially in the banking sector, the range of research is much narrower. In this paper, we investigate the existence, direction and intensity of the relationship between capital structure and profitability of banks in the Federation of B&H. The entire population of banks in the Federation of B&H, in the period from 2009-2018, served as a sample. As independent variables, parameters of the structure of financing sources, we chose the debt-to-assets ratio, and debt-to-equity ratio, and as dependent variables, bank value indicators, we took profitability measures, i.e., ROA, ROE, and the net profit margin. In addition to the variables that describe the capital structure, the relationship of which is the topic of this paper, as control variables we used additional variables specific to banks, which describe the bank's liquidity, credit risk exposure, operating cost management, size, and market share. The impact of the macroeconomic environment is observed through the assessment of inflation and gross national income per capita, which indicate the direction of the economic cycle for a given year. The results of the research testify to the weak connection between the structure of sources of financing and return on assets, i.e., the negative connection between financial leverage and return on capital. This outcome first relativizes the significance of Modigliani-Miller's position on the irrelevance of capital structure, and then raises the question of the validity of traditional theory. The establishment and management of the capital structure of local banks can only be explained by the pecking order theory.

Keywords: capital structure; financial leverage; bank profitability; traditional theory; Modigliani-Miller position; pecking order theory

JEL classification: G21, G32

Introduction

The financing decision is one of the three basic decisions of financial management of all companies, including financial institutions (in addition to the investment decision and the asset management decision). As the structure of financing sources, in principle, consists of debt and capital, and as debt is considered a cheaper source of financing (due to lower levels of associated risk), the question of utilization of leverage (actually, debt levels in the structure of funding sources) has occupied the attention of both the academic and professional communities for more than half a century. While academic interest focuses on the relationship between leverage and company value, the interest of financial managers is focused on reducing the cost of financing, and thus increasing the profitability of the company they manage (and ultimately, increasing the value of the company).

Despite the divided opinions of the academic community regarding the relationship between financial leverage and company value (there are numerous studies that show a positive relationship, as well as papers that deny such a relationship), the behavior of financial managers around the world is mainly based on the idea that the optimal use of financial leverage can increase company value. However, research based on the banking market and banks is much rarer, especially in the markets of transition countries. The aim of this paper is to test the relationship between the structure of funding sources and profitability (one of the basic measures of value) of banks in the Federation of Bosnia and Herzegovina.

Theoretical Background

The study of the relationship between the structure of sources of financing (capital, in a broader sense) and the value of the company results in several different views, which can still be categorized in four theoretical directions:

- Modigliani-Miller theory,
- Traditional theory,
- Agency models (Choice theory), and
- Theory of asymmetric information.

Back in 1958, Franco Modigliani and Merton Miller laid the foundation for modern views on capital structure, arguing that capital structure does not affect the perception of value and value of the company at all. Under the assumption of perfect competition, the value of the company is affected only by cash flows and the amount of business risk that the company undertakes, while the level of indebtedness is not a variable relevant for assessing and determining the value of the company. The value of an indebted company before tax is equal to the value of an indebted company, in conditions of a perfect market. Subsequently, however, the authors consider the circumstances in which there is a taxation of profits, and prove that, after taxation, there is a difference between a company with financial leverage and without leverage (Ross et al, 2013).

Modigliani-Miller's theory provoked academic controversy and gave rise to several new views on the problem. Traditional theory defines an optimal capital structure as the equality of the minimum cost of financing a company and the weighted average cost of capital and argues that there is an optimal capital structure (Brealey et al, 2011). At low debt levels, lender risk remains constant while

shareholder risk increases, yet the total cost of capital is low. After a certain level of indebtedness, the risk of both creditors and shareholders begins to grow. Lenders incorporate their risk into the cost of debt, and shareholders demand a higher rate of return on capital. According to traditional theory, the job of a manager is to find a level of indebtedness that minimizes the weighted average cost of capital while maximizing the value of the company.

The Choice theory introduces two new variables on which the capital structure depends, namely agency costs and bankruptcy costs. According to this theory, an optimal capital structure exists, and it lies in the equality of benefits and costs of debt. The benefits of debt can be a reduced tax amount and a reduction in agency costs, while borrowing can result in bankruptcy and agency costs. The conclusion of the theory is that financial leverage has a positive relationship with the probability of financial stress that a company may experience, the value of the company, the level of regulation, cash flows, liquidation value, the level at which the company is a possible object of take-over and the reputation of management. The financial leverage has a negative relationship with the possibilities of further development, interest coverage, the cost of analyzing the company's perspective and the probability of reorganization that occurs after the company experiences financial stress (Brealey et al, 2011).

Models based on asymmetric information are based on the idea of the existence of asymmetric information between different stakeholders: managers, shareholders, creditors. Within the model, two theoretical directions stand out: signaling theory and packing order theory. Signaling theory starts from the assumption that managers borrow when they invest in a profitable investment, so that they do not have to share earnings with shareholders. Therefore, the public believes that the increase in leverage is a signal of expected good profitability (Harris, 1991). Pecking order theory assumes that there is an order in which managers choose the source of funding. The investment project will be financed first from the accumulated profit, then by low-risk debt instruments, convertible bonds and finally by common shares (Vidučić et al, 2018).

Literature Review

Each of the briefly described theoretical approaches to the problem of the optimal structure of funding sources has encouraged many authors to research, in order to confirm or refute theoretical concepts. Research based on the practice of companies in developed markets are relatively numerous, while the situation in transition (emerging and marginal) markets is different. We will present some of the papers that treat the relationship between the structure of funding sources and the value of companies and banks, relevant to our research, both in terms of relative comparability of the environment and the research methodology used.

When it comes to developed markets, it is first necessary to highlight the research conducted by Berger (1995) on the American banking market. All insured commercial banks served as a sample. The observed period was 1983-1989, including a three-year lag, for data on capital to assets (CAR) and return on equity (ROE). The author first determines the causality of the relation between CAR and ROE (Granger test), and then examines the direction of the relation. Contrary to the expected negative sign, which is consistent with the theoretical assumptions, the research results showed a positive direction between the share of capital in assets and return on capital. The regression model also used a number of control variables, such as the HH concentration index, the bank's share in total

deposits, deposit growth rates, and the ratio of risk-weighted assets, bad loans and written-off loans to total bank assets.

Cooper et al. (2003) investigate the possibility of predicting bank returns on a sample of 213 publicly traded banking holding groups, for the period from June 1986 to December 1999. The focus of this research is not exclusively on examining the relationship between the structure of sources of financing and profitability, but the range of independent variables is much wider and included trends of: loan-to-asset ratio, loan-to-loan ratio, non-interest-bearing interest ratio, credit letters, interest rate swaps and total loans, as well as (relevant to us) the ratio of the book value of capital and the total value of assets. The dependent variable is the percentage change in quarterly earnings per share. The research is aimed at examining the relationship between fundamental indicators of banks' business performance and the market performance of its shares. The results of the research showed that the movement of non-interest income, loan provisions, earnings, letters of credit issued, and financial leverage (capital to assets ratio) have the predictor power of earnings per share. A regression (this time a panel) model was again used to test the relations.

Demirguc-Kunt and Huizinga deal with the problem of the relationship between the financial structure (but also much more broadly, the characteristics of the financial system) and the profitability of banks. The authors use a regression model to test the relationship of three groups of independent variables with indicators of bank profitability (net margin and profit ratio before taxes and assets). Independent variables are divided into: bank-specific (capital to assets ratio, loan to assets ratio, non-interest income to assets ratio, deposit to assets ratio, and operating costs to assets ratio), macroeconomic indicators (GDP per capita, growth rate, inflation rate, tax rate), and financial system indicators (asset ratio of deposit banks and GDP, asset ratio of central bank and GDP, ratio of loans to private sector and GDP, ratio of stock market capitalization and GDP, ratio of total value of traded shares and GDP, the ratio of capitalization and assets of banks, the ratio of the value of traded shares and loans to the private sector, the product of the value of traded shares and average operating costs of banks, and a complex indicator of the banking sector structure-average value of capitalization and assets and product turnover and operating costs). The survey was conducted on data from banks from 44 countries (developed, developing countries and underdeveloped countries), for the period 1990-1997. The results indicate that banks have higher profit rates and higher margins in less developed financial systems, despite expensive resources and operational inefficiencies. With the development of the financial system, the efficiency of banks increases, but also the competition between them, and therefore the profitability indicators decrease.

When it comes to the markets of transition countries, research that deals with the relationship between the structure of sources of financing and profitability is significantly more common for companies than for banks. For example, Gupta et al. (2011) test the relationship between the level of debt in Indian companies' sources of financing and return on investment (ROI), return on equity (ROE), return on share (RET), earnings before taxes and sales (EBIT/S) and the ratio of operating income to sales (OPR/S). Khan (2012), on a sample of companies from the Pakistani Stock Exchange, tests the relationship between ROA, ROE, gross profit margin (GPM) and Tobin Q, as dependent variables, and the ratio of short-term to total debt (STDTA), long-term to total debt (LTDTA), and the ratio of total debt to assets (TDTA), as independent variables, representing the structure of financing sources. Adekunle and Sunday (2010) investigated the effect of capital structure on the financial performance of companies in Nigeria, where an independent variable, the capital structure is measured by the debt-to-asset ratio, and dependent with ROA and ROE ratios. The Nigerian Stock Exchange served

as basis to the Luper and Isaac survey (2012) as well. The authors used the ratio of short-term debt to total assets (STDTA), long-term debt to total assets (LTDTA), and the debt-to-equity ratio (TDE), as independent variables, and as dependent variables and performance indicators return on assets (ROA) and profit margin (PM). Ebaid (2009) examined the relationship between capital structure and the performance of non-financial companies on the Egyptian stock exchange. The author measured business performance with accounting indicators ROA, ROE, and gross profit margin (GPM), and financial leverage was measured by the ratio of short-term debt to total assets (STD), long-term debt and total assets (LTD), and the ratio of total debt to total assets (TTD). Abu Rub (2012) investigates the effect of capital structure on company performance based on data from the Palestinian Stock Exchange (PSE) for the period 2007-2010, using a linear multiple regression analysis. Performance is a dependent variable measured by both accounting and market indicators. ROA and ROE were used as accounting indicators, and Tobin Q, EPS, and the ratio of market to book value of capital (MBVR) as market indicators of company performance. The capital structure is an independent variable represented by the ratio of short-term debt to total assets (SDTA), long-term debt and total assets (LDTA), total debt and total assets (TDTA), total debt and total capital (TDTQ).

The mentioned research brings different results on the connection between the capital structure and the business performance of the companies. Some studies have shown a positive relationship (Gupta et al.), a negative relationship (Adekunle and Sunday, Luper and Isaac), or the absence of a relationship or mixed effects (Ebaid, Abu Rub, Khan).

Papers related to the research of the relationship between the structure of sources of financing and the performance of banks are somewhat less represented. However, we will point out a few. Authors Siddiqui and Shoaib (2011) investigated the theory of agency costs in the banking sector of Pakistan using panel data from 22 banks in the period 2002-2009. They used the efficiency of the bank as a dependent variable, and as independent variables they used: financial leverage, earnings, risk, size, investments and loans. The bank's efficiency was measured by the ROE coefficient and Tobin's Q, which were used as proxy variables to measure earnings efficiency and market value. The results of the study showed that the bank's profitability increases significantly with the increase in leverage. During the observed period, the size of the bank also played a significant role in the efficiency in earnings generation and market value. Finally, the authors suggested to banks that, in order to improve the efficiency and quality of management, they should separate ownership from management. They also noted the need to move from consumer banking to real sector lending and instead of short-term earnings from lending home and car purchases, focus on longer-term investments.

The impact of ownership structure, on the business performance of commercial banks in Ethiopia, was investigated by the authors Kapur and Gualu (2012). They measured the performance by analytical measures such as profitability, asset quality, efficiency, liquidity and capital management, while under the ownership structure they viewed the state versus private capital, rather than the use of leverage. The object of the research were 8 commercial banks, 6 of which were private, while 2 banks were state-owned, and their performance in the period 2001-2008. The return on assets (ROA), net interest margin (NII), return on equity (ROE), and non-interest income were considered as indicators of profitability. Efficiency was measured by the share of non-interest expenses in the average amount of assets, the share of general expenses in assets, the share of employee costs in assets and the share of general expenses in revenues. The following variables were used as asset quality indicators: reservations for non-performing loans, reservations for total loans, reservations for total assets and the amount of non-performing loans (NPLs). Liquidity was measured by the following

indicators: the share of loans in deposits, the share of liquid assets in total assets, and the share of liquid assets in deposits. Capital adequacy was measured by the share of capital in loans, the share of capital in assets, the share of capital in net loans and the share of capital in deposits. Based on the study, looking at profitability, asset quality and capital adequacy, the authors concluded that private banks have a better business performance than state-owned banks. However, in the management of costs, state-owned banks are in the lead, while in liquidity management there are no significant differences between private and state-owned commercial banks.

Author Yaregal (2011) conducted a study with the same topic and scope of research as Kappur and Gualu, for the period 2005-2010, gaining significantly different results. The study showed that state-owned banks perform better in profitability, liquidity and efficiency, while private banks achieve better capital adequacy and faster growth.

A study of the relationship between capital structure and performance of banks listed on the Ghana Stock Exchange was conducted by the authors Awunyo-Vitor and Badu (2011). They used a qualitative and quantitative approach and processed qualitative data by panel regression analysis. The dependent variable - bank performance was measured by ROA and ROE, and Tobin's Q, and the independent variable - capital structure, was expressed by the share of debt in capital. The results of the study showed a statistically significant negative relationship between capital structure and business performance, based on which the author concluded that banks in the Ghanaian market had high leverage, which consisted mainly of short-term debt, not adding to profitability.

For the financial market of Southeast Europe, the works of Athanasoglou and others are especially relevant. In the paper "Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability" (Athanasoglou et al., 2005), the authors used a linear regression model on a number of Greek banks in the period 1985-2001, seeking to identify determinants of profitability, from three separate groups: determinants specific to banks (ratio of capital and assets-EA, ratio of provisions for loans and credits-PL, ratio of income and number of employees-PR, ratio of operating costs and assets-EXP, bank size-S and S2), banking industry (bank ownership type - closed-Op or public-Om, HHI concentration index), and macroeconomic determinants (inflation rate-CPI or IR, economic cycle stage-CO). They use ROA and ROE as indicators of profitability. The results of the research indicate that capital is an important determinant of profit, and that increased risk exposure reduces the profit rate. Also, labor productivity has a positive and significant relationship with yield. Operating costs have a negative impact on yield, while bank size is not a significant determinant. When it comes to macroeconomic variables, a significant relation of inflation and stages of the economic cycle was determined, with an indication of asymmetry, since the positive relation of the economic cycle with the yield was determined only in the phases of above-average yield.

In the paper "Determinants of Bank Profitability in the Southeastern European Region" (Athanasoglou et al., 2006), the authors apply a similar methodological framework, but on a much broader sample. This time the research is based on an unbalanced sample of 71 to 132 banks (different number of banks in the observed years), for the period 1998-2002, from seven countries of Southeast Europe (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, North Macedonia, Romania, and Serbia). The ROA and ROE were again selected as dependent variables, and the authors divided the independent variables, as in the previous research, into three groups: specific for individual banks (loan-to-assets ratio-LA, loan-to-loan reserves-LLP, capital-to-assets ratio- EA, the ratio of operating costs and assets-OEA, and the size of the bank-S and S2, origin of ownership-Dfo and market share-MS), determinants of the banking

industry (EBRD banking system reform index and HHI concentration index), and macroeconomic variables (inflation rate-INF and real per capita income-RGC). The data were prepared in a panel, and the relations were tested in the LS model with fixed and random effects. The results indicate a positive relation LA, EA, S, MS, HHI, INF, RGC with ROA, a negative relation LLP, OEA, S2 with ROA, and a mixed relation Dfo by observed countries. With ROE, a positive relation of the variables LA, EA, S, S2, MS, HHI, INF and RGC was recorded, a negative relation of the variables LLP and OEA, while the sign of the relation of the variable Dfo is again different, depending on the country where the banks are based.

We have not found research on this problem in the local banking market. Although the authors Kadić (2017) and Milisav (2018) conducted a kind of analysis of the capital structure of banks in the FB&H, they mostly relate to the impact of banks with majority foreign capital on the profitability and efficiency of the banking sector. To our knowledge, at the time of writing this paper, the relationship between capital structure and profitability of commercial banks in the Federation of B&H has not been examined.

The considered empirical studies bring different results of the connection between the capital structure and the business performance of both companies and banks. Nevertheless, research is useful in methodological terms. We have shown that the authors use the share of short-term debt in total assets (STD), the share of long-term debt in total assets (LTD), the share of total debt in total assets (TDA) and the share of debt in total capital (TDTQ) to measure capital structure. As performance measurement they use earnings per share (EPS), return on assets (ROA), return on equity (ROE), Tobin Q, gross profit margin (GPM) and the ratio of market value to book value of capital.

Research Methodology

There are 15 commercial banks operating on the market of the Federation of B&H, which is a number that has been constant since 2016. Of that number, 14 banks are majorly privately owned, and only one bank is state-owned. The ownership structure of private banks is dominated by foreign ownership (10 banks), with Austrian, Turkish and Croatian capital at the helm. The research was done on the complete population, in the ten-year period of 2009-2018.

When it comes to the business performance of the industry, we can point out that in 2009 and 2010, which are the first two years covered by the survey, profitability measured by ROA, ROE and net profit margin is stable but relatively low, namely: 0.44%, 2.17% and 7.18% in 2009, respectively, and 0.41%, 2.22% and 11.01% in 2010, respectively. Profitability ratios in these years reflect the consequences of the 2008 crisis. Already in 2011, there was a noticeable increase in profitability, which is especially evident through the net profit margin, which increased by 3.46 pp compared to the previous year. The main drivers of profitability growth in 2011 are the growth of net interest income and the reduction of risk costs in the form of value adjustments, as a result of the slowdown in the deterioration of the quality of the loan portfolio.

The trend of profitability growth started in 2011 and remained until the end of the observed period. In the last year, 2018, compared to the beginning of the period, the profitability of banks represented by the coefficients ROA, ROE and NPM increased by 117%, 210% and 214% respectively. In general, it can be concluded that the banking sector in the Federation of B&H flourished in the period from 2009 to 2018, despite the large loss-making baggage of the banking sector, and an additional blow,

the spillover of the global economic crisis on the FB&H market.

The purpose of this research is to examine the relationship between capital structure and profitability of commercial banks in the Federation of B&H. The following were selected as independent variables, i.e., representatives of the capital structure:

- ratio of total liabilities to total assets (hereinafter OA coefficient),
- ratio of total liabilities to total capital (hereinafter coefficient OK).

The following were selected as dependent model variables, i.e. profitability representatives:

- return on assets, i.e., the ratio of net profit to total assets (hereinafter ROA coefficient),
- return on capital, i.e., the ratio of net profit to total capital (hereinafter ROE ratio),
- net profit margin, i.e., the share of net profit in total revenue (hereinafter NPM).

In addition to the independent variables that describe the capital structure and whose relationship to bank profitability is the primary focus of this research, the following bank-specific variables were added, which have a controlling role in the model:

- liquidity, measured by the ratio of loans and assets (hereinafter KA ratio)
- credit risk, measured by the ratio of provisions for credit losses to loans (hereinafter RKGK ratio)
- management of operating costs, measured by the share of operating costs in the amount of assets (hereinafter OTA coefficient)
- size, measured by the logarithm of the total assets of the bank (hereinafter logV)
- market share, measured by the share of banks' assets in total assets for the observed year (hereinafter TU)

Macroeconomic conditions and the direction of the macroeconomic cycle also have a significant impact on banks' profitability. For this reason, the following economic variables were also observed in the model:

- inflation, measured by the average annual growth rate of the consumer price index (hereinafter INF)
- economic activity, measured by gross national income per capita (hereinafter BNDpc)

For the variable size and economic activity, logarithmic amounts were observed in order to equalize the variations among the asset sizes of different banks, and in order to make the descriptive analysis of statistical data series more efficient.

The research relies entirely on secondary data and on publicly available financial statements. For the period 2009-2013, the official document of the FB&H Banking Agency, entitled Abbreviated Report of External Auditors on Financial Statements of Banks in the Federation of Bosnia and Herzegovina, was used. Considering that the issuance of the abbreviated report of external auditors ceased at the end of 2013, the financial statements for the period 2014-2018 were collected from the website of the Sarajevo Stock Exchange.

A regression model according to the following formula was used to specify the model:

$$Y_{it} = a + \sum_{j=1}^J b_j X_{it}^j + \sum_{m=1}^M b_m X_{it}^m + \varepsilon_{it}, \quad (1)$$

where:

Y_{it} – dependent variable for the bank and in year t (ROA, ROE, NPM),

a – section on the y-axis,

$\sum_{j=1}^J b_j X_{it}^j$ – independent variables j specific for bank i in year t (OA, OK, KA, RKGK, OTA, logV, TU)

$\sum_{m=1}^M b_m X_{it}^m$ – independent macroeconomic variables m for the bank and in year t (INF, BND_{pc})

ε_{it} – model error, a random variable that gives a stochastic character to the model.

The data were prepared in a panel, with the dimensions of the years of the observed period and the banks from the sample. After descriptive statistics, a correlation analysis was performed to determine the existence, significance, and intensity of the relationship between independent and dependent variables. The relationship between the capital structure and profitability of banks was tested by applying regression analysis with the model of fixed effects (Least-Squares Dummy Variable Regression - LSDV Regression) and the model of random effects (Random Effects Model - REM), after which the Hausman test evaluated which model was more suitable. As a prerequisite for the application of the model, all predicted tests were performed (test of normality, multicollinearity, autocorrelation, and heteroskedasticity test).

Research Results

In order to consider the general statistical features of the sample (size, minimum and maximum, homogeneity and rank), we first present the results of descriptive statistical analysis:

Table 1: Measures of Mean Value and Variation (descriptive statistics)

Variable	N	Minimum	Maximum	Mean	St.deviation
ROA	165	0	0.019212	0.0063259	0.0058264
ROE	165	0	0.1481511	0.0404842	0.0387715
NPM	165	0	0.4090981	0.1315073	0.1163357
OA	165	0.3478953	0.9499514	0.8307712	0.0837217
OK	165	1.2671994	18.980588	6.1733379	3.0896395
logV	165	4.7339512	6.7760019	5.7525849	0.4944672
KA	165	0.0651834	0.9370046	0.6336301	0.1652893
RKGK	165	0	0.160224	0.0177104	0.0274435
OTA	165	0.0043172	0.0965474	0.0355415	0.0147759
TU	165	0.0035802	0.28488	0.0606061	0.072457
INF	165	-0.011	0.037	0.0070061	0.0157079
logBNDpc	165	3.861719	3.978155	3.899965	0.0368263

Source: authors' calculations

The presented values indicate the modest profitability of banks in the observed period. Namely, the average value of the net profit margin is 13.15%, while the average values of return on assets and return on capital are 0.63% and 4.05%, which is significantly below the average of the European financial market in the same period (source: European Banking Federation - www.ebf.eu). From the relatively small values of the standard deviation of the same indicators, we can conclude that the business performance of the observed banks is balanced. The ratio of liabilities to assets averaged 83.08%, i.e., the ratio of liabilities to equity was 6.17 times, with slightly greater heterogeneity, measured by standard deviation.

A prerequisite for examining the impact of capital structure on bank profitability is the existence, intensity and sign of the relationship between independent and dependent variables, which we examined by correlation analysis. The following table presents the matrix of Pearson correlation coefficient values, among all variables (* -significant at the level of 5%, ** - significant at the level of 1%):

Table 2: Matrix of Pearson Correlation Coefficients

	OA	OK	ROA	ROE	NPM	logV	KA	RKGK	OTA	TU	INF	logBNDpc
OA	1											
OK	.793**	1										
ROA	-.188*	-.280**	1									
ROE	.124	-.022	.901**	1								
NPM	-.109	.207**	.959**	.909**	1							
logV	.511**	.421**	.262**	.556**	.325**	1						
KA	.382**	.176*	-.078	.104	-.025	.243**	1					
RKGK	-.134	-.076	-.128	-.185*	-.218**	.009	.016	1				
OTA	.239**	.267**	.291**	.362**	.419**	.432**	.093	.185*	1			
TU	.277**	.224**	.399**	.573**	.393**	.851**	.037	.141	.284**	1		
INF	-.112	-.075	-.039	-.044	-.051	-.043	.036	.211**	.021	.000	1	
logBNDpc	.228**	.170*	.246**	.318**	.359**	.270**	.008	.446**	.399**	.047	.166*	1

Source: authors' calculations

The results of the correlation analysis indicate that ROA has a negative relationship with the independent variables OA, OK, KA, RKGK, OTA and INF, and has a positive relationship with logV, TU, logBNDpc. ROE has a positive relationship with OA, logV, KA, TU, logBNDpc, and a negative relationship with OK, RKGK, OTA and INF. NPM has a negative relationship with OA, OK, KA, RKGK, OTA, INF, while with logV, TU and logBNDpc, it has a positive relationship. These correlations would mean that the profitability of the sample of banks in the FB&H, measured by return on assets, increases

with declining share of debt in asset financing, declining exposure to credit risk, operating costs and inflation, and increasing liquidity or declining share of loans in assets. Also, return on assets increases with increasing bank size, market share and economic activity. Return on equity increases with an increase in the share of debt in asset financing, bank size, an increase in the share of loans in assets, market share, and economic activity, and decreases with an increase in debt-to-equity ratio, credit risk, operating costs and inflation, which at first gives an ambiguous conclusion about the relation of ROE and the variables of capital structure. Net profit margin decreases with increasing share of debt in asset financing, increasing debt-to-equity ratio, and with increasing share of loans in total assets, credit risk, operating costs and inflation, while increasing with increasing bank size, market share and economic activity.

Finally, the relationship between the structure of funding sources and the profitability of banks was tested by a regression model of fixed and random effects, according to the previously presented formula. We used the Hausman test to evaluate which model better describes the relationship between the subject variables, the results of which are shown in Table 3.

Table 3: Result of the Hausman Specification Test

Dependent variable	Model	Hausman test result
	Independent variable representing capital	Prob>chi2
ROA	OA	0.7157
ROA	OK	0.0011
ROE	OA	0.7278
ROE	OK	0.0143
NPM	OA	0.9995
NPM	OK	0.0047

Source: authors' calculations

The test result indicates that the random effects model ($p > 0.05$) is more suitable for the relationship of the debt-to-assets ratio and bank profitability measures, while the fixed-effects model ($p < 0.05$) model is more suitable for testing the relationship of capital-to-assets ratio and performance indicators. Table 4 presents the results of the regression analysis of the relationship between capital structure and profitability measured by return on assets - ROA, estimated through two models. The dependent variable in both models is ROA, while the independent variables in the first model are the debt-to-asset ratio (OA) as a variable describing the capital structure and other bank-specific variables, as well as macroeconomic variables, and in the second model the debt-to-equity ratio (OK) as a variable describing the capital structure, and other bank-specific variables, as well as macroeconomic variables.

Table 4: Capital Structure and Profitability Expressed in Return on Assets

RE model estimation (ROA_OA)				
	Coef.	Std. Err.	z	P> z
OA	-0.02	0.0055851	-3.95	0
logV	0.00	0.00	-0.42	0.678
KA	0.00	0.00	1.59	0.112
RKGK	0.0005122	0.0130274	0.04	0.969
OTA	-0.0139369	0.029585	-0.47	0.638
TU	0.0292845	0.0192568	1.52	0.128
INF	-0.0104385	0.0177655	-0.59	0.557
logBNDpc	0.0477477	0.0115084	4.15	0
_cons	-0.1584619	0.0399668	-3.96	0
Wald test	46.32			
R ²	0.3559			
No of obs	165			
FE model estimation (ROA_OK)				
	Coef.	Std. Err.	t	P> t
OK	0.00	0.0001496	-3.87	0
logV	0.00	0.00	0.65	0.518
KA	0.00	0.00	1.19	0.236
RKGK	0.00912	0.0126585	0.72	0.472
OTA	-0.0180483	0.0333579	-0.54	0.589
TU	-0.0281125	0.0303232	-0.93	0.356
INF	-0.0085205	0.0166598	-0.51	0.61
logBNDpc	0.0371742	0.0128296	2.9	0.004
_cons	-0.1506506	0.0396783	-3.8	0
F test	6.77			
R ²	0.0266			
No of obs	165			

Source: authors' calculations

At first glance, according to the negative sign of the coefficients in the first model, and the neutral coefficient in the second model, it can be concluded that the capital structure has a weak impact on the profitability of banks in FB&H, measured by return on assets. The size of a bank's assets, and the ratio of loans to assets, as control variables, have no clear link with banks' profitability measured by return on assets in both models. Of the remaining control variables, profitability in both models is negatively affected by operating costs and inflation, while the results for the impact of market share on profitability are ambiguous. Gross national income per capita has a positive impact on the profitability of banks in the FB&H. The impact of the credit risk variable is negligible.

In the first model, the ratio of the debt-to-assets ratio (OA) is -0.02 with a p value of 0.000, which indicates that an increase in the share of debt in assets by 1% leads to a decrease in profitability measured by return on assets by 2%, with statistical significance at 1%. In the second model, the coefficient of the debt-to-equity (OK) variable is -0.00 with a p value of 0.000, indicating that the impact of the capital structure measured by the debt-to-equity ratio is neutral on profitability measured by return on assets.

Of the remaining control variables, economic cycle variables, market share, and operating cost management have the greatest impact on profitability measured by return on assets. An increase in gross national income per capita by 1% leads to an increase in profitability measured by return on assets by 4.77% in the first model, and by 3.71% in the second model. An increase in market share by 1% leads to an increase in profitability measured by return on assets by 2.92% in the first model, and by 2.81% in the second model. An increase in the share of operating expenses in assets by 1% leads to a decrease in profitability measured by return on assets by 1.39% in the first model, and by 1.80% in the second model.

Furthermore, the coefficient of determination R2 for the first model is 0.3559, while for the second model it is 0.0266, which means that the variability of return on assets is explained by 35.59% and 2.66% by the variables used in the first and second models.

Table 5 shows the results of the regression analysis of the relationship between capital structure and profitability measured by return on capital - ROE, again through two models.

Table 5: Capital Structure and Profitability Expressed in Return on Equity

RE model estimation (ROE_OA)				
	Coef.	Std. Err.	z	P> z
OA	-0.10	0.0353075	-2.75	0.006
logV	0.01	0.02	0.74	0.461
KA	0.03	0.02	1.99	0.047
RKGK	-0.0758315	0.0835231	-0.91	0.364
OTA	0.0825705	0.1858656	0.44	0.657
TU	0.1708826	0.1144611	1.49	0.135
INF	-0.0029067	0.1146738	-0.03	0.98
logBNDpc	0.301668	0.0727027	4.15	0
_cons	-1.165319	0.2556029	-4.56	0
Wald test	63.94			
R ²	0.4401			
No of obs	165			
FE model estimation (ROE_OK)				
	Coef.	Std. Err.	t	P> t
OK	0.00	0.0009488	-2.92	0.004
logV	0.04	0.03	1.31	0.191
KA	0.03	0.02	1.82	0.071
RKGK	-0.0130529	0.080291	-0.16	0.871
OTA	0.0164192	0.2115853	0.08	0.938
TU	-0.2903439	0.1923366	-1.51	0.133
INF	-0.0011192	0.1056713	-0.01	0.992
logBNDpc	0.2562459	0.0813768	3.15	0.002
_cons	-1.147472	0.2516744	-4.56	0
F test	8.27			
R ²	0.0057			
No of obs	165			

Source: authors' calculations

The dependent variable in both models is ROE, while the independent variables in the first model are the debt-to-assets ratio (OA) as a variable describing the capital structure and other bank-specific variables, as well as macroeconomic variables, and in the second model the debt-to-equity ratio (OK) as a variable describing the capital structure, and other bank-specific variables, as well as macroeconomic variables.

According to the negative sign of the coefficients in the first model, and the neutral coefficient in the second model, it can be concluded that the capital structure measured by the ratio of liabilities to assets has a negative impact on bank profitability in FB&H, measured by return on capital. The size of the bank's assets, the loan-to-assets ratio, operating cost management, and gross national income per capita have a positive relationship with banks' profitability measured by return on capital in both models. The variable of credit risk and inflation has a negative relationship, while market share has a different sign of the coefficient in the two models.

In the first model, the debt-to-asset ratio (OA) ratio is -0.10 with a p value of 0.006, indicating that a 1% increase in debt to assets leads to a 10% decrease in return on equity with statistical significance at level of 1%. In the second model, the coefficient of the variable debt-to-equity (OK) ratio is 0.00 with a p value of 0.004, which indicates that the increase in debt-to-equity financing has no impact on the profitability of banks in FB&H, with a statistical significance of 1%.

Of the remaining control variables, economic cycle variables, market share, operating cost management and credit risk have the greatest impact on profitability measured by return on equity. An increase in gross national income per capita by 1% leads to an increase in profitability measured by return on capital by 3.01% in the first model, and by 2.56% in the second model. An increase in market share by 1% leads to an increase in profitability measured by return on equity by 1.71% in the first model, and by 2.90% in the second model. An increase in the share of operating expenses in assets by 1% leads to a decrease in profitability measured by return on equity by 8.25% in the first model, and by 1.64% in the second model.

The coefficient of determination R2 for the first model is 0.4401, while for the second model it is 0.0057, which means that the variability of return on equity is explained by 44% and 0.57% by the variables used in the first and second models.

Finally, Table 6 presents the results of a regression analysis of the relationship between capital structure and profitability measured by net profit margin - NPM, through two previously explained models. The dependent variable in both models is NPM, while the independent variables are the debt-to-assets ratio (OA) as a variable describing the capital structure and other bank-specific variables, as well as macroeconomic variables, in the first model, and in the second they are debt-to-equity (OK) as a variable describing the capital structure, and other bank-specific variables, as well as macroeconomic variables.

Table 6: Capital Structure and Profitability Expressed in Net Profit Margin NPM

RE model estimation (NPM_OA)				
	Coef.	Std. Err.	z	P> z
OA	-0.44	0.1115482	-3.97	0
logV	-0.04	0.05	-0.71	0.479
KA	0.09	0.05	1.82	0.069
RKGK	-0.2529283	0.2699306	-0.94	0.349
OTA	-1.186878	0.5824963	-2.04	0.042
TU	0.7575806	0.3300018	2.3	0.022
INF	-0.1203507	0.3752372	-0.32	0.748
logBNDpc	1.127895	0.2305959	4.89	0
_cons	-3.744105	0.8240382	-4.54	0
Wald test	80.3			
R ²	0.4433			
No of obs	165			
FE model estimation (NPM_OK)				
	Coef.	Std. Err.	t	P> t
OK	-0.01	0.0031914	-3.41	0.001
logV	0.06	0.09	0.69	0.489
KA	0.07	0.06	1.25	0.215
RKGK	0.0130541	0.2700536	0.05	0.962
OTA	-0.8454435	0.7116532	-1.19	0.237
TU	-0.3630822	0.6469116	-0.56	0.576
INF	-0.0700308	0.3554185	-0.2	0.844
logBNDpc	0.9452761	0.2737056	3.45	0.001
_cons	-3.841913	0.8464902	-4.54	0
F test	8.81			
R ²	0.2072			
No of obs	165			

Source: authors' calculations

Given the negative signs of the coefficients in both models, we can conclude that the capital structure negatively affects the profitability of banks in the FB&H, measured by net profit margin. The size of the bank's assets, market share, and the credit risk variable, as control variables, have the opposite result of the direction of the relationship in the two models. Operating costs and inflation have a negative impact on profitability, while gross national income pc and the loan-to-assets ratio have a positive impact on profitability.

In the first model, the coefficient of the debt-to-assets ratio (OA) is -0.44 with a p value of 0.00, which indicates that an increase in this ratio by 1% leads to a decrease in profitability measured by net profit margin by 44%, with statistical significance at level of 1%. In the second model, the debt-to-equity ratio (OK) ratio is -0.01 with a p value of 0.001, indicating that a 1% increase in the debt-to-equity ratio reduces profitability measured by net profit margin by 1% with statistical significance at the level of 1%.

Of the remaining control variables, economic cycle variables, inflation, operating cost management and credit risk have the greatest impact on profitability measured by net profit margin. An increase in gross national income per capita by 1% leads to an increase in profitability measured by net profit

margin by 112% in the first model, and by 94% in the second model. An increase in inflation by 1% leads to a decrease in profitability measured by net profit margin by 12% in the first model, and by 7% in the second model. An increase in the share of operating expenses in assets by 1% leads to a decrease in profitability measured by net profit margin by 118.68% in the first model, and by 84% in the second model. The variables of market share and credit risk have different direction of relationship in the models.

The coefficient of determination R^2 for the first model is 0.4433 while for the second model it is 0.2072, which means that the variability of the net profit margin is explained by 44% and 21% by the variables used in the first and second models.

Conclusions

The results of the research firstly call into question the usability of the return on assets, as dependent variables. Namely, the capital structure has a weak impact on profitability measured by the ROA indicator, while the size of the bank and the loan-to-asset ratio do not have a clear relationship with ROA. Leverage, on the other hand, has a clear negative link to ROE. The size of the bank, the ratio of loans and assets, and the management of operating costs, as endogenous parameters of the bank's business performance have a positive relationship with profitability. Exposure to credit risk is negatively related to return on capital. Exogenous variables of the economic system, such as inflation and income, have, as expected, a negative or positive relationship with profitability indicators. A similar impact of independent variables on profitability is illustrated by the net profit margin, as a dependent model variable.

This result, if we focus on ROE as a measure of profitability, first relativizes the applicability of Modigliani-Miller's theory of capital structure, which speaks to the irrelevance of capital structure to company value. The results of the regression analysis on the relationship between capital structure and profitability are most closely described by the pecking order theory, within the theoretical directions of asymmetric information. According to the pecking order theory, companies are first financed by internal funds – generated and retained profits, then from various capital positions. Only when all the funds generated within the company are exhausted, management reach for debt. Therefore, as the bank's profitability declines, financial leverage is expected to grow. This theory is applicable to imperfect emerging markets, which are characterized by asymmetric information flow.

However, the negative link between debt increase and returns on capital is not necessarily the result of a direct link. The return on capital can be affected by the operational efficiency and the efficiency of the use of assets, so the negative relationship between leverage and return on capital could have the following path: the increase in debt has a negative impact on the operational and efficiency of the use of assets. By reducing efficiency, profitability, i.e., return on capital, also decreases. The decline in efficiency with the increase in the share of debt in financing may have its origin in the relationship owner (shareholder) - agent (manager), because the owner cannot fully control and predict the operational efficiency and efficiency of use of assets. In addition, if managers tend to reduce the risk exposure that comes with increasing debt, they may miss good placements, which can be reflected in return on equity.

Furthermore, the results indicate that the profitability of banks increases as the level of financing by internal sources, i.e., profit and capital, increases. The negative relationship between leverage and net profit margin indicates that the liabilities of banks in the FB&H largely depend on the deposit base, which is the only option for a bank operating in a market where the debt and capital market is still in its infancy. At a time of negative interest rates, financing with deposits is not expensive, but in conditions of higher interest rates, access to financing on the domestic financial market would be more efficient. Financing of local banks in the international financial market, in addition to questionable and difficult access, lack of knowledge and experience, high costs, always contains a component of country risk, which further increases the cost of funds.

Unlike financial leverage, the size of a bank has a significantly positive relationship with profitability, measured by all three parameters. There are several possible reasons for this result. One of them is the economies of scale that the bank achieves through its growth, while its fixed costs remain the same or have a lower growth rate than revenue growth. Another reason is that the growth of the bank increases the capacity of borrowing and reduces the cost of bankruptcy. Creditors trust larger banks that are supposed to have lower earnings volatility and good performance. Creditors are more likely to lend to large banks because they believe they are "too big to fail", even in a small and underdeveloped market, with modest deposit insurance capacity. This finding points to the traditional theory of capital structure, which just indicates that the size of the company has a positive impact on profitability, due to economies of scale and positive perception of shareholders and other stakeholders.

Banks in the Federation of Bosnia and Herzegovina operate with high financial leverage and relatively low profitability. The financing decision, it seems, is not in the domain of active financial management, but it is, in fact, a passive result of the circumstances, in accordance with the settings of the pecking order theory. The level of indebtedness is first determined by the deposit function of banks, then by the capital financing in accordance with regulatory requirements. The return on capital, in such circumstances, is the resultant, rather than the achievement of financial management.

On the other hand, the underdevelopment of the domestic, and limited access to international financial markets, objectively limit the management of banks in optimizing the capital structure and finding an adequate level of financial leverage, which would be in the function of maximizing the value of banks. The source of profitability of local banks, therefore, can be sought in size, economies of scale, and operational efficiency and efficiency of asset use, rather than in financial leverage.

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DIGITALNE VALUTE CENTRALNIH BANAKA

Vesna Martin

Narodna banka Srbije*
vesna.martin@nbs.rs
martinv0803@hotmail.com

*„Novac može stvoriti svako; problem je navesti druge da ga prihvate“
- Hajman Filip Minski*

Rezime

Digitalne valute centralnih banaka predstavljaju digitalni izazov za međunarodni monetarni i finansijski sistem. Od razvoja kripto valuta, poput bitcoina, savremeni svet se suočio sa mogućnošću digitalne tehnološke transformacije i obezbeđenja digitalnog oblika plaćanja za privredu i stanovništvo. Pored toga, najavom digitalne valuta koja bi imala globalni domet, poput Libre koju bi izdavala društvena mreža Facebook, pokrenuta su pitanja o pravnim i regulatornim zaštitnim merama, finansijskoj stabilnosti i ulozi digitalne valute u društvu. Sve je to uticalo da vodeće centralne banka prepoznaju potrebu sprovođenja detaljne analize o mogućnostima izdavanja digitalne valute centralne banke, koja bi bila dopuna gotovinskom i bezgotovinskom obliku plaćanja. Te analize podrazumevaju sagledavanje prednosti i nedostataka te valute, određivanje njenog dizajna i tehnološkog rešenja, kao i neophodna regulatorna prilagođavanja. U narednom periodu bićemo svedoci tehnološke transformacije u poslovanju centralnih banaka, koje, kao i do sada, treba da brinu o očuvanju cenovne i finansijske stabilnosti kao njenih glavnih ciljeva, ali i da odgovore na nove izazove digitalnog poslovanja.

Ključne reči: digitalna valuta centralne banke; digitalni oblici plaćanja; tehnološke inovacije; monetarni suverenitet

JEL klasifikacija: E42, O33

***Za stavove iznete u ovom radu odgovoran je autor i stavovi ne predstavljaju nužno zvaničan stav Narodne banke Srbije**

Uvod

Tehnološke inovacije u domenu digitalnih oblika plaćanja su nova realnost savremenog sveta. Pored već razvijenog tržišta digitalnih valuta, poput bitcoina, polako se javljaju i inicijative centralnih banaka za razvojem digitalnih valuta centralnih banaka. Te valute bi bile pod kontrolom centralne banke koja bi bila njen emitent, čime bi se stvorio dodatni oblik plaćanja, pored gotovinskog i bezgotovinskog oblika plaćanja. Digitalizacija platnog sistema je postala naročito bitna tokom pandemije virusa korona, koja je tokom 2020, ali i u 2021. godini, značila primenu mera zatvaranja ekonomija radi ograničenja kontakata i suzbijanja širenja virusa. Upravo je to zatvaranje ekonomija uticalo na pojačani napor centralnih banaka da još aktivnije rade na razvoju svojih digitalnih valuta. U toku tog razvoja neophodno je uspostaviti tehnologiju koja će pratiti idejna rešenja digitalnih valuta centralnih banaka, razmotriti sve prednosti i nedostatke tih valuta, pravne aspekte izdavanja, ali i uticaj na finansijsku stabilnost i monetarni suverenitet. Cilj ovog rada je sagledavanje mogućnosti izdavanja digitalnih valuta Evropske centralne banke, Sistema federalnih rezervi, Banke Engleske i Banke Rusije, kao predstavnika vodećih globalnih centralnih banaka po pitanju tehnoloških inovacija u domenu digitalnih valuta. U radu će biti predstavljena regulativa digitalnih valuta u Srbiju, dok ćemo u zaključku sumirati rezultate ovog rada.

Pregled literature

Pandemija virusa korona je uticala na poverenje ljudi u valute nekih zemalja i ukazala je na potrebu postojanja alternative koja ima dobre performanse u okruženju beskontaktnih plaćanja i zatvaranja ekonomija kako bi se izbegla kriza likvidnosti. Navedeno utiče da zemlje deluju proaktivno u prihvatanju digitalizacije i ubrzavanju interesa centralnih banaka ka istraživanju digitalnih valuta centralnih banaka (Kuo Chuen Leea i saradnici, 2021). Prvu sveobuhvatnu definiciju digitalne valute centralne banke objavila je Banka za međunarodna poravnanja u izveštaju publikovanom u martu 2018. god., gde je navela da digitalna valuta centralne banke predstavlja „pasivu centralne banke denominovana u postojećoj obračunskoj jedinici, koja služi i kao sredstvo razmene i kao skladište vrednosti“ (BIS, 2018, 3). Adrian i Mancini-Griffoli (2019) ukazuju da neophodnost da se napravi razlika između digitalne valute centralne valute i sintetičke digitalne valute centralne koja po njima predstavlja digitalnu verziju gotovine, gde se centralne banke u nekim zemljama udružuju sa pružaocima usluga elektronskog novca (eng. e-money) kako bi efikasno obezbedile digitalnu valutu centralne banke. U oktobru 2020. god. objavljen je zajednički izveštaj na kojem su saradivale Banka Kanade, Evropska centralna banka, Banka Japana, Centralna banka Švedske, Švajcarska nacionalna banka, Banka Engleske, Sistem federalnih rezervi i Banka za međunarodna poravnanja u kojem su analizirani temeljni principi i suštinska obeležja digitalne valute centralne banke. Izveštaj ukazuje na izazove izdavanja digitalne valute centralne banke (kontinuirani pristup novcu centralne banke, otpornost, povećane mogućnosti plaćanja, podsticanje finansijske inkluzije), ali i potencijalne rizike po finansijsku stabilnost (smanjenje posredničke uloge banaka, kao i mogućnost ugrožavanja monetarnog suvereniteta) (BISA).

Barontini i Holden (2019) su krajem 2018. god. sprovedi istraživanje da li centralne banke rade na razvoju digitalne valute centralne banke i ako rade na kojoj vrsti digitalne valute rade i koliko je to obiman posao. U istraživanju su učestvovala 63 centralne banke, od kojih se 41 nalazi u zemljama tržišta u razvoju, a 22 u razvijenim zemljama. Oko 70% ispitanika je tada odgovorilo da trenutno radi (ili će uskoro započeti) rad na razvoju digitalne valute centralne banke. Isto istraživanje su krajem

2019. god. sprovedi Boar i saradnici (2020) na uzorku od 66 centralnih banaka i rezultati tog istraživanja su pokazali da 80% ispitanih centralnih banaka je na neki način uključena u razvoj digitalne valute centralne banke, što je porast u odnosu na prethodno prikazano istraživanje.

Bossu i saradnici (2020) ističu pravne aspekte izdavanja digitalne valute centralne banke i ukazuju na značaj monetarnog zakona (eng. monetary law) koji predstavlja zakonski i regulatorni okvir koji daje pravne osnove za korišćenje monetarne vrednosti u društvu, ekonomiji i pravnom sistemu. Osnovni princip ovog zakona predviđa potrebu da se za suverenu državu odredi i uspostavi valutni sistem. Shirai (2019) ukazuje na potrebu izdavanja digitalne valute centralne banke jer tokom vremena se smanjuje nivo gotovine u opticaju, ali i neke ekonomije, posebno zemlje u razvoju žele da smanje troškove štampanja i upravljanja gotovinom i promovišu bezgotovinske instrumente. U svojoj analizi Bordo i Levin (2017) su ukazali na potrebne karakteristike dobro dizajnirane digitalne valute centralne banke: (1) da bude sredstvo razmene bez dodatnih troškova; (2) da obezbedi očuvanje vrednosti; (3) da olakša postepeno zastarevanje papirnog novca kako bi digitalna valuta centralna banke bila dostupna široj javnosti i (4) monetarna politika treba da obezbedi cenovnu stabilnost kako bi i vrednost digitalne valute centralne banke bila stabilna. Engert i Fung (2017) ističu motive da centralna banka izda digitalnu valutu i ukazuju da bi to uradila radi obezbeđenja adekvatnog nivoa novca u opticaju i radi čuvanja prihoda od senioraže, potom da snizi donju granicu kamatnih stopa i pruži podršku primeni nekonvencionalne monetarne politike, poboljšanju finansijske stabilnosti, povećanju konkurentnosti u oblicima plaćanja, promovisanju finansijske inkluzije i sprečavanju kriminalnih aktivnosti. Mancini-Griffoli i saradnici (2018) ukazuju na dve koristi koje nudi izdavanje digitalne centralne banke. Prva se odnosi na tražnju i to u kojoj meri digitalna valuta centralne banke može da zadovolji potrebu krajnjih korisnika za novcem, a druga se bazira na ponudi u smislu da centralne banke izdavanjem digitalne valute može potpunije da ostvari cilj monetarne politike i da prevaziđe određene tržišne neuspehe.

Pored potencijalnog eliminisanja gotovine, digitalna valuta centralne banke daje mogućnost da njeni korisnici direktno drže tu valutu na računu otvorenom kod centralne banke (Fernández-Villaverde i saradnici, 2020). S druge strane, Chiu i saradnici (2019) razvili su model sa nesavršenom konkurencijom na tržištu depozita i analizirali su da li bi uvođenje digitalne valute centralne banke dovelo do smanjenja posredničke uloge banaka. Njihov zaključak je da uvođenje digitalne valute centralne banke ne mora nužno da dovede do smanjenja posredničke uloge banaka i da bi uvođenje te valute moglo da promoviše bankarsko posredovanje. Khiaonarong i Humphrey (2019) smatraju da bi za digitalni oblik novca, kako bi bio uspešan, neophodno da postoji podsticaj da se prihvati. Za krajnje korisnike podsticaj je pogodnost da ne moraju da idu do bankomata ili banaka kako bi podigli gotovinu.

Razvoj digitalnog evra od strane Evropske centralne banke

Digitalizacija je prisutna u svakom aspektu života svakog od nas i utiče na transformaciju sistema plaćanja. Digitalni evro bi predstavljao brz, jednostavan i siguran instrument za svakodnevna plaćanja. Na taj način podržala bi se digitalizacija evropske ekonomije i podstakle dalje inovacije u sistemu plaćanja u maloprodaji. U oktobru 2020. god. Evropska centralna banka (eng. European Central Bank - ECB) je najavila mogućnost izdavanja digitalnog evra. Uvođenje digitalnog evra garantovaće da svi građani zone evra ostvare pristup jednostavnom i univerzalno prihvaćenom, sigurnom i pouzdanom načinu plaćanja. Digitalni evro će biti evro – kao papirni i kovani novac samo u digitalnoj

formi. Izdavanje digitalnog evra biće povereno Evrosistemu (ECB i nacionalnim centralnim bankama) i biće dostupan svim građanima i kompanijama. Time digitalni evro neće zameniti gotovinu, već će predstavljati njenu dopunu i omogućiti dodatni izbor u pogledu plaćanja, čime će doprineti finansijskog inkluziji (Grafikon 1). Digitalni evro bi predstavljao kombinaciju efikasnog instrumenta digitalnog plaćanja zajedno sa sigurnošću novca koji izdaje centralna banka. Time bi se pomoglo da se prevaziđu situacije u kojima građani više ne žele posjedovanje gotovine i izbegla bi se zavisnost od digitalnih sredstava plaćanja koja se izdaju i kontrolišu izvan zone evra (na primer bitcoin i druge kriptovalute), što bi moglo da utiče na ugrožavanje finansijske stabilnosti i monetarnog suvereniteta. Očuvanje privatnosti bi predstavljalo ključni prioritet pri izdavanju digitalnog evra, kako bi se očuvalo poverenje u digitalna plaćanja. Za sada ECB nije postavila rok za uvođenje digitalnog evra, ali aktivno radi na razvoju koncepta, sprovođenju praktičnog eksperimenta i osluškivanju mišljenja široke javnosti. ECB bi i u slučaju emitovanja digitalnog evra bila garant sigurnosti i stabilnosti, kako za gotovinu, tako i za digitalnu formu novca. Time bi digitalni evro predstavljao digitalni simbol napretka i integracije Evrope (ECB).

Grafikon 1: Razlozi za izdavanje digitalnog evra



Izvor: ECBa – Evropska centralna banka, *Report on a digital euro*, Pristupljeno: 1.7.2021.
<https://www.ecb.europa.eu/euro/html/digitaleuro-report.en.html>

U oktobru 2020. god. ECB je objavila „Izveštaj o digitalnom evru“ u kojem su predstavljeni sledeći aspekti potencijalnog izdavanja digitalne valute zone evra (ECBb):

- **Razlozi za izdavanje digitalnog evra** – podrška digitalizacije evropske ekonomije i strateška nezavisnost Evropske Unije; digitalni evro bi predstavljao odgovor na značajan pad uloge gotovine kao sredstva plaćanja; razmatranje potencijala da se rasprostranjeno koristi strana digitalna valuta centralnih banaka ili privatnih digitalnih plaćanja u zoni evra; digitalni evro bi mogao da postane novi transmisioni kanal monetarne politike; smanjenje rizika za kontinuirano pružanje platnih usluga; da se poveća međunarodna uloga evra i da se pruži podrška smanjenju ukupnih troškova, naročito sa aspekta ekološkog pristupa monetarnom i platnom sistemu.

- **Potencijalni efekti izdavanja digitalnog evra** – dizajniranje digitalnog evra treba da izbegne potencijalne neželjene posledice njegovog izdavanja na monetarnu politiku i finansijsku stabilnost i potrebno je izbegnuti da prekomerna upotreba digitalnog evra dovede do situacije gde bi se desio rizik od iznenadne promene nivoa bankarskih depozita u korist digitalnog evra. Pored toga, neophodno je uspostaviti uslove za njegovo funkcionisanje van zone evra i brinuti o sprečavanju sajber napada.

- **Pravna razmatranja** – od izbora konkretnog načina izdavanja digitalnog evra zavisiće pravni osnovi, jer primarni zakoni Evropske Unije ne isključuju mogućnost izdavanja digitalnog evra kao legalnog sredstva plaćanja. Tu se pre svega misli na član 127 Konsolidovane verzije o funkcionisanju Evropske Unije (eng. Consolidated Version of the Treaty on the Functioning of the European Union), koji se odnosi na funkcionisanje monetarne politike evropskog sistema centralnih banaka i na član 20 Statuta evropskog sistema centralnih banaka i Evropske centralne banke (eng. Statute of the European System of Central Banks and of the European Central Bank), koji definiše ostale instrumente monetarne kontrole.

- **Funkcionalni dizajn digitalnog evra** – u pogledu dizajna digitalnog evra izveštaj je identifikovao dva koja ispunjavaju neophodne karakteristike, a to su van mreže (eng. offline) i na mreži (eng. online). Oba navedena dizajna za izdavanje digitalnog evra su kompatibilni jedni sa drugim i mogu se istovremeno primeniti.

- **Tehnički i organizacioni pristupi uslugama digitalnog evra** – infrastruktura za pružanje digitalnog eura može biti centralizovana (gde bi sve transakcije bile evidentirane od strane centralne banke) ili decentralizovana (gde bi evidentiranje transakcija bilo povereno posrednicima i/ili pod nadzorom posrednika). Bez obzira na izabrani pristup, infrastruktura za pružanje usluga korišćenja digitalnog evra bi trebala da bude pod kontrolom centralne banke.

U periodu od 12. oktobra 2020. god. do 12. januara 2021. god. ECB je sprovela javne konsultacije u kojima su prikupljeni stavovi o prednostima i izazovima izdavanja digitalnog evra i o njegovom mogućem dizajnu na uzorku od 8.221 ispitanika, koji su dali odgovor na osamnaest pitanja (ECBc). U aprilu 2021. godine ECB je objavila Izveštaj Eurosistema o javnim konsultacijama o digitalnom evru (eng. Eurosystem report on the public consultation on a digital euro) u kojem se 94% učesnika izjasnilo kao građani, a 6% kao profesionalni. I jedni i drugi su saglasni da izdavanje digitalnog evra treba da bude integrisano u postojeći bankarski i platni sistem i smatraju da je pitanje privatnosti transakcija korišćenjem digitalne valute od ključnog značaja, kao i sprečavanje ilegalnih aktivnosti. Većina ispitanika je spremna da podrži izdavanje digitalnog evra, posebno na to da se digitalni evro ne bi koristio ni za ukidanje gotovine ni za snižavanje kamatnih stopa u ekonomijama zone evra (ECBd).

Razvoj digitalnog dolara od strane Sistema federalnih rezervi

Tehnološke inovacije daju mogućnost da se o novcu misli na nove načine. U tom pogledu Sistem federalnih rezervi (eng. Federal Reserve System - FED) ima ulogu da promoviše siguran, pristupačan i efikasan platni sistem u Sjedinjenim Američkim Državama, ali je istovremeno uključen u kontinuirano eksperimentisanje i istraživanje najnovijih tehnologija plaćanja. U avgustu 2020. god. FED je ukazao na značaj istraživanja i probnog testiranja koje je započeo kako bi se razumele mogućnosti i rizici povezani sa izdavanjem digitalnih valuta centralnih banaka. Kao i druge centralne banke i FED će proceniti mogućnosti i izazove izdavanja digitalne valute (to jest digitalnog dolara), načine primene te valute kao dodatak gotovini i drugim opcijama plaćanja. U okviru FED-a postoji Tehnološka laboratorija (eng. Technology Lab - TechLab) koja razvija probno testiranje i eksperimentisanje relevantnih tehnologija za izdavanje digitalne valute, ali i razvija druge inovacije u sistemu plaćanja. Tehnološka laboratorija predstavlja multidisciplinarni tim koji obuhvata zaposlene koji poseduju ekspertizu u oblastima platnog prometa, ekonomije, prava, informacionoj tehnologiji i računarstvu. Pored toga, FED u Bostonu više godina unazad aktivno sarađuje sa Institutom Tehnologije u Masačusetsu kako bi razvili hipotetičku digitalnu valutu čije izdavanje je vezano za centralnu banku. Glavni cilj ovog istraživanja jeste da se proceni bezbednost i efikasnost sistema digitalnih valuta centralnih banaka.

Osnovni fokus projekta jeste razvijanje kapaciteta i relevantnih tehnologija, umesto da služi za razvoj prototipa digitalne valute koju bi FED potencijalno mogao da izdaje ili da rešava brojna politička pitanja vezana sa potencijalno izdavanje digitalne valute. Pored toga, FED aktivno sarađuje sa drugim centralnim bankama i međunarodnim organizacijama kako bi unapredila nivo saznanja o digitalnim valutama drugih centralnih banaka (FED).

Lael Brainard, članica Odbora guvernera FED-a u avgustu 2020. god. izjavila je da digitalne valute, uključujući i digitalne valute centralnih banaka, predstavljaju prednost, ali da sa sobom nose i rizike vezane sa privatnost, mogućnost korišćenja za nezakonite aktivnosti i potencijalnu pretnju za finansijsku stabilnost. Uvođenjem bitcoina, kao i naknadnom pojavom stablecoin-a, tj. digitalne valute čija vrednost je vezana za fiat novac, kao i najavom izdavanja digitalne valute koja bi imala globalni domet, poput Libre koju bi izdavala društvena mreža Facebook, pokrenuta su pitanja o pravnim i regulatornim zaštitnim merama, finansijskoj stabilnosti i ulozi digitalne valute u društvu. Sve prethodno pobrojano uticalo je da se aktivno krene u testiranje i razvoj digitalnih valuta centralnih banaka, kako bi se održala nacionalna valuta kao sidro nacionalnih platnih sistema (FEDa). Radi dalje saradnje po pitanju inovacija i tehnoloških promena u pogledu razvoja digitalnih valuta centralni banaka FED je ostvario inicijativu sa Innovation Hub-om Banke za međunarodna poravnanja i ta saradnja je rezultirala otvaranjem centra za inovacije u okviru FED-a u Njujorku. Innovation Hub Banke za međunarodna poravnanja osnovan je 2019. sa ciljem identifikovanja i daljeg razvoja finansijske tehnologije koja je od značaja za funkcionisanje centralnih banaka, ali i radi poboljšanja funkcionisanja finansijskog sistema i ostvarivanja kontakata između stručnjaka centralnih banaka zaduženih za inovacije (BISb).

Analizom uporedivosti između mehanizama plaćanja centralne banke bavili su se Wong i Maniff (2020) i za poređenje izabrali su sledećih sedam kategorija: dostupnost, anonimnost, neophodni instrumenti izdavaoca, nezavisnost, operativna efikasnost, programiranje i dostupnost usluge (Tabela 1). Njihova analiza je pokazala da digitalne valute centralnih banaka imaju bolje rezultate od gotovine i platnog sistema RTGS (to jest sistema izvršavanja naloga za prenos u realnom vremenu po bruto principu) u pogledu programiranja, ali i u pogledu operativne efikasnosti. Sa druge strane, digitalne valute centralnih banaka imaju lošije rezultate u poređenju sa gotovinom u pogledu anonimnosti i nezavisnosti.

Tabela 1: Poređenje mehanizama plaćanja centralne banke

Mehanizmi plaćanja	Dostupnost	Anonimnost	Neophodni instrumenti izdavaoca	Nezavisnost	Operativna efikasnost	Programiranje	Dostupnost usluge
Cash	5	5	5	5	1	1	5
Central bank digital currency	4.9	4	5	4	3	3	5
RTGS	4.7	1	1	1	4	3	4.99
RTGS+	4.75	1	1	3	4	4	4.99

Napomena: Ocena 5 je najviša, dok je ocena 1 najniža

Izvor: Wong P. and Maniff J. L. (2020). Comparing Means of Payment: What Role for a Central Bank Digital Currency?. FEDS Notes, Pristupljeno: 3.7.2021.

<https://www.federalreserve.gov/econres/notes/feds-notes/comparing-means-of-payment-what-role-for-a-central-bank-digital-currency-20200813.htm#fig1>

Randal K. Quarles, potpredsednik za nadzor Saveta guvernera FED-a od 2017. god., ukazao je na argumente onih koji podržavaju izdavanje digitalne valute centralne banke i argumente koji se protive izdavanju. U prilog izdavanja digitalne valute centralnih banaka gospodin Quarles navodi da bi FED trebalo da razvije digitalnu valutu centralne banke kako bi odbranio dolar od pretnji koje bi predstavljale strane digitalne valute centralnih banaka, s jedne strane, kao i zbog kontinuiranog širenja privatnih digitalnih valuta, s druge strane. Protivnici izdavanja digitalne valute centralne banke ukazuju na rizike po strukturu bankarskog sektora, koji se trenutno oslanja na depozite kao izvore kreditne aktivnosti stanovništva i privrede, potom digitalna valuta centralne banka može predstavljati privlačnu metu za sajber napade i druge bezbednosne pretnje, kao i da bi izdavanje te valute bio skup i komplikovan proces za FED (FEDb).

Predsednik FED-a Jerome H. Powell je u maju 2021. god. ukazao da još uvek nije doneta odluka da li će Sjedinjene Američke Države izdati digitalnu valutu centralne banke. Ipak, imajući globalni značaj dolara neophodno je FED zadrži punu posvećenost razvoju digitalne valute centralne banke, boljem razumevanju neophodne tehnologije za njen razvoj i njene potencijale (FEDc). Cheng, Lawson i Wong (2021) smatraju da za Sjedinjene Američke Države, bez obzira na to koji su specifični ciljevi izdavanja digitalne valute centralne banke, oni bi trebali biti u skladu sa dugoročnim ciljevima FED-a, kao što su sigurnost i efikasnost nacionalnog platnog sistema, kao i monetarna i finansijska stabilnost.

Razvoj digitalne rublje Banke Rusije

Udeo bezgotovinskih plaćanja raste poslednjih godina, što je posebno postalo važno u vreme pandemije virusa korona. Digitalna rublja može postati novo i pogodno dodatno sredstvo plaćanja kako za kupce, tako i za prodavce, uključujući udaljene, retko naseljene i teško dostupne teritorije sa ograničenim pristupom finansijskoj infrastrukturi. Digitalna rublja će pomoći u širenju pokrivenosti fizičkih lica finansijskim uslugama čineći ih pristupačnijim, što će poboljšati kvalitet života ljudi. Domaća digitalna valuta takođe će ublažiti rizik od preraspodele sredstava u strane digitalne valute, doprinoseći tako makroekonomskoj i finansijskoj stabilnosti.

Banka Rusije (eng. Bank of Russia – BoR) je u oktobru 2020. god. objavila konsultativni dokument o mogućnostima izdavanja digitalne rublje, što je u skladu sa opredeljenjem drugih centralnih banaka da započnu emitovanje digitalnih valuta centralnih banaka. Digitalna rublja predstavlja digitalnu formu nacionalne valute Rusije koja će biti emitovana zajedno sa trenutno postojećim oblicima novca (to jest gotovinska i bezgotovinska rublja). Pojedinci će moći da svoje digitalne rublje drže u svom elektronskom novčaniku i da ih koriste pomoću mobilnog telefona ili drugih uređaja i to kada budu imali pristup internetu ili bez pristupa internetu, to jest kada budu bili na mreži ili van mreže. U slučaju da ne postoji mreža, postojaće mogućnost da se rezerve određene iznos digitalne rublje u elektronski novčanik, kao što se to radi sa gotovinom kada ne postoji mogućnost bezgotovinskog plaćanja. Kada postoji mreža transakcije će biti izvršene na sličan način kao i kod bezgotovinskog plaćanja. U zavisnosti od svojih potreba stanovništvo i privreda će imati mogućnost da vrše konverziju svog novca između različitih formi – na primer digitalne rublje da konvertuju u gotovinu ili da ih deponuju na svoj račun u banci, a važi i obrnuto. Da bi se navedena konverzija izvršila, potreban je razvoj specijalne tehnologije koja će omogućiti upotrebu digitalne valute van mreže (eng. offline usage). Time će digitalna rublja imati mogućnosti da kombinuje koristi gotovine i bezgotovinskog novca. Vrhunska tehnologija koja će biti korišćena za razvoj digitalne rublje pomoći će smanjenju troškova plaćanja, povećati finansijsku uključenost i podstaći dalje unapređenje tehnologija plaćanja.

U razvoju digitalne rublje BoR će razmotriti sve ove aspekte, zajedno sa primenom beskompromisnih zahteva informacione sigurnosti (BoR).

Tabela 2: Faze u razvoju digitalne rublje

1. Objava konsultativnog dokumenta
2. Sprovođenje javnih konsultacija
3. Razvoj koncepta digitalne rublje
4. Razvoj platforme digitalne rublje
5. Sprovođenje probnog projekta digitalne rublje sa ograničenim brojem učesnika
6. Analiza rezultata probnog projekta
7. Donošenje odluke o izvodljivosti i fazama lansiranja digitalne rublje

Napomena: Vremenski okviri za sve faze biće utvrđeni naknadno i uzimaće u obzir rezultate javnih konsultacija

Izvor: BoRa - Centralna banka Rusije, Konsultativni dokument „A Digital Rouble“, strana 11, Pristupljeno: 30.6.2021. https://www.cbr.ru/StaticHtml/File/113008/Consultation_Paper_201013_eng.pdf

Uvođenje digitalne rublje zahtevaće reviziju, pre svega, Građanskog zakonika Ruske Federacije (eng. Civil Code of the Russian Federation), s obzirom na uključivanje digitalne rublje u spisak predmeta građanskopravnih prava, uspostavljanje mogućnosti plaćanja korišćenjem digitalne rublje i uključivanje digitalne rublje u opšte propise o poravnanjima, kao i Saveznog zakona o Centralnoj banci Ruske Federacije - Banka Rusije (eng. Federal Law On the Central Bank of the Russian Federation - the Bank of Russia) u vezi s proširivanjem funkcija BoR i definisanjem pitanja emisije i cirkulacije digitalne rublje (BoRa).

U svom konsultativnom dokumentu BoR ističe da će svi ekonomski agenti imati pristup digitalnoj rublji, uključujući pojedince, privredu, učesnike na finansijskim tržištima i vladu. Kao i gotovina i bezgotovinska plaćanja i digitalna rublja imaće tri funkcije novca i to sredstvo plaćanja, meru vrednosti i sredstvo očuvanja vrednosti. Sve tri funkcije ruske rublje biće apsolutno jednake: kako se jedna gotovinska rublja izjednačava sa jednom bezgotovinskom rubljom, tako će se jedna digitalna rublja uvek izjednačiti sa svakom od njih. Pri tome, BoR navodi da digitalna valuta neće zameniti gotovinu ili bezgotovinska plaćanja, već će predstavljati dodatni oblik novca pored uobičajenih oblika novca. Takođe, precizira se da digitalna rublja nije kripto valuta, jer kripto valute nemaju jedinstvenu instituciju koja će ih emitovati, za njih ne postoji garantovanje prava potrošača, njihova vrednost je podložna značajnoj fluktuaciji, mnoge zemlje ne prihvataju kripto valute kao sredstvo za plaćanje roba i usluga i ne postoji jedinstvena institucija koja će obezbediti njihovu sigurnost. Sa druge strane

za digitalnu rublju odgovara BoR koja će je implementirati upotrebom digitalne tehnologije. Suštinski gledano digitalna rublja predstavlja fiat novac čiju stabilnost obezbeđuje država koju predstavlja centralna banka (BoRb).

U aprilu 2021. god. BoR objavila je koncept digitalne valute koji se zasniva na povratnim informacijama dobijenim od ispitanika i učesnika na tržištu nakon rasprave o konsultativnom dokumentu o digitalnoj rublji iz oktobra 2020. godine. BoR je za implementaciju digitalne rublje izabrala dvostepeni maloprodajni model (eng. two-tier retail model) koji podrazumeva da je BoR istovremeno izdavalac digitalne rublje i operater platforme digitalne rublje. Kako bi digitalna rublja funkcionisala u praksi neophodno je da finansijske institucije otvore elektronske novčanike za svoje klijente i obavljaju operacije preko tih novčanika na platformi digitalne rublje. Stanovništvo i privreda moći će da pristupe svojim digitalnim rubljama preko bilo koje banke u kojoj imaju otvoren račun i digitalni novčanik. BoR je izabrala dvostepeni maloprodajni model jer su istraživanja drugih regulatora i pilot testovi digitalnih valuta centralne banke pokazali da je dvostepeni maloprodajni model najpoželjniji u pogledu inovacija i stabilnosti na finansijskom tržištu (BoRc). U pogledu roka emitovanja digitalne valute guvernerka BoR Elvira Nabiullina je u oktobru 2020. god. izjavila da će centralna banka prvo primeniti pilot (probni) projekat za ograničen broj učesnika preko kojeg će sagledati sve prednosti i nedostatke digitalne rublje i najavila je da bi to moglo da se desi do kraja ove godine. Gospođa Nabiullina je rekla da ukoliko se BoR odluči da uvede digitalnu rublju da će njeno uvođenje biti postepeno i da je predviđeno da digitalna valuta ima jedinstveni kod, kao što gotov novac ima serijske oznake. Upravo će jedinstveni kod učiniti da digitalna valuta obezbedi transparentnost njihovih transakcija, uz očuvanje poverenja i privatnosti (BoRd).

Razvoj digitalne funte Banke Engleske

U martu 2020. god. Banka Engleske (eng. Bank of England - BoE) je objavila Dokument u kojem je razmatrala uvođenje digitalne valute centralne banke u kojem je analizirala mogućnosti, izazove i dizajn izdavanja digitalne valute (BoE). U tom dokumentu se navode četiri koraka za potencijalno uvođenje digitalne valute centralne banke (BoEa):

- 1) Razumevanje mogućnosti i izazova pri izdavanju digitalne valute centralne banke – potrebno je jasno razumevanje mogućnosti koje izdavanje digitalne valute centralne banke nosi sa sobom, ali i izazova sa kojima je potrebno da se centralna banka izbori.
- 2) Potrebno je da se razmotre opšti ciljevi koje bi svaki dizajn izdavanja digitalne valute centralne banke trebalo da ispuni – opšti ciljevi bi trebalo da budu usaglašeni sa ciljem i mandatom BoE, imajući u vidu ciljeve i drugih politika, pored monetarne. Polazeći od cilja BoE da održi monetarnu i finansijsku stabilnost neophodno je da se ispuni da dizajn digitalne valute bude pouzdan i otporan, brz i efikasan i da bude otvoren za inovacije i konkurenciju.
- 3) Dizajn digitalne valute centralne banke – potrebno je da se ispune dva elementa: a) za samu digitalnu valutu centralne banke (to jest pristup novom obliku novca od strane centralne banke) i b) infrastruktura digitalne valute centralne banke koja treba da omogući prenos i plaćanja pomoću te valute. U tom pogledu potrebno je analizirati tri principa kada je u pitanju dizajn digitalne valute centralne banke:

- Podela odgovornosti u izdavanju digitalne valute centralne banke. Odgovornost i funkcije pri

izdavanju digitalne valute centralne banke mogu se podeliti između javnog sektora (na primer između centralne banke i ostalih institucija) i privatnog sektora (na primer finansijske institucije, pružaoci usluga platnog prometa i tehnološke firme). Podela odgovornosti pri izdavanju digitalne valute bi uticala i na to da li je digitalna valuta centralne banke otvorena za konkurenciju, otporna i dizajnirana na bazi komparativne prednosti privatnog i javnog sektora;

- **Funkcionalni dizajn** odnosi se na osiguranje da funkcija plaćanja digitalnom valutom centralne banke obezbedi jasnu korist i dobrobit za njene korisnike. To se odnosi na vrste plaćanja koje se mogu ostvariti korišćenjem ove valute, ali i razmatranjem o proširenju funkcionalnosti digitalne valute centralne banke ukoliko bi se potrebe za plaćanjem promenile u budućnosti. Donete odluke u pogledu dizajna bi imale poseban uticaj na to da li je digitalna valuta centralne banke prilagođena korisnicima, da li je dostupna široj javnosti, kao i na nivo privatnosti pri izvršenju transakcija;

- **Ekonomski dizajn** se odnosi na aspekte kao što su pristup (ko sve može da ima pristup korišćenju digitalne valute centralne banke), naknade (da li je potrebno da digitalna valuta centralne banke nosi kamatu?) i konvertibilnost (da li digitalna valuta centralne banke može biti u potpunosti konvertibilna za druge oblike novca koje izdaje centralna banka i za bankarske depozite). U zavisnosti od izbora direktno se utiče na mogućnost da centralna banka ostvari svoj cilj održavanja monetarne i finansijske stabilnosti, kao i na uticaj koji bi digitalna valuta centralne banke imala na druge oblike plaćanja i na platne sisteme, kao i na funkcionisanje bankarskog sistema.

4) **Tehnologija** – potrebno je proceniti koja bi tehnologija mogla da ispuni dizajn i zahtev funkcionalnosti imajući u vidu karakteristike svakog modela izdavanja digitalne valute centralne banke. Potrebno je razmotriti i o tehnološkim kompromisima koju su prisutni između različitih principa dizajna ove valute. Od izbora tehnologije zavisi u kojoj meri bi digitalna valuta centralne banke mogla da bude otporna, sigurna, brza, efikasna i dostupna.

U junu 2021. god. BoE je objavila mišljenje javnosti o Dokumentu u kojem je razmatrala uvođenje digitalne valute centralne banke iz marta 2020. god. Ispitanici su ukazali da bi BoE trebalo da pažljivo analizira digitalnu valutu centralne banke. U tom pogledu BoE planira da produbi svoje istraživanje digitalne valute centralne banke kroz pokretanje tri inicijative. Prva se odnosi na uspostavljanje zajedničke radne grupe sa Ministarstvom finansija, kako bi se obezbedio koordinirani pristup istraživanja pitanja od javnog značaja oko digitalne valute centralne banke od strane predstavnika vlasti Ujedinjenog Kraljevstva. Druga inicijativa se odnosi na uspostavljanje foruma digitalne valute centralne banke koji će obuhvatiti zainteresovane strane akademske zajednice i predstavnika društva po pitanju analize izazova dizajniranja, primene i upravljanja ovom valutom. I treća inicijativa se odnosi na formiranje tehnološkog foruma digitalne valute centralne banke kako bi se obezbedilo da BoE u potpunosti razume stanje vrhunske tehnologije kada bude razmatrala tehnološka rešenja izdavanja digitalne valute centralne banke (BoEb). U saopštenju od 7. juna 2021. god. BoE je objavila da još uvek nije donela odluku o izdavanju digitalne valute centralne banke, ali da će buduća odluka biti doneta na bazi detaljnog razmatranja o tome kako digitalna valuta centralne banke može da utiče na ciljeve BoE, kao i ciljeve Vlade (BoEc).

Regulacija digitalne valute u Srbiji

Narodna banka Srbije je nekoliko puta, kao što je to učinila u oktobru 2014. god. (NBS) i maju 2016. god. (NBS), javno upozoravala da digitalne valute nisu zakonsko sredstvo plaćanja u Srbiji. Prema članu

53. Zakona o Narodnoj banci Srbije, dinar je zakonsko sredstvo plaćanja Republike Srbije i Narodna banka Srbije ima ekskluzivno pravo da emituje novčanice i kovani novac u Republici Srbiji. Zakon o sprečavanju pranja novca i finansiranja terorizma, u članu 3. definiše pojam virtuelne valute kao „digitalni zapis vrednosti koje nisu izdate i čiju vrednost ne garantuje centralna banka, niti drugi organ javne vlasti, a koji nisu nužno vezani sa zakonsko sredstvo plaćanja i nemaju pravni status novca ili valute, ali ih prihvataju fizička ili pravna lica kao sredstvo razmene i mogu se kupiti, prodati, razmeniti, preneti i čuvati elektronskim putem“. To ukazuje da Narodna banka Srbije nadgleda sprovođenje ovog zakona nad licima koja se bave pružanjem usluga povezanih sa virtuelnim valutama (Martin, 2020).

U decembru 2020. godine, sa primenom od 30. juna 2021. godine, u Srbiji je stupio na snagu Zakon o digitalnoj imovini. Usvajanje ovog zakona predstavlja značajan trenutak u razvoju savremenog srpskog zakonodavstva i Zakon o digitalnoj imovini je prvi zakon u Republici Srbiji koji reguliše sferu digitalnog poslovanja i trgovine digitalnom imovinom. Glavna novina je uvođenje virtuelne valute i digitalnih tokena kao važećeg sredstva razmene između fizičkih i/ili pravnih lica, kao i legalizacija rudarenja digitalne imovine. Sa pravne tačke gledišta, najvažnije je da je transakcijama sa digitalnom imovinom sada zagarantovana pravna zaštita, kako regulatorna, tako i sudska. Nadzorni organi zakona su Narodna banka Srbije i Komisija za hartije od vrednosti. Narodna banka Srbije je odgovorna za pitanja koja se odnose na donošenje odluka u upravnim postupcima, donošenje podzakonskih akata, nadzor nad obavljanjem delatnosti i ostvarivanje drugih prava i obaveza nadzornog tela u delu koji se odnosi na virtuelne valute kao vrstu digitalne imovine. Komisija je odgovorna za pitanja iz ovog zakona koja se odnose na donošenje odluka u upravnom postupku, donošenje podzakonskih akata, nadzor nad obavljanjem delatnosti i vršenje drugih prava i obaveza nadzornog tela u delu koji se odnosi na digitalne tokene kao vrstu digitalne imovine, kao i u delu koji se odnosi na digitalnu imovinu koja ima karakteristike finansijskih instrumenata. Član 15. Zakona o digitalnoj imovini precizno definiše da Republika Srbija, Narodna banka Srbije, Komisija i drugi nadležni organi i organi javne vlasti ne garantuju vrednost digitalne imovine i nisu odgovorni za eventualne pretrpljene štete i gubitke od strane korisnika i drugih imaoca digitalne imovine i/ili pružaoca usluga povezanih sa digitalnom imovinom i/ili treće strane pretrpe u vezi sa obavljanjem transakcija s digitalnom imovinom. Početkom jula 2021. god. Narodna banka Srbije je objavila saopštenje da nije izdala nijedno odobrenje za beli papir koji se objavljuje pri izdavanju virtuelnih valuta kao vrste digitalne imovine, kao i da Narodnoj banci Srbije nije do tada podnet nijedan zahtev za davanje takvog odobrenja, a sve u cilju demantovanja navoda medija da je izdata prva srpska virtuelna valuta (NBSb).

Za sada Narodna banka Srbije nije izdala saopštenje o mogućem izdavanju digitalne valute centralne banke. Ipak, stupanjem na snagu Zakona o digitalnoj imovini, Republika Srbija je stvorila prvi okvir regulacije digitalne imovine, čime je stvorila pravnu sigurnost za korisnike digitalne imovine i sve potencijalne investitore. Istovremeno ovaj zakon daje mogućnost da se dalje razvija domaće tržište kapitala koristeći digitalnu tehnologiju, uz jačanje pravnog okvira za borbu protiv finansiranja terorizma, pranja novca i potencijalnih zloupotreba na tržištu digitalne imovine.

Zaključak

Razvoj digitalne tehnologije i bezgotovinskih sredstava plaćanja uticali su da vodeće centralne banke započnu razvoj digitalne valute centralne banke, što predstavlja izazove za savremeni monetarni i finansijski sistem. Takvoj transformaciji u poslovanju doprineo je ubrzan razvoj digitalnih valuta, gde je najpoznatija bitcoin, ali i najava o mogućem uvođenju digitalne valute koja bi imala globalni domet,

poput Libre koju bi izdavala društvena mreža Facebook. Dodatni podsticaj centralnim bankama da razvijaju svoje digitalne valute dala je pandemija virusa korona, koja je uvela socijalnu distancu radi sprečavanja širenja virusa, kao i preporuka da se što više koriste bezgotovinski oblici plaćanja.

U radu je analiziran proces razvoja digitalnih valuta centralnih banaka od strane najznačajnijih centralnih banaka, koje su još uvek u probnoj fazi testiranja digitalne valute centralne banke, analizi prednosti i nedostataka, poželjnog tehnološkog dizajna i neophodnih pravnih prilagođavanja. Evropska centralna banka je u oktobru 2020. god. najavila mogućnost izdavanja digitalnog evra i njegovim uvođenjem garantovaće se da svi građani zone evra ostvare pristup jednostavnom i univerzalno prihvaćenom, sigurnom i pouzdanom načinu plaćanja. Izdavanje digitalnog evra biće povereno Evrosistemu i biće dostupan svim građanima i kompanijama. Za sada Evropska centralna banka nije postavila rok za uvođenje digitalnog evra, ali aktivno radi na razvoju koncepta, sprovođenju praktičnog eksperimenta i osluškivanju mišljenja široke javnosti. Evropska centralna banka bi i u slučaju emitovanja digitalnog evra bila garant sigurnosti i stabilnosti, kako za gotovinu, tako i za digitalnu formu novca. Time bi digitalni evro predstavljao digitalni simbol napretka i integracije Evrope. Sistem federalnih rezervi su u avgustu 2020. god. ukazali na značaj istraživanja i probnog testiranja kako bi se razumele mogućnosti i rizici povezani sa izdavanjem digitalnih valuta centralnih banaka. Kao i druge centralne banke i Sistem federalnih rezervi će proceniti mogućnosti i izazove izdavanja digitalne valute (to jest digitalnog dolara), načine primene te valute kao dodatak gotovini i drugim opcijama plaćanja. Predsednik Sistem federalnih rezervi Jerome H. Powell je u maju 2021. god. ukazao da još uvek nije doneta odluka da li će Sjedinjene Američke Države izdati digitalnu valutu centralne banke. Ipak, imajući globalni značaj dolara neophodno je da Sistem federalnih rezervi zadrži punu posvećenost razvoju digitalne valute centralne banke, boljem razumevanju neophodne tehnologije za njen razvoj i njene potencijale.

U oktobru 2020. god. Banka Rusije je objavila konsultativni dokument o mogućnostima izdavanja digitalne rublje, koja bi predstavljala digitalnu formu nacionalne valute Rusije koja će biti emitovana zajedno sa trenutno postojećim oblicima novca. U pogledu roka emitovanja digitalne valute guvernerka Banke Rusije Elvira Nabiullina je u oktobru 2020. god. izjavila da će centralna banka prvo primeniti pilot (probni) projekat za ograničen broj učesnika preko kojeg će sagledati sve prednosti i nedostatke digitalne rublje i najavila je da bi to moglo da se desi do kraja ove godine. Banka Engleske je u martu 2020. god. objavila Dokument u kojem je razmatrala uvođenje digitalne valute centralne banke u kojem je analizirala mogućnosti, izazove i dizajn izdavanja digitalne valute, dok je u junu 2021. god. objavila da još uvek nije donela odluku o izdavanju digitalne valute centralne banke, ali da će buduća odluka biti doneta na bazi detaljnog razmatranja o tome kako digitalna valuta centralne banke može da utiče na ciljeve Banke Engleske, kao i ciljeve Vlade.

Narodna banka Srbije, za sada, nije izdala saopštenje o mogućem izdavanju digitalne valute centralne banke. Ipak, stupanjem na snagu Zakona o digitalnoj imovini, Republika Srbija je stvorila regulatorni okvir za digitalnu imovinu, i to ne samo da pruža jasan pravni okvir i pravnu sigurnost za investitore i korisnike digitalne imovine, već i šalje signal svetu da Srbija postaje zemlja fintech-a. Glavna novina ovog zakona je uvođenje virtuelne valute i digitalnih tokena kao važećeg sredstva razmene između fizičkih i/ili pravnih lica, kao i legalizacija rudarenja digitalne imovine.

U narednom periodu možemo očekivati objavu daljih rezultata pilot projekata u izdavanju digitalne valute centralne banke, a potom i prvu emisiju tih valuta. Time bi se pomerile granice u digitalizaciji plaćanja, uz neophodnost očuvanja cenovne i finansijske stabilnosti. Sve to će imati uticaj i na

transformaciju do sada znanog monetarnog i finansijskog sistema i na prisustvo novih oblika plaćanja za građane i privredu. Za krajnje korisnike biće prihvatljiva ona digitalna valuta centralne banke koja će biti dostupna, otporna, sigurna, brza i efikasna i koja će zaštititi privatnost izvršenja transakcija. Dalji razvoj digitalne valute centralne banke predstavlja izazov za centralne banke, koje će time postati deo savremenog digitalnog tržišta kroz razvoj ove inspirativne oblasti bankarskog poslovanja.

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CENTRAL BANK DIGITAL CURRENCIES

Vesna Martin
National Bank of Serbia*
vesna.martin@nbs.rs
martinv0803@hotmail.com

*“Everyone can create money; the problem is to get it accepted”
-Hyman Philip Minsky*

Summary

Central bank digital currencies are a digital challenge to the international monetary and financial system. Since the development of cryptocurrency, such as bitcoin, the modern world has faced the possibility of digital technological transformation and providing a digital form of payment for the economy and the household. In addition, the announcement of a digital currency that would have a global reach, such as the Libre issued by the social network Facebook, raised questions about legal and regulatory safeguards, financial stability, and the role of the digital currency in society. All this influenced the leading central banks to recognize the need to conduct a detailed analysis of the possibilities of issuing digital currency of the central bank, which would be a supplement to the cash and non-cash form of payment. These analyzes include considering the advantages and disadvantages of that currency, determining its design and technological solution, as well as the necessary regulatory adjustments. In the coming period, we will witness a technological transformation in the operations of central banks, which, as before, should take care of preserving price and financial stability as its main goals, but also respond to new challenges of digital business.

Keywords: central bank's digital currency; digital forms of payment; technological innovations; monetary sovereignty

JEL classification: E42, O33

***The views expressed in this paper are those of the author and do not necessarily represent the official view of the National Bank of Serbia.**

Introduction

Technological innovations in the aspect of digital forms of payment are a new reality of the modern world. In addition to the already developed digital currency market, such as bitcoin, central bank initiatives for the development of central bank digital currencies are slowly emerging. These currencies would be under the control of the central bank, which would be its issuer, which would create an additional form of payment, in addition to cash and non-cash forms of payment. The digitalization of the payment system became especially important during the coronavirus pandemic, which during 2020 and 2021, led to the application of measures to close economies in order to limit contacts and suppress the spread of the virus. It was this closing of economies that influenced the intensified effort of central banks to work even more actively on the development of their digital currencies. During this development, it is necessary to establish technology that will follow the conceptual solutions of digital currencies of central banks, consider all the advantages and disadvantages of these currencies, legal aspects of issuance, but also the impact on financial stability and monetary sovereignty. The aim of this paper is to consider the possibility of issuing digital currencies of the European Central Bank, the Federal Reserve System, the Bank of England, and the Bank of Russia, as representatives of leading global central banks in terms of technological innovation in the field of digital currencies. The paper will present the regulation of digital currencies in Serbia, while the conclusion will summarize the results of this paper.

Literature Review

The coronavirus pandemic has affected the people's confidence in the currencies of some countries and stressed the need to have an alternative that has a good performance in an environment of contactless payment and closing the economy to avoid a liquidity crisis. The aforementioned influences countries to act proactively in the acceptance of digitization and accelerates the interest for central banks to study central banks' digital currency (Kuo Lee Chuen et al. 2021). The first comprehensive definition of the central bank's digital currency was published by the Bank for International Settlements in a report published in March 2018, stating that the central bank's digital currency is a "central bank liability denominated in an existing unit of account, serving as both a medium and a store of value" (BIS, 2018, 3). Adrian and Mancini-Griffoli (2019) point out that the need to distinguish between the central bank's digital currency and the synthetic central bank's digital currency, which according to them is a digital version of cash where central banks in some countries associate with electronic money providers to effectively secure the central bank's digital currency. In October 2020, a joint report was published in which the Bank of Canada, the European Central Bank, the Bank of Japan, the Central Bank of Sweden, the Swiss National Bank, the Bank of England, the Federal Reserve System and the Bank for International Settlements cooperated, analyzing the basic principles and essential features of central bank's digital currency. The report points to the challenges of issuing digital currency by the central bank (continuous access to central bank money, resilience, increased payment opportunities, encouraging financial inclusion), but also potential risks to financial stability (reducing the intermediary role of banks and jeopardizing monetary sovereignty) (BISa).

At the end of 2018, Barontini and Holden (2019) conducted research on whether central banks are working on the development of the central bank's digital currency and, if they are working on one, what type of digital currency they are working on and how extensive the work is. The survey involved 63 central banks, 41 of which are located in developing market countries and 22 in developed countries.

About 70% of respondents then answered that they are currently working (or will soon start) working on the development of the central bank's digital currency. The same survey was conducted at the end of 2019 by Boar et al. (2020) on a sample of 66 central banks and the results of that survey showed that 80% of the surveyed central banks are in some way involved in the development of the central bank's digital currency, which is an increase over the previously presented research.

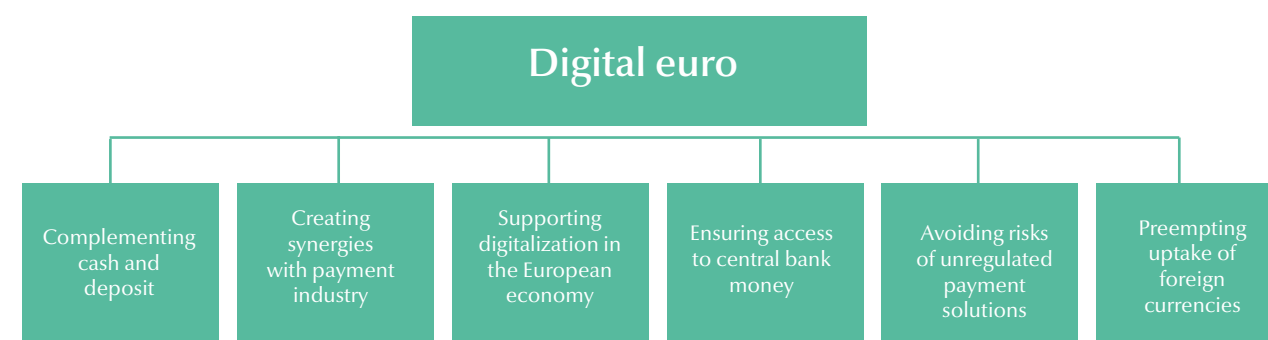
Bossu et al. (2020) emphasize the legal aspects of issuing central bank's digital currency and point out the importance of monetary law, which is the legal and regulatory framework that provides the legal basis for the use of monetary value in society, economy, and the legal system. The basic principle of this law envisages the need to determine and establish a currency system for a sovereign state. Shirai (2019) points to the need to issue a central bank's digital currency because over time the level of cash in circulation decreases, but some economies, especially developing countries, want to reduce printing and cash management costs and promote non-cash instruments. In their analysis, Bordo and Levin (2017) pointed out the necessary characteristics of a well-designed central bank's digital currency: (1) to be a medium of exchange without additional costs; (2) to ensure the preservation of values; (3) to facilitate the gradual obsolescence of paper money so that the central bank's digital currency is available to the general public; and (4) monetary policy should ensure price stability so that the value of the central bank's digital currency is also stable. Engert and Fung (2017) point out the motives for the central bank to issue digital currency and indicate that it would do so in order to ensure an adequate level of money in circulation and to preserve seniority income, then to reduce the lower boundary of interest rates and support the implementation of unconventional monetary policy, improving financial stability, increasing competitiveness in forms of payment, promoting financial inclusion and preventing criminal activities. Mancini-Griffoli et al. (2018) point to two benefits offered by issuing a digital central bank. The first refers to the demand and the extent to which the central bank's digital currency can meet the needs of end users for money, and the second is based on supply, in the sense that central banks, by issuing digital currency, can more fully achieve monetary policy goals and overcome certain market failures.

In addition to the potential elimination of cash, the central bank's digital currency provides the possibility for its users to directly hold that currency in an account opened with the central bank (Fernández-Villaverde et al. 2020). On the other hand, Chiu et al. (2019) developed a model with imperfect competition in the deposit market and analyzed whether the introduction of a central bank's digital currency would lead to a reduction in the intermediary role of banks. Their conclusion is that the introduction of a central bank's digital currency does not necessarily lead to a reduction in the intermediary role of banks and that the introduction of that currency could promote banking intermediation. Khiaonarong and Humphrey (2019) believe that, in order for a digital form of money to be successful, there would be an incentive to accept. For end users, the incentive is the convenience of not having to go to ATMs or banks to withdraw cash.

Digital Euro Development by the European Central Bank

Digitization is present in every aspect of the lives of each of us and affects the transformation of the payment system. The digital euro would be a fast, simple, and secure instrument for everyday payments. In that way, the digitalization of the European economy would be supported and further innovations in the retail payment system would be encouraged. In October 2020, the European Central Bank (ECB) announced the possibility of issuing a digital euro. The introduction of the digital euro will guarantee that all citizens of the euro zone have access to a simple and universally accepted, secure and reliable method of payment. The digital euro will be the same euro - like paper and coin money only in digital form. The issuance of the digital euro will be entrusted to the Eurosystem (ECB and national central banks) and will be available to all citizens and companies. Thus, the digital euro will not replace cash, but will complement it and provide additional choices in terms of payments, thus contributing to financial inclusion (Graph 1). The digital euro would be a combination of the efficiency of the digital payment instrument together with the security of money issued by the central bank. This would help overcome situations where citizens no longer want to own cash and avoid dependence on digital means of payment issued and controlled outside the euro area (for example bitcoin and other cryptocurrencies), which could jeopardize financial stability and monetary sovereignty. Preserving privacy would be a key priority in issuing the digital euro, in order to preserve confidence in digital payments. So far, the ECB has not set a deadline for the introduction of the digital euro, but is actively working on developing the concept, conducting a practical experiment and listening to the opinions of the general public. Even in the case of digital euro issuance, the ECB would be a guarantor of security and stability, both for cash and for the digital form of money. Thus, the digital euro would be a digital symbol of Europe's progress and integration (ECB).

Graph 1: *Reasons for Issuing the Digital Euro*



Source: ECBa - European Central Bank, *Report on a digital euro*, Accessed: 1.7.2021
<https://www.ecb.europa.eu/euro/html/digitaleuro-report.en.html>

In October 2020, the ECB published the “Report on a Digital Euro”, which presented the following aspects of the potential issuance of the digital currency of the euro area (ECBb):

- **reasons for issuing the digital euro** - support for the digitalisation of the European economy and the strategic independence of the European Union; the digital euro would be a response to the significant decline in the role of cash as a means of payment; consideration of the potential for widespread use of foreign digital currency by central banks or private digital payments in the euro area; the digital euro could become a new transmission channel for monetary policy; risk reduction for continuous provision of payment services; to increase the international role of the euro and to support the reduction of total costs, especially from the aspect of ecological approach to the monetary and payment system.
- **potential effects of the digital euro issuance** - the design of the digital euro should avoid the potential unintended consequences of its issuance on monetary policy, and it is necessary to avoid that excessive use of the digital euro leads to a situation where there would be a risk of a sudden change in the level of bank deposits in favor of the digital euro. In addition, it is necessary to establish conditions for its functioning outside the euro zone and take care to prevent cyber-attacks.
- **legal considerations** - the legal basis will depend on the source of the specific way of issuing the digital euro, because the primary laws of the European Union do not exclude the possibility of issuing the digital euro as the legal tender. This primarily refers to Article 127 of the Consolidated Version of the Treaty on the Functioning of the European Union, which refers to the functioning of the monetary policy of the European System of Central Banks, and Article 20 of the Statute of the European System of Central Banks and the European Central Bank defines other instruments of monetary control.
- **functional design of the digital euro** - in terms of the design of the digital euro, the report identified two that meet the necessary characteristics, namely offline and online. Both of these designs for the issuance of the digital euro are compatible with each other and can be applied simultaneously.
- **technical and organizational approaches to digital euro services** - the infrastructure for providing digital euro can be centralized (where all transactions would be recorded by the central bank) or decentralized (where the recording of transactions would be entrusted to intermediaries and/or under the supervision of intermediaries. Regardless of the approach chosen, the infrastructure for the provision of digital euro services should be under the control of the central bank.

Between 12 October 2020 and 12 January 2021, the ECB conducted a public consultation to gather views on the benefits and challenges of issuing the digital euro and its possible design on a sample of 8,221 respondents, who answered eighteen questions (ECBc). In April 2021, the ECB published the Eurosystem report on the public consultation on a digital euro, in which 94% of participants declared themselves as citizens and 6% as professionals. Both agreed that the issue of digital euro should be integrated into the existing banking and payments system and consider that the issue of privacy of transactions using digital currency is crucial, as well as preventing illegal activities. The majority of respondents are ready to support the issuance of the digital euro, especially considering that the digital euro would not be used either to abolish cash or to lower interest rates in euro area economies (ECBd).

Development of the Digital Dollar by the Federal Reserve System

Technological innovations provide an opportunity to think about money in new ways. In this regard, the Federal Reserve System (Fed) has a role in promoting a secure, affordable, and efficient payment system in the United States, but at the same time is involved in continuous experimentation and research into the latest payment technologies. In August 2020, the Fed pointed out the importance of research and pilot testing, and that it had begun to understand the opportunities and risks associated with issuing central bank’s digital currency. Like other central banks, the Fed will assess the opportunities and challenges of issuing a digital currency (i.e., the digital dollar), and ways to apply that currency in addition to cash, and other payment options. Within the Fed, there is a Technology Lab (TechLab) that develops pilot testing and experimentation of relevant technologies for issuing digital currency, but also develops other innovations in the payment system. The technology laboratory is a multidisciplinary team that includes employees who have expertise in the fields of payment operations, economics, law, information technology and computing. In addition, the Fed in Boston has been actively collaborating with the Massachusetts Institute of Technology for several years to develop a hypothetical digital currency whose issuance is tied to the central bank. The main goal of this research is to assess the security and efficiency of central bank’s digital currency systems. The main focus of the project is to develop capacity and relevant technologies, instead of serving to develop a digital currency prototype that the Fed could potentially issue or address a number of policies related to the potential issuance of digital currency. In addition, the Fed actively cooperates with other central banks and international organizations to improve the level of knowledge about the digital currencies of other central banks (FED).

Lael Brainard, member of the Board of Governors of the Fed in August 2020, said that digital currencies, including central bank’s digital currency, represent an advantage, but also carry risks associated with privacy, the possibility of using illegal activities and potential threat to financial stability. With the introduction of bitcoin, as well as the subsequent appearance of stablecoin, i.e., digital currencies whose value is linked to fiat money, as well as the announcement of the issuance of a digital currency that would have a global reach, such as the Libre issued by the social network Facebook, raised questions about legal and regulatory safeguards, financial stability and the role of digital currency in society. All of the above has influenced the active testing and development of central bank digital currencies, in order to maintain the national currency as an anchor of national payment systems (FEDa). For further cooperation on innovation and technological change in the development of digital currencies, the Fed has taken the initiative with the Innovation Hub of the Bank for International Settlements and this cooperation has resulted in the opening of an innovation center within the Fed in New York. Innovation Hub of the Bank for International Settlements was established in 2019 with the aim of identifying and further developing financial technology that is important for the functioning of central banks, but also to improve the functioning of the financial system and establish contacts between central bank experts in charge of innovation (BISb).

Wong and Maniff (2020) analyzed the comparability between central bank payment mechanisms and chose the following seven categories for comparison: availability, anonymity, bearer instrument, independence, operational efficiency, programmability, and service availability (Table 1). Their analysis showed that the digital currencies of central banks have better results than the cash and payment system RTGS (i.e., real-time gross settlement) in terms of programmability, but also in terms of operational efficiency. On the other hand, digital currencies of central banks have poorer results compared to cash, in terms of anonymity and independence.

Table 1: Comparison of Central Bank Payment Mechanisms

Payment mechanism	Accessibility	Anonymity	Bearer instrument	Independence	Operational Efficiency	Programmability	Service availability
Cash	5	5	5	5	1	1	5
Central bank digital currency	4.9	4	5	4	3	3	5
RTGS	4.7	1	1	1	4	3	4.99
RTGS+	4.75	1	1	3	4	4	4.99

Note: Grade 5 is the highest while grade 1 is the lowest.

Source: Wong P. and Maniff J. L. (2020). Comparing Means of Payment: What Role for a Central bank's digital currency ?. FEDS Notes, Accessed: 3.7.2021 <https://www.federalreserve.gov/econres/notes/feds-notes/comparing-means-of-payment-what-role-for-a-central-bank-digital-currency-20200813.htm#fig1>

Randal K. Quarles, vice chair for supervision of the Fed Board of Governors since 2017, pointed to the arguments of those who support the issuance of central bank's digital currency and the arguments against issuing it. In support of the issuance of central bank's digital currency, Mr. Quarles states that the Fed should develop central bank's digital currency to defend the dollar from threats posed by foreign digital currencies of central banks, on the one hand, and the continued spread of private digital currencies. Opponents of issuing central bank's digital currency point to risks in the structure of the banking sector, which currently relies on deposits as sources of lending to households and the economy. The central bank's digital currency can, thus, be an attractive target for cyber-attacks and other security threats that currency was an expensive and complicated process for the Fed (FEDb).

Fed President Jerome H. Powell indicated in May 2021 that a decision had not yet been made on whether the United States would issue the central bank's digital currency. Nevertheless, given the global significance of the dollar, it is necessary for the Fed to maintain its full commitment to the development of the central bank's digital currency, a better understanding of the technology necessary for its development and its potential (FEDc). Cheng, Lawson, and Wong (2021) argue that for the United States, no matter what the specific targets for central bank's digital currency issuance are, they should be consistent with the Fed's long-term goals, such as the security and efficiency of the national payment system, as well as monetary and financial stability.

The Development of the Digital Ruble of the Bank of Russia

The share of non-cash payments has been growing in recent years, which has become especially important during the coronavirus pandemic. Digital ruble can become a new and convenient additional means of payment for both buyers and sellers, including remote, sparsely populated, and hard-to-reach areas with limited access to financial infrastructure. Digital ruble will help expand private individuals' coverage with financial services by making them more affordable, which will improve people's quality of life. The domestic digital currency will also mitigate the risk of reallocation of funds to foreign digital currencies, thus contributing to macroeconomic and financial stability.

In October 2020, the Bank of Russia – BoR published a consultative document on the possibilities of issuing digital rubles, which is in line with the determination of other central banks to start issuing digital currencies of central banks. The digital ruble is a digital form of the national currency of Russia that will be issued together with the currently existing forms of money (that is, cash and non-cash rubles). Individuals will be able to keep their digital ruble in their electronic wallet and use it with a mobile phone or other devices when they have access to the Internet or without Internet access, that is, when they are online or offline. In case there is no network, there will be a possibility to reserve a certain amount of digital ruble in an electronic wallet, as is done with cash when there is no possibility of non-cash payment. When there is a network, transactions will be performed in a similar way as for non-cash payments. Depending on their needs, the household and the corporates will have the opportunity to convert their money between different forms - for example, to convert digital rubles into cash or to deposit them in their bank account, and vice versa. In order to perform this conversion, it is necessary to develop special technology that will enable offline usage. This will allow the digital ruble to combine the benefits of cash and non-cash money. Cutting edge technology that will be used to develop digital ruble will help reduce payment costs, increase financial involvement and encourage further advancement of payment technologies. In developing the digital ruble, the BoR will consider all of these aspects, along with the application of uncompromising information security requirements (BoR).

Table 2: Stages in the Development of Digital Ruble

1. Publication of a consultation paper
2. Conducting public consultations
3. Developing a digital ruble concept
4. Developing a digital ruble platform
5. Piloting digital rouble amid a limited number of participants
6. Analysing pilot results
7. Making a decision of feasibility and stages of digital ruble launch

Note: Timeframes for all stages will be determined later and will take into account public consultation results

Source: BoRa – Bank of Russia, A Digital Ruble. Consultation paper, page 11, Accessed: 30.6.2021, https://www.cbr.ru/StaticHtml/File/113008/Consultation_Paper_201013_eng.pdf

The introduction of digital rubles will require a revision, first of all, of the Civil Code of the Russian Federation with regard to the inclusion of digital rubles in the list of civil law cases, the establishment of payment options using digital rubles and the inclusion of digital rubles in general settlement regulations, as well as the Federal Law on the Central Bank of the Russian Federation - Bank of Russia in connection with the expansion of the BoR's function and defining the issue of emissions and circulation of digital rubles (BoRa).

In its consultation paper, the BoR points out that all economic agents will have access to the digital ruble, including individuals, the economy, financial market participants and the government. Like cash and non-cash payments, the digital ruble will have three functions of money, namely the means of payment, the measure of value and the store of value. All three functions of the Russian ruble will be absolutely equal: as one cash ruble is equated with one non-cash ruble, so one digital ruble will always be equated with each of them. In doing so, the BoR states that the digital currency will not replace cash or non-cash payments, but will be an added form of money in addition to the usual forms of money. Also, it is specified that the digital ruble is not a cryptocurrency, because cryptocurrencies do not have a single institution that will issue them, there is no guarantee of consumer rights, their value is subject to significant fluctuation, many countries do not accept cryptocurrencies as a means of paying for goods and services. and there is no single institution to ensure their safety. On the other hand, digital ruble is the responsibility of the BoR, which will implement it using digital technology. In essence, the digital ruble is fiat money whose stability is ensured by the state represented by the central bank (BoRb).

In April 2021, the BoR published the concept of digital currency, which is based on feedback received from respondents and market participants after the discussion on the consultative document on digital ruble from October 2020. BoR has chosen a two-tier retail model for the implementation of the digital ruble, which means that BoR is both a digital ruble issuer and a digital ruble platform operator. In order for digital ruble to function in practice, it is necessary for financial institutions to open electronic wallets for their clients and perform operations through those wallets on the digital ruble platform. household and corporates will be able to access their digital rubles through any bank in which they have an open account and a digital wallet. BoR chose the two-tier retail model because research by other regulators and pilot tests of central bank digital currencies have shown that the two-tier retail model is the most desirable in terms of innovation and financial market stability (BoRc). Regarding the deadline for issuing digital currency, BoR Governor Elvira Nabiullina said in October 2020 that the central bank would first implement a pilot (trial) project for a limited number of participants, through which it would see all the advantages and disadvantages of the digital ruble and announced that it could happen by the end of this year. Ms. Nabiullina said that if the BoR decides to introduce the digital ruble, its introduction will be gradual and that it is envisaged that the digital currency has a unique code, just as cash has serial markings. It is the unique code that will make digital currency ensure the transparency of their transactions, while preserving trust and privacy (BoRd).

The Development of the Digital Pound of the Bank of England

In March 2020, the Bank of England - BoE published a Document discussing the introduction of a digital currency by the central bank in which it analyzed the possibilities, challenges and design of issuing digital currency (BoE). The document outlines four steps for the potential introduction of a digital central bank currency (BoEa):

1) Understanding the possibilities and challenges in issuing digital currency of the central bank - it is necessary to clearly understand the possibilities that issuing digital currency of the central bank brings with it, but also the challenges that the central bank needs to deal with.

2) It is necessary to consider the general objectives that each digital bank digital currency issuance design should meet - the general aims should be in line with the BoE objective and mandate, bearing in mind policy objectives other than monetary. Starting from the BoE's goal of maintaining monetary and financial stability, it is essential to ensure that the digital currency design is reliable and resilient, fast and efficient, and open to innovation and competition.

3) Design of the digital currency of the central bank - it is necessary to meet two elements: a) for the digital currency of the central bank itself (i.e., access to a new form of money by the central bank) and b) infrastructure of the central bank's digital currency using that currency. In this regard, it is necessary to analyze three principles when it comes to the design of the digital currency of the central bank:

- Division of responsibilities in issuing the digital currency by the central bank. Responsibilities and functions in issuing the central bank's digital currency can be divided between the public sector (for example among the central bank and other institutions) and the private sector (for example financial institutions, payment service providers and technology companies). The division of responsibilities in issuing that the digital currency would also affect whether the central bank's digital currency is open to competition, resilient and designed based on the comparative advantage of the private and public sectors.

- Functional design refers to ensuring that the central bank's digital currency payment function provides clear benefits and utilities to its customers. This refers to the types of payments that can be made using this currency, but also by considering expanding the functionality of the digital currency of the central bank if payment needs change in the future. The decisions made would have a particular impact on whether the central bank's digital currency is user-friendly, available to the general public, and as well as the level of privacy in the execution of transaction.

- Economic design refers to aspects such as access (who can have access to the use of the central bank's digital currency), fees (does the central bank's digital currency need to bear interest?) and convertibility (whether the digital currency of the central bank can be fully convertible for other forms of money issued by the central bank and for bank deposits). Depending on the choice, it directly affects the possibility for the central bank to achieve its goal of maintaining monetary and financial stability, as well as the impact that the digital currency of the central bank would have on other forms of payments and payment systems, as well as on the functioning of the banking system.

4) Technology - it is necessary to assess which technology could meet the design and functionality requirements, having in mind the characteristics of each model of issuing central bank's digital currency. It is also necessary to consider the technological trade-offs that are present between the different design principles of this currency. The choice of technology determines the extent to which the central bank's digital currency could be resilient, secure,

fast, efficient and accessible.

In June 2021, the BoE issued a public opinion on a document discussing the introduction of the central bank's digital currency from March 2020. Respondents indicated that the BoE should carefully analyze the central bank's digital currency. In this regard, the BoE plans to deepen its research into the central bank's digital currency by launching three initiatives. The first concerns the establishment of a joint working group with the Ministry of Finance to ensure a coordinated approach to research on issues of public importance around the central bank's digital currency by representatives of the United Kingdom authorities. The second initiative relates to the establishment of a forum of the digital currency of the central bank that includes stakeholders of the academic community and representatives of society in terms of analyzing the challenges of designing, implementing and managing this currency. The third initiative also concerns the establishment of a central bank's digital currency technology forum to ensure that the BoE fully understands the state-of-the-art technology when considering technological solutions for issuing digital central bank currency (BoEb). In a statement dated 7 June 2021, the BoE announced that it had not yet made a decision on issuing the central bank's digital currency, but that a future decision would be made based on a detailed consideration of how the central bank's digital currency could affect the BoE objectives, as well as the objectives of the Government (BoEc).

Regulation of Digital Currency in Serbia

On several occasions, such as in October 2014 (NBS) and in May 2016 (NBSa), the National Bank of Serbia made public warnings that digital currencies are not legal tender in Serbia. According to Article 53 of the Law on the National Bank of Serbia the dinar is the legal tender of the Republic of Serbia and the National Bank of Serbia has the exclusive right to issue banknotes and coins in the Republic of Serbia. Law on the Prevention of Money Laundering and Financing of Terrorism, in Article 3 defines the term virtual currency as "digital records of values not issued and whose value is not guaranteed by the central bank or other public authorities, which are not necessarily linked to a legal tender and do not have the legal status of money or currency, but are accepted by natural or legal persons as a means of exchange and may be bought, sold, exchanged, transferred and stored electronically". This indicates that the National Bank of Serbia supervises the implementation of this law over persons engaged in the provision of services related to virtual currencies (Martin, 2020).

In December 2020, with implementation starting as of 30 June 2021, Law on Digital Asset in Serbia came into force. The adoption of this law represents a significant moment in the development of modern Serbian legislation and the Law on Digital Asset is the first law in the Republic of Serbia that regulates the sphere of digital business and trade in digital assets. The main novelty is the introduction of virtual currency and digital tokens as a valid means of exchange between individuals and/or legal entities, as well as the legalization of digital asset mining. From a legal point of view, the most important thing is that transactions with digital assets are now guaranteed legal protection, both regulatory and judicial. The supervisory bodies of the law are the National Bank of Serbia and the Securities Commission. The National Bank of Serbia is responsible for issues related to decision-making in administrative procedures, adoption of bylaws, supervision over the performance of activities and realization of other rights and obligations of the supervisory body in the part related to

virtual currencies as a type of digital asset. The Commission is responsible for issues referred to in this Law related to decision-making in administrative proceedings, adoption of bylaws, supervision over the performance of activities and exercise of other rights and obligations of the supervisory body in the part related to digital tokens as a type of digital asset, as well as in the part related to digital assets that have the characteristics of financial instruments. Article 15 of the Law on Digital Assets precisely defines that the Republic of Serbia, the National Bank of Serbia, the Commission and other competent authorities and public authorities do not guarantee the value of digital assets and are not responsible for any possible damages and losses suffered by users and other digital asset owners and/or digital asset-related service providers and/or third parties, in connection with the conduct of digital asset transactions. In early July 2021, the National Bank of Serbia issued a statement that it had not issued any approval for white paper issued when issuing virtual currencies as a type of digital asset, and that no request for such approval had been submitted to the National Bank of Serbia until then in order to deny the media's allegations that the first Serbian virtual currency was issued (NBSb).

For now, the National Bank of Serbia has not issued a statement on the possible issuance of central bank's digital currency. However, with the entry into force of the Law on Digital Assets, the Republic of Serbia has created the first framework for the regulation of digital assets, which has created legal security for users of digital asset and all potential investors. At the same time, this law provides an opportunity to further develop the domestic capital market using digital technology, while strengthening the legal framework to combat terrorist financing, money laundering and potential abuses in the digital asset market.

Conclusion

The development of digital technology and non-cash means of payment have influenced the leading central banks to start developing the central bank's digital currency, which creates challenges for the modern monetary and financial system. Such a transformation in business was contributed to by the accelerated development of digital currencies, the best-known being bitcoin, but also by the announcement of the possible introduction of a digital currency that would have a global reach, such as Libre, which would be emitted by the social network Facebook. An additional incentive for central banks to develop their digital currencies was given by the corona virus pandemic, which introduced a social distance to prevent the spread of the virus, as well as a recommendation to use non-cash forms of payment as much as possible.

The paper analyzes the process of developing a central bank's digital currency by the most important central banks, which are still in the trial phase of testing the central bank's digital currency, analysis of advantages and disadvantages, desirable technological design and necessary legal adjustments. In October 2020, the European Central Bank announced the possibility of issuing a digital euro, and its introduction will guarantee that all citizens of the euro zone have access to a simple and universally accepted, secure and reliable method of payment. The issuance of the digital euro will be entrusted to the Eurosystem and will be available to all citizens and companies. For now, the European Central Bank has not set a deadline for the introduction of the digital euro, but is actively working on developing the concept, conducting a practical experiment, and listening to the opinions of the general public. The European Central Bank would be a guarantor of security and stability, both for cash and for the digital form of money, even in the case of digital euro issuance. Thus, the digital euro would be a digital symbol of Europe's progress and integration. In August 2020, the Federal Reserve System pointed

out the importance of research and pilot testing in order to understand the possibilities and risks associated with the issuance of central bank's digital currency. Like other central banks, the Federal Reserve System will assess the opportunities and challenges of issuing digital currency (i.e., digital dollar), ways to apply that currency in addition to cash, and other payment options. Federal Reserve System President Jerome H. Powell indicated in May 2021 that no decision had yet been made on whether the United States would issue the central bank's digital currency. However, given the global significance of the dollar, it is necessary for the Federal Reserve System to maintain full commitment to the development of the central bank's digital currency, a better understanding of the technology necessary for its development and its potential.

In October 2020, the Bank of Russia published a consultative document on the possibilities of issuing digital ruble, which would represent the digital form of the national currency of Russia, which will be issued together with the currently existing forms of money. Regarding the deadline for issuing digital currency, the Governor of the Bank of Russia Elvira Nabiullina stated in October 2020 that the central bank will first implement a pilot (trial) project for a limited number of participants through which it will see all the advantages and disadvantages of digital ruble and announced that it could happen by the end of this year. In March 2020, the Bank of England published a document discussing the introduction of central bank's digital currency, which analyzed the possibilities, challenges and design of digital currency issuance, while in June 2021 it was announced that it had not yet made a decision to issue digital currency, but that a future decision will be made on the basis of a detailed consideration of how the central bank's digital currency may affect the objectives of the Bank of England as well as the objectives of the Government.

For now, the National Bank of Serbia has not issued a statement on the possible issuance of the central bank's digital currency. However, with the entry into force of the Law on Digital Assets, the Republic of Serbia has created a regulatory framework for digital assets, not only providing a clear legal framework and legal certainty for investors and users of digital assets, but also sending a signal to the world that Serbia is becoming a fintech country. The main novelty of this law is the introduction of virtual currency and digital tokens as a valid means of exchange between individuals and/or legal entities, as well as the legalization of digital asset mining.

In the coming period, we can expect the publication of further results of pilot projects in the issuance of central bank's digital currency, and then the first issue of these currencies. This would push the boundaries in the digitalization of payments, with the need to preserve price and financial stability. All this will have an impact on the transformation of the hitherto known monetary and financial system and on the presence of new forms of payment for citizens and the economy. For end users, the central bank's digital currency that will be accessible, resilient, secure, fast and efficient and that will protect the privacy of transactions will be acceptable. Further development of the central bank's digital currency is a challenge for central banks, which will thus become part of the modern digital market through the development of this inspiring area of banking.

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SAJBER INCIDENTI POVEZANI SA FINANSIJSKIM INSTITUCIJAMA

Ksenija Popović, doktorand,
Alpen Adria Univerzitet u Austriji
email: ksenijapo@edu.aau.at

Rezime

Osnovna tema rada je ubrzana digitalna transformacija finansijskih institucija koja, pored prednosti, donosi i povećan rizik od sajber incidenata. Sajber incidenti mogu naneti štetu od sistemskog značaja i zato izgradnja dobrog sistema sajber bezbednosti prevazilazi okvire pojedinačnih finansijskih institucija. Na osnovu uporedne analize trenda svesti javnosti o sajber napadima, zaključak ovog rada je da za razliku od razvijenih zemalja, svest javnosti u Srbiji nema kontinuiran nego povremen rast izazvan pojedinačnim događajima povezanim sa sajber napadima. Dizajniranje nacionalne kampanje za podizanje svesti javnosti o sajber bezbednosti, kao i obučavanje i zadržavanje visokokvalifikovanih kadrova dve su preporuke koje se same nameću nakon opservacije i analize informacija o sajber incidentima u Srbiji.

Ključne reči: Zlonamerni sajber incident; digitalna transformacija; finansijske institucije; sajber bezbednost

JEL klasifikacija: G20, K24

Uvod

Grupa G20 je 2017. godine upozorila da sajber incidenti mogu ugroziti stabilnost finansijskog sektora (G20 Communiqué, 2017), te je dodelila zadatak svom Odboru za finansijsku stabilnost da popiše nacionalne regulative i primere dobre prakse u vezi sa sajber incidentima. Zemlje članice G20 proizvode 80% svetskog BDP-a, a u njima živi 60% svetske populacije. U aprilu 2020. godine pomenuti Odbor za finansijsku stabilnost je objavio preporuke finansijskim institucijama šta raditi pre, za vreme i nakon sajber incidenta (G20 Financial Stability Board, 2020). Odbor za finansijsku stabilnost je jačanje otpora na sajber napade takođe postavio među prioritetne zadatke u svom programu za 2021. godinu (G20 Financial Stability Board, 2021).

Kristin Lagard, predsednica Evropske centralne banke, upozorila je u februaru 2020. godine da bi dobro organizovan sajber incident na glavne finansijske institucije mogao izazvati ozbiljnu finansijsku krizu (Thornton, 2020). A u isto vreme, Evropski odbor za sistemski rizik, zadužen za makroprudencijalni nadzor u EU, objavljuje izveštaj Sistemski sajber rizik. U ovom izveštaju piše: „...nije nezamislivo da bi u budućnosti veliki sajber incident u finansijskom sektoru mogao stvoriti poremećaj tolikog obima da može imati ozbiljne negativne posledice na unutrašnje tržište i realnu ekonomiju“ (European Systemic Risk Board, 2020, str. 23). U aprilu 2021. godine, predsedavajući Federalnih američkih rezervi Džerom Pael je izjavio da je sajber rizik povezan sa finansijskim institucijama veći i iznad bilo kog drugog rizika u zemlji (Vavra, 2021).

Putem opservacije i analize već postojećih informacija na ovu temu, cilj ovog rada je da odgovori na dva pitanja: prvo, zašto se tolika pažnja usmerava na sajber incidente i drugo, kakva je situacija na finansijskom tržištu Srbije. Struktura rada je sledeća: U prvom delu se navode prednosti i nedostaci tehnološkog progressa u finansijskim institucijama. Definicija sajber incidenta, akteri pretnje, vrste i konkretni primeri sajber incidenata se daju u drugom delu. U trećem delu se definiše sistemski sajber rizik i analiziraju mere za poboljšanje sajber bezbednosti, uključujući i par preporuka za Srbiju.

Digitalna transformacija

Digitalna transformacija obuhvata niz malih i velikih tehnoloških pomaka koje ne samo da pomeraju ponudu ka onlajn i digitalnim uslugama finansijskih institucija, već uključuju i primenu savremene tehnologije u svim sferama rada. U procesu regrutovanja novih radnika, na primer, banke sve češće koriste veštačku inteligenciju da napravi uži izbor kandidata na osnovu ključnih reči iz njihovih biografija. Sa jedne strane, digitalizacija čini interne procese efikasnijim, a sa druge strane, menja način komunikacije sa korisnicima bankarskih usluga. Skoro sve banke sada imaju svoje profile na društvenim mrežama (Facebook, Twitter, LinkedIn...), dok veb-roboti komuniciraju sa korisnicima na platformama za časkanje zahvaljujući veštačkoj inteligenciji. Banke takođe nude digitalno otvaranje računa, instant plaćanja u roku od nekoliko sekundi, usluge u digitalnoj filijali, elektronske keš kredite... E-banking omogućava korisnicima da pristupe svojim računima i koriste ih bilo kad i bilo gde. M-banking omogućava bankama da prodaju svoje proizvode i putem aplikacija za mobilne telefone.

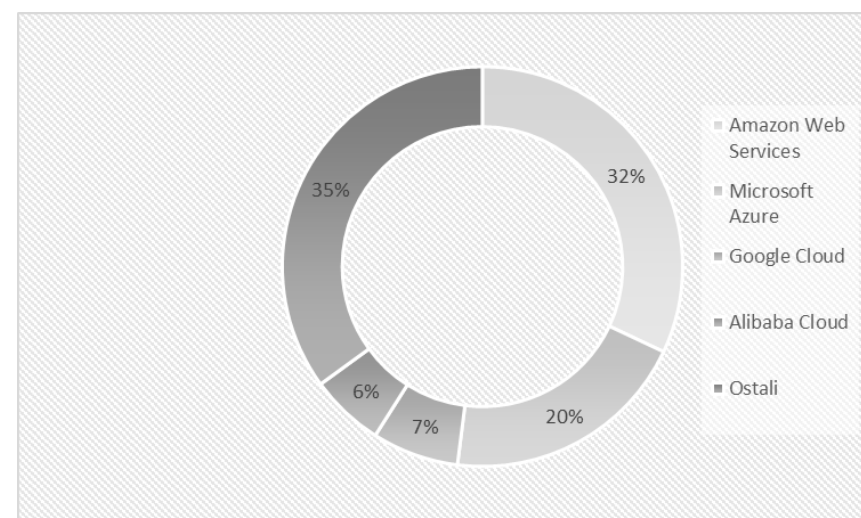
Prema empirijskom istraživanju, u periodu od 1992. do 2014. godine, bankarski sektori zemalja evrozone razvijaju se konvergirajući prema najboljoj dostupnoj tehnologiji, a produktivnost bankarskih sektora raste zahvaljujući stalnim tehnološkim pomacima, mada po sve nižim stopama (Casu, Ferrari, Girardone, & Wilson, 2016). Bankarski sektor Srbije drži korak sa ovim tehnološkim promenama (Zec, 2021), najviše zato što u njemu dominiraju razvijene strane banke.

Na finansijskom tržištu postoji mali broj onih koji su predvodnici tehnološkog razvoja, sa jedne strane, i postoji većina koja prate tržišne lidere nastojeći da smanje tehnološki jaz, sa druge strane. Navodim nekoliko primera napredne digitalne transformacije koju provode velike bankarske grupacije: HSBC grupa, koja je šesta i Bank of Amerika koja je osma najveća bankarska grupacija na svetu prema ukupnoj imovini na kraju 2019. godine (S & P Global Market Intelligence, 2020):

- **Cloud computing** je nova tehnologija koja obezbeđuje internet mesto ili oblak dajući pojedincima i bankama (kao i ostalim kompanijama) mogućnost da koriste resurse, kao što su virtuelne mašine, baze podataka, memorija, usluge, arhiva, slanje poruka, itd. Zbog toga cloud computing doprinosi, pored ostalog, nižim troškovima kompjuterske infrastrukture, boljem izveštavanju i analizi, bržem i lakšem pristupu podacima, boljem uvidu u potencijal unakrsne prodaje. U oktobru 2019. godine, Bank of Amerika je 80% aktivnosti izvršavala preko sopstvenog oblaka, čime je smanjila sa 200.000 na 70.000 broj svojih servera. Bank of Amerika sada namerava da preseli svoje aktivnosti na javni oblak (CapGemini & EFMA, 2021, str. 22). HSBC banka je objavila u julu 2020. godine da je odabrala javni oblak firme Amazon Web Services za svoje poslovne aktivnosti na globalnom nivou (Flinders, 2020).

To internet mesto može biti u sopstvenom vlasništvu ili javno (u tom slučaju domaćin je neko drugi, tj. dobavljač oblaka). Četiri najveća dobavljača oblaka su Amazon Web Services, Microsoft Azur, Google Cloud i Alibaba Cloud. Prema procenama Canalysa (Canalys, 2021), njihovo tržišno učešće u Q4 2020 je dominantno u odnosu na ostale dobavljače (grafika 1). Iako se podaci Canalysa ne odnose samo na potrošnju oblaka resursa od strane banaka, jasna je tendencija homogenizacije oko nekoliko najvećih cloud dobavljača.

Grafika 1: Svetska potrošnja infrastrukture oblaka, 39,9 milijardi USD, Q4 2020



Izvor: Canalys (Canalys, 2021).

- HSBC banka učestvuje i u evropskom NEASQC istraživačkom projektu primene **quantum computing tehnologije**. NEASQC je skraćenica za Next Applications of Quantum Computing (u prevodu „Buduće primene kvantum tehnologije“). Smatra se da kvantum kompjuteri imaju veće sposobnosti da obavljaju izuzetno kompleksne zadatke u odnosu na današnje kompjutere (HSBC, 2020).

- **Biometrijska tehnologija** u bankama znači da će se PIN kodovi i lozinke uskoro zameniti biološkim karakteristikama ljudi. HSBS banka je najavila glasovnu verifikaciju svojih klijenata (Grant, 2021).

Čak i naprednije zemlje razmišljaju o novim tehnologijama koje mogu potpuno preokrenuti način rada u budućnosti:

- Na **distributed ledger technology (DLT)** se gleda kao na moguću treću generaciju platnog sistema, nakon generacije zasnovane na papiru i one zasnovane na batch obradi (IMF Fintech Notes 20/01, 2020). Na primer, centralna banka Kanade i monetarne vlasti Singapura bilateralno su povezale svoje eksperimentalne platne sisteme u kojima se koristi digitalni novac. One su povezale dve različite DLT platforme. Drugi primer, SWIFT je kreirao novu GPI platformu radi povećanja brzine plaćanja. Ta platforma nije DLT platforma, ali istražuje se mogućnost da se blokčejn kompanije povežu na SWIFT GPI platformu (IMF Fintech Notes 20/01, 2020). Blokčejn je vrsta DLT platforme.

Sa pojavom pandemije, finansijske institucije pokušavaju da se prilagode promenljivom, neizvesnom i složenom okruženju. Zatvaranja koja su usledila u svim zemljama tokom pandemije korona virusa primorala su banke i ostale finansijske institucije da zatvore svoje filijale, a korisnike da se sve više okrenu onlajn uslugama. Udeo beskontaktnih plaćanja, onlajn plaćanja, plaćanja putem kartica se povećava, dok se udeo plaćanja gotovim novcem smanjuje (Ernst & Young, 2020). Zbog pandemije i veći broj radnika finansijskih institucija počinje da radi od kuće, što znači da zaposleni ne rade više u virtuelnom i fizičkom prostoru pod kontrolom tih finansijskih institucija. Prisustvujemo ubrzanju primene digitalne tehnologije.

Međutim, digitalna transformacija ima i određene nedostatke. Tokom pandemije broj sajber napada na finansijske institucije se toliko uvećao da je finansijski sektor postao druga najčešća meta napada, odmah nakon zdravstvenog sektora (BIS, 2021). Postavlja se pitanje da li finansijski sektor može da drži korak sa rastućim brojem zlonamernih sajber napada.

Sajber incident

Sajber incidenti postaju sve češći, inovativniji, sofisticiraniji, u višestrukim formama dok je sajber rizik tek delimično shvaćen (Kopp, Kaffenberger, & Wilson, 2017). Svaka finansijska institucija je izložena sajber riziku, zato što ne postoji savršen sistem sajber bezbednosti - “neke nepoznate rupe u sistemu uvek postoje bez obzira na tehnološku sofisticiranost” (Uddin, Ali, & Hassan, 2020, str. 9). Ideja mog rada je da se približi tema sajber incidenata, počevši od definicije, aktera i vrsta sajber incidenata.

Prema sajber leksikonu (G20 Financial Stability Board, 2018, str. 9), sajber incident je: „sajber događaj koji:

- ugrožava sajber bezbednost informacionog sistema ili informacija koje sistem obrađuje, čuva ili prenosi; ili
- krši bezbednosne politike, bezbednosne procedure ili politike prihvatljive upotrebe, bilo da proizilazi iz zlonamerne aktivnosti ili ne“.

Sajber incident može dakle biti slučajan ili zlonameran. Ali, ovde nas interesuju prevashodno zlonamerni sajber incidenti, zato što su oni brojniji. Preciznosti radi, razlika između sajber napada i sajber incidenta je u tome što napad prethodi incidentu. Mada, u Srbiji se koristi termin sajber napad da opiše oba događaja, i napad i incident.

Nekoliko je aktera sajber pretnje: nacionalni, kriminalni, teroristički, aktivisti, zaposleni sa različitim motivima (videti tabelu 1). Severna Koreja se često smatra sponzorom sajber grupa koje su uključene u krađe novca, pranje novca i kampanje iznude (Varga, Brynielsson, & Franke, 2021; Cybersecurity & Infrastructure Security Agency, 2020). Sajber kriminalne grupe su ipak najčešći akteri pretnje, a neke od dobro poznatih su Carbanak, Silence, Lazarus, Old-Gremlin i Black Shadow.

Tabela 1:

Akter pretnje	Motivi
Nacionalni	Geopolitički i ideološki
Kriminalni	Sticanje materijalne koristi
Terorističke grupe, hakeri aktivisti	Ideološki, nezadovoljstvo
Interna pretnja	Pohlepa, razočarenje

Izvor: ESRB (European Systemic Risk Board, 2020).

Postoji i više vrsta sajber incidenata, a najčešće vrste uz kratak opis su navedene u tabeli 2. Međutim, ima nekoliko zajedničkih karakteristika različitih vrsta sajber incidenata. Prvo, teško se uočavaju. Istraživanje koje je obuhvatilo finansijske institucije širom sveta u periodu od 2002-2019. god. došlo je do zaključka da je u proseku je potrebno 251 dan od momenta dešavanja do momenta detektovanja gubitaka nastalih po osnovu sajber incidenata (Aldasoro, Gambacorta, Giudici, & Leach, 2020a). Drugo, zbog svoje anonimnosti i ireverzibilnosti transakcija, kriptovalute su se ustalile kao metod plaćanja sajber napadača od strane žrtava napada (EUROPOL, 2020). Treće, finansijske institucije nisu uvek voljne da prijavljuju sajber incidente zbog reputacionog rizika (Britz, 2013; Varga, Brynielsson, & Franke, 2021).

Tabela 2:

Vrsta sajber incidenta	Kratak opis
Malware	Softver dizajniran da nanese štetu (npr. kompjuterski virusi, Trojanci...)
Man-in-the middle	Smeštanje usred transakcije između dve strane
Cross-site scripting	Zloupotreba ranjivosti veb aplikacije, kojoj žrtva, korisnik te aplikacije, inače veruje
Phishing	Oponašanje pouzdanog entiteta u digitalnoj komunikaciji, kako bi se zadobilo poverenje žrtve
Password cracking	Identifikacija nepoznate lozinke
A zero-day exploit	Zloupotreba uočene ranjivosti softvera ili hardvera
Distributed Denial of Service(DDoS)	Višestruki napad na metu (na primer server, internet stranicu ili mrežu) koji onemogućava dalju uslugu korisnicima

Izvor: BIS bilten br. 37 (BIS, 2021) i Aldasoro, Gabacorta, Giudici & Leach (2020b).

Na zvaničnoj internet stranici Carnegie fondacije za međunarodni mir nalazi se baza podataka koja sadrži važnije sajber incidente povezane sa finansijskim institucijama širom sveta (tzv. Timeline of Cyber Incidents Involving Financial Institutions - Carnegie Endowment for International Peace). Carnegie fondacija za međunarodni mir je međunarodni analitički centar, osnovan 1910. godine. Vrste sajber incidenata koje evidentira ova baza su upad u bazu podataka, krađa, špijunaža i prekid rada. Evo nekoliko primera sajber incidenata u svetu:

- U januaru 2021. god., centralna banka Novog Zelanda pretrpela je upad u svoju bazu podataka.
- U decembru 2020. god. izraelska osiguravajuća kompanija bila je pod napadom Black Shadow sajber kriminalne grupe, koja je tražila 200 bitcoina u zamenu za ukradene podatke.
- U septembru 2020. god. nekoliko mađarskih banaka je prekinulo rad zbog DDoS napada.
- U avgustu 2020. god. jedna marokanska banka je pretrpela upad u račune klijenata i neovlašćeno sprovođenje transakcija.
- U martu 2020. god. kriminalna sajber grupa OldGremlin ulazi u mreže nekoliko ruskih banaka, šifrira podatke i traži otkup.

Na osnovu javno dostupne evidencije Nacionalnog CERT Republike Srbije (CERT je akronim za Computer emergency response team), najčešći sajber incidenti povezani sa finansijskim institucijama u našoj zemlji odnose se na maliciozne phishing kampanje usmerene prema klijentima banaka (<https://cert.rs/obavestenja.html#613>). Mediji su u maju 2017. godine preneli da je bio pokušaj da se nanese materijalna šteta Zavodu za izradu novčanica i kovanog novca, koji posluje u okviru Narodne banke Srbije, putem zlonamerne phishing poruke (Tanjug, 2017; BizLife, 2017).

Zapravo svi oni sektori koji su od kritičke važnosti za ekonomiju jedne zemlje, kao što su naftovodi, električno snabdevanje, bankarski sektor, itd., treba da budu predmet nacionalne bezbednosti kada su sajber incidenti u pitanju (Aldasoro, Gambacorta, Giudici, & Leach, 2020b; Brenner, 2017).

Sistemijski sajber rizik

Visok je nivo međusobne povezanosti među finansijskim institucijama, a naročito njihovih IT sistema. To doprinosi većoj brzini i širim razmerama prenosa negativnih posledica potencijalnog sajber incidenta. Ali nije svaki sajber incident sistemijske prirode. Izveštaj Carnegie fondacije za međunarodni mir predlaže nekoliko konkretnih uslova koji kumulativno treba da budu zadovoljeni za kategorisanje sajber incidenta u sistemijski (Brauchle, Göbler, Seiler, & von Busekist, 2020):

- usmerenost ka sistemijski važnoj finansijskoj instituciji ili nekoliko finansijskih institucija (funktionalni kanal);
- vreme trajanja incidenta traje 2 sata i/ili je dugo toliko da sprečava poravnanje na kraju dana;
- direktni i indirektni finansijski gubitak prelazi nivo kapitala banke (finansijski kanal);
- gubitak poverenja meren trajanjem vesti o incidentu, brojem uključenih medija i geografski prostor koji pokrivaju (kanal poverenja).

Evropski odbor za sistemijske rizike je analizirao nekoliko hipotetičkih sistemijskih sajber rizika (European Systemic Risk Board, 2020), među njima: (i) pad sistema plaćanja sistemijski važne domaće banke i (ii) brisanje podataka o stanju na računima praćeno neovlašćenim plaćanjima. U oba slučaja, što duže traje sajber napad, to su veće negativne posledice. Opšti gubitak poverenja izaziva sistemijski karakter sajber incidenta. „Na primer, ako bi - nakon uspešnog zlonamernog sajber incidenta - klijenti banke utvrdili da su sva stanja na računima nula ili nedostupna duže vreme, te da institucija ne može da reši situaciju u razumnom vremenskom roku, moguće je da bi panika počela da se širi. Kao otežavajući faktor, lažne vesti i dezinformacije u takvom slučaju mogu se širiti putem društvenih mreža, moguće i kao deo incidenta, dodatno destabilišući tržišta i društvo“ (European Systemic Risk Board, 2020, str. 38).

Postoji mišljenje da prenos IT funkcija finansijskih institucija na cloud može biti takođe izvor sistemijskog sajber rizika (Danielsson & Macrae, 2019; Aldasoro, Gambacorta, Giudici, &

Leach, 2020b). Obzirom na trend homogenizacije oko najvećih cloud dobavljača, bilo kakav sajber ili neki drugi incident na cloud-u može uticati na više finansijskih institucija u isto vreme. Setimo se požara u martu 2021 godine, kada je od četiri data centra OVH cloud-a u Strazburu, jedan uništen, a drugi oštećen. Milionski broj veb-sajtova bio je van funkcije, uključujući i one od raznih agencija vlade, banaka, novina, radnji, itd. OVH cloud je inače najveći evropski cloud dobavljač. Danielsson i Macrae (2019) predlažu regulisanje poslovanja cloud dobavljača, jer je pitanje da li bi jedan privatni cloud dobavljač dao prioritet klijentima iz svoje ili neke druge zemlje, da li bi dao prioritet vladi ili finansijskim institucijama – u slučaju rešavanja posledica zlonamernog sajber incidenta.

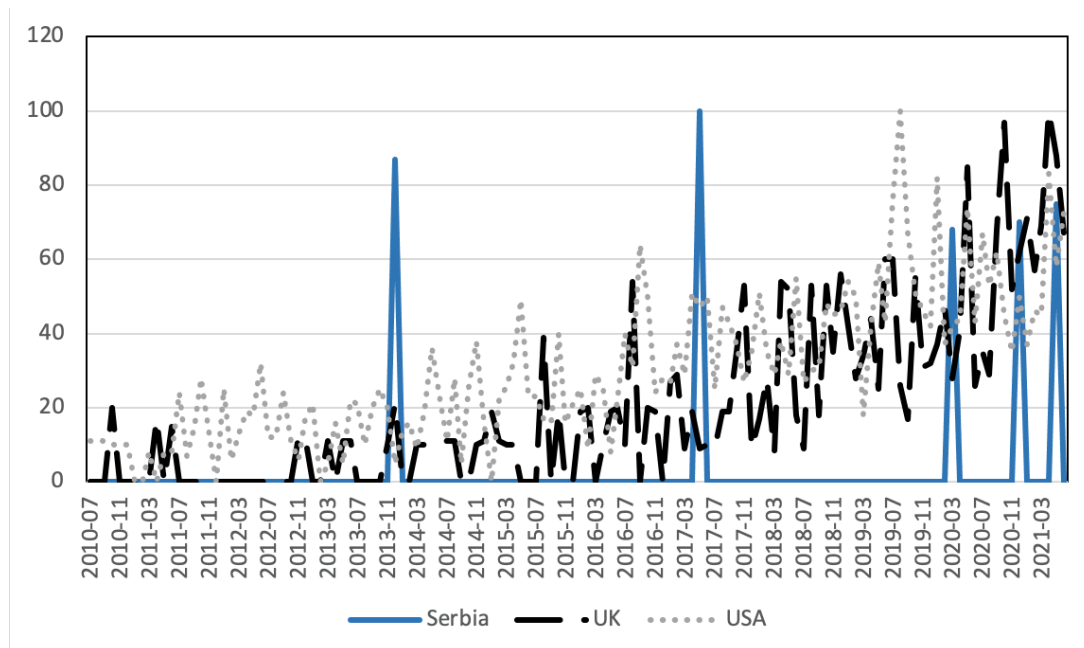
Jedan od važnih zadataka radi povećanja stepena sajber bezbednosti je uvođenje standarda i regulativa na nacionalnom, ali i internacionalnom nivou. Postavljanje standarda i regulative u oblast sajber prostora je važno zato što „se pojedinačne kompanije ne bave u potpunosti izgubljenim poverenjem javnosti u ceo sistem kada neko upadne u podatke njihovih klijenata, zbog čega mogu u sajber bezbednost uložiti manje nego što bi bilo u javnom interesu. Ova briga ima poseban značaj u finansijskom sektoru, gde je održavanje poverenja javnosti ključno“ (Carrière-Swallow & Haksar, 2021, str. 13). Neke centralne banke, kao npr. Centralna banka Francuske, imaju posebne jedinice (The Paris Resilience Group ili le groupe de place Robustesse) posvećene simulaciji raznih šok scenarija, od prirodnih katastrofa do izazvanih kriza kao što je sajber napad. Cilj ovih jedinica je da održi kredibilitet u institucije i pojača otpornost u slučaju velikih operativnih kriza (Donas, 2021).

Obzirom da sajber napadi prevazilaze pojmove fizičkih granica među zemljama, jer se odigravaju u virtuelnom sajber prostoru, veoma je važna međunarodna saradnja i razmena podataka. U novembru 2020. godine, Carnegi fondacija za međunarodni mir i Svetski ekonomski forum objavili su Međunarodnu strategiju za bolju zaštitu globalnog finansijskog sistema od sajber pretnji. U velikom broju zemalja, uključujući i našu, osnovani su CERT timovi koji imaju za cilj da promptno odgovore na eventualne sajber incidente. Podjednako je strateški važna precizna raspodela odgovornosti unutar zemlje, kao i demarkacija nacionalnih jurisdikcija u slučaju sajber napada. Tek nekoliko zemalja sveta ima jasnu raspodelu uloga i odgovornosti između bitnih aktera u zaštiti sistema od sajber napada. U većini zemalja nažalost dominira fragmentaran pristup (Maurer & Nelson, 2021).

Upravo zbog svih ograničenja za postizanje bolje sajber bezbednosti, možda je najvažnije podizanje svesti javnosti. Primenjujući sličan pristup kao i Aldasoro, Gambacorta, Giudici & Leach (2020b), uporedila sam trend kretanja svesti javnosti o sajber incidentima u SAD, Ujedinjenom Kraljevstvu i u Srbiji (grafika 2). Može se primetiti da u SAD i Ujedinjenom Kraljevstvu svest javnosti kontinuirano raste, a naročito od 2017 godine, kada se desio globalni WannaCry sajber incident. U Srbiji se međutim povremeno povećava svest javnosti, izazvana događajima povezanim sa sajber napadima. Jedna zanimljiva uporedna analiza kampanja o podizanju svesti javnosti o sajber bezbednosti u Ujedinjenom kraljevstvu i zemljama Afrike, istakla je dva zaključka: (i) da kampanje vode računa o specifičnim kulturnim aspektima, jer kampanje

u Ujedinjenom Kraljevstvu koriste više individualistički pristup, a kampanje u Africi kolektivistički pristup; (ii) da postoji veliki broj kontinuiranih kampanja u Ujedinjenom Kraljevstvu dok u Africi postoji ograničen broj kampanja, moguće zbog nedostatka resursa (Bada, Sasse, & Nurse, 2015). U SAD nacionalna kampanja nosi naziv STANI.RAZMISLI.POVEŽI SE, a oktobar 2021. god. je proglašen mesecom svesti o sajber bezbednosti. Može se stoga zaključiti da postoji prostor i potreba za podizanjem svesti javnosti o sajber rizicima u našoj zemlji. Često se navodi da nije pitanje da li će se sistemski sajber napad desiti, nego kada će se desiti (Maurer & Nelson, 2021; Donas, 2021).

Grafika 2: Svest javnosti, Srbija, Ujedinjeno Kraljevstvo i SAD, juli 2010 – juli 2021



Izvor: Google Trends.

Napomene: Reči pretrage su „sajber napad“ za Srbiju i „sajber incident“ za Ujedinjeno kraljevstvo i SAD. Relevantni događaji u Srbiji: (1) decembar 2013, najava albanske sajber grupe Anonimusi da će izvršiti napade na veb stranice više srpskih javnih institucija; (2) maj 2017, globalni WannaCry sajber incident; (3) mart 2020, javno komunalno preduzeće Informatika je bilo meta uspešnog zlonamernog sajber incidenta; (4) decembar 2020, SAD optužuju Rusiju za seriju sajber napada; (5) maj 2021, Norveška je poklonila Srbiji platformu za simuliranje sajber napada.

Izgradnja nacionalnih kapaciteta za sajber bezbednost uključuje razvoj menadžerskih, tehničkih, socijalnih, pravnih, političkih i regulatornih inicijativa kako bi se povećala otpornost nacije na povrede sajber sigurnosti, na sajber kriminal i terorizam (Dutton, Creese, Shillair, & Bada, 2019). „Srbija ima dobar rezultat u mnogim oblastima kapaciteta za sajber bezbednost, dobro razume postojeće nedostatke i mogućnosti za izgradnju kapaciteta“, navodi se u izveštaju „Prve procene modela zrelosti kapaciteta za sajber bezbednost“ koji se tiče naše zemlje, a koji je sprovedla Svetska banka (World Bank Press Release, 2020). Izveštaj sugerise

vladi naše zemlje da se posveti inter alia izazovu zadržavanja stručnjaka iz oblasti sajber bezbednosti. U izgradnji efikasnog sistema zaštite od sajber napada, važno je imati dobro edukovan kadar. Potrebe rastu za zapošljavanje kadrova koji poseduju ne samo tehničko znanje, nego i netehničko znanje u oblasti izazova sa kojima se finansijski sistem suočava, kontinuiteta poslovanja ili ljudskih resursa (Maurer & Nelson, 2021; Donas, 2021; Uddin, Ali, & Hassan, 2020). Centralna banka Francuske, na primer, sarađuje sa školama u cilju formiranja raznoraznih vrsta kadrova neophodnih u oblasti sajber bezbednosti (Donas, 2021). Deo radnika otpuštenih tokom pandemije mogao bi takođe da se prekvalifikuje za tražena nova zanimanja.

Zaključak

U pojedinim infrastrukturnim oblastima od kritične važnosti, između ostalog i u bankarskom sektoru, sajber bezbednost postaje sve više pitanje nacionalne bezbednosti. Ovo zbog toga što negativne posledice zlonamernih sajber incidenata na finansijske institucije mogu biti sistemske prirode.

Obzirom na to da broj i sofisticiranost sajber napada konstantno raste, tako i sistem sajber bezbednosti treba konstantno da se unapređuje. U Srbiji, konkretno, ima prostora da se unapredi svest javnosti o sajber rizicima. Ako ostavimo po strani medije, pojedine institucije od javnog značaja mogu doprineti tom zadatku.

Srbija ima visoko kvalifikovanu radnu snagu, ali je problem što tradicionalno predstavlja zemlju koja je izvor migracije ljudi. Naročito je velik izazov za javne vlasti migratornih zemalja zadržavanje visoko obrazovanih kadrova. Buduća domaća naučna istraživanja i preporuke treba da budu fokusirana ne samo u zaustavljanje „odliva mozgova“ nego i stvaranje uslova za njihov povratak u zemlju..

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CYBER INCIDENTS CONNECTED TO FINANCIAL INSTITUTIONS

Ksenija Popović, PhD student,
Alpen Adria University in Austria
email: ksenijapo@edu.aau.at

Summary:

The main topic of the paper is the accelerated digital transformation of financial institutions, which, in addition to the advantages, also brings an increased risk of cyber incidents. Cyber incidents can cause systemic damage and, therefore, building a good cyber security system goes beyond individual financial institutions. Based on a comparative analysis of the trend of public awareness about cyber-attacks, the conclusion of this paper is that, unlike developed countries, public awareness in Serbia has no continuous but occasional growth caused by individual events related to cyber-attacks. Designing a national campaign to raise public awareness about cyber security, as well as training and retaining highly qualified personnel, are two recommendations that are self-imposed after the observation and analysis of information on cyber incidents in Serbia.

Keywords: Malicious cyber incident; digital transformation; financial institutions; cyber security

JEL classification: G20, K24

Introduction

In 2017, G20 warned that cyber incidents may endanger the stability of the financial sector (G20, 2017) and for that reason, assigned the task to its Financial Stability Board to stock-take national regulations and effective practices related to cyber incidents. Countries that are members of G20 account for 80% of the world's GDP and 60% of the world's population. In April 2020, the mentioned Financial Stability Board provided recommendations to financial institutions on what to do before, during, and after a cyber incident (G20 Financial Stability Board, 2020). Enhancing cyber resilience is also among the priority tasks in the Financial Stability Board's work program for 2021 (G20 Financial Stability Board, 2021).

In February 2020, Christine Lagarde, president of the European Central Bank, warned that a well-organized cyber incident on major financial institutions could cause a serious financial crisis (Thornton, 2020). At the same time, the European Systemic Risk Board, responsible for macroprudential oversight in the EU, published its report Systemic Cyber Risk. This report states that „...it is not inconceivable that in future, a large-scale cyber incident in the financial sector could create disruption on such a scale that it has the potential to have serious negative consequences for the internal market and the real economy“ (European Systemic Risk Board, 2020, p. 23). In April 2021, Federal Reserve Chairman, Jarome Powel, said that cyber risk connected to financial institutions is above and beyond any other risks to the economy (Vavra, 2021).

Through observation and analysis of already existing information, the aim of this paper is to answer two questions: first, why so much attention is focused on cyber incidents and second, what is the situation on the financial market of Serbia. The structure of the work is as follows. The first part lists the advantages and disadvantages of technological progress in financial institutions. The definition of a cyber incident, threat actors, types and specific examples of cyber incidents are given in the second part. The third part defines systemic cyber risk and analyzes measures to improve cyber security, including a couple of recommendations for Serbia.

Digital Transformation

Digital transformation encompasses small and large technological improvements that not only shift the offer of financial institutions towards online and digital services, but also include the application of modern technology in all spheres of work. During the process of recruiting new employees, for example, banks more often use artificial intelligence to short-list candidates based on keywords from their résumés. On the one side, digitalization makes internal processes more efficient, and on the other side, it changes communication channels towards customers. Nowadays almost all banks have their profiles on social networks (Facebook, Twitter, LinkedIn...), while bots communicate with clients on chat platforms thanks to artificial intelligence. Banks also offer digital account opening, instant payments within a few seconds, services in digital branches, electronic cash loans... E-banking enables customers to approach and use their accounts anytime and anywhere. M-banking enables banks to sell their products through applications for mobile phones.

According to empirical research, in the period from 1992 to 2014, the banking sectors of the Eurozone countries develop by converging towards the best available technology and the productivity of the banking sectors grows due to constant technological shifts, albeit at decreasing speed (Casu, Ferrari, Girardone, & Wilson, 2016). The banking sector of Serbia has kept pace with these technological

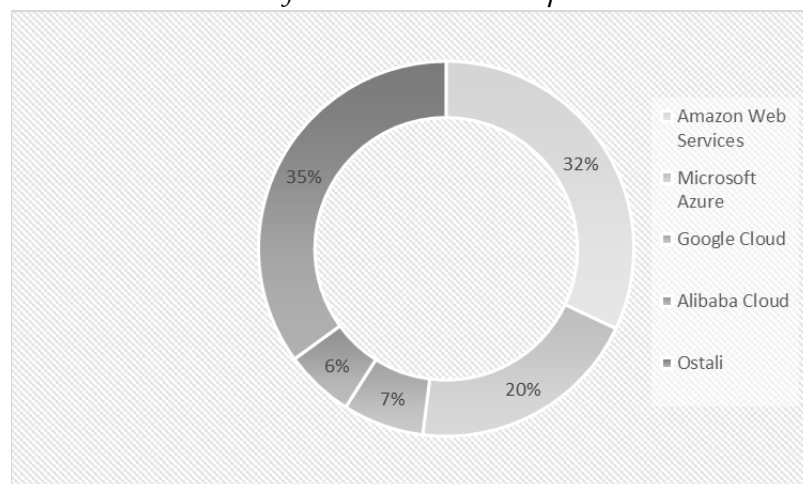
changes (Zec, 2021), mostly because it is dominated by developed foreign banks.

In the financial market, there are a small number of those who are leaders in technological development, on the one hand, and there is a majority who follow market leaders in an effort to reduce the technological gap, on the other hand. Here are a few examples of the advanced digital transformation carried out by the large bank groups: HSBC Group, the sixth, and Bank of America, the eighth largest banking group in the world according to total assets at the end of 2019 (S & P Global Market Intelligence, 2020):

- **Cloud computing** is a new technology that provides an internet place or cloud giving individuals and banks (as well as other companies) the opportunity to use resources, such as virtual machines, database, memory, services, storage, messaging, etc. Therefore, cloud computing contributes, among other things, to lower computer infrastructure costs, better reporting and analysis, faster and easier access to data, better insight into the potential of cross-selling. In October 2019, Bank of America ran 80% of its workload via an internal cloud, reducing the number of its servers from 200.000 to 70.000. Now Bank of America aims to move its workload to a public cloud (CapGemini & EFMA, 2021, p. 22). HSBC Bank announced in July 2020 that it has selected Amazon Web Services' public cloud for its business operations globally (Flinders, 2020).

This internet place can be privately owned or public (in which case, it is hosted by another party, i.e., a cloud provider). The top 4 cloud providers are Amazon Web Services, Microsoft Azure, Google Cloud and Alibaba Cloud. According to the Canalys estimates (Canalys, 2021), their market participation as of Q4 2020 is dominant in comparison to other cloud providers (Figure 1). Although the data do not refer only to the banks' cloud services spending, it is clear that there is a trend to homogenize around several largest cloud vendors.

Figure 1: *Worldwide Cloud Infrastructure Services Spent USD 39.9 billion, Q4 2020*



Source: Canalys (Canalys, 2021)

- The HSBC bank participates also in the European NEASQC research project related to the application of **quantum computing technology**. NEASQC is an abbreviation for Next Application of Quantum Computing. It is believed that quantum computers have higher capabilities to tackle high complex tasks in comparison to today's computers (HSBC, 2020).

- **Biometric technology** in banking means that soon PIN codes and passwords will be replaced by human biological characteristics. HSBS bank announced the use of customer voice verification (Grant, 2021).

Even more advanced countries think about new technologies that can be a potential game-changer for how they will operate in the future:

- **Distributed ledger technology (DLT)** has been viewed as a potential platform for the third generation of payment systems, after the paper-based generation and the generation based on batch processing (IMF Fintech Notes 20/01, 2020). For example, the central bank of Canada and monetary authorities of Singapore bilaterally connected their experimental payment systems in which a central bank digital currency is used. They connected two different DLT platforms. Another example, SWIFT created a new GPI platform to improve the speed of payments. Although this platform is not a DLT platform, research is ongoing to enable blockchain companies to connect to the SWIFT GPI platform (IMF Fintech Notes 20/01, 2020). Blockchain is a type of DLT platform.

With the onset of the pandemic, financial institutions are trying to adapt to a volatile, uncertain and complex environment. The lockdowns that followed in all countries during the corona virus pandemic forced banks and other financial institutions to close their branches and customers to increasingly turn to online services. The portion of contactless payments, online payments and card payments increases, while the portion of payments in cash decreases (Ernst & Young, 2020). Due to the pandemic, a larger number of employees of financial institutions started working from home, which means that employees no longer work in the virtual and physical space under the control of those financial institutions. We are witnessing the acceleration of the implementation of digital technology.

However, such acceleration of digital transformation also has certain disadvantages. During the pandemic, the number of cyber-attacks on financial institutions increased so much that the financial sector became the second most common target of attacks, right after the health sector (BIS, 2021). The question is whether the financial sector can keep pace with the growing number of malicious cyber-attacks.

Cyber Incident

Cyber incidents are becoming more frequent, more innovative, more sophisticated, in multiple forms while cyber risk is only partially understood (Kopp, Kaffenberger, & Wilson, 2017). Every financial institution is exposed to cyber risk, because there is no perfect cyber security system - "some unknown system loopholes always exist irrespective of technological sophistication" (Uddin, Ali, & Hassan, 2020, p. 9). The idea of my work is to shed light on the

topic of cyber incidents, starting with the definition, the actors, and types of cyber incidents. According to the Cyber Lexicon (G20 Financial Stability Board, 2018, p. 9), cyber incident is: “a cyber event that:

- jeopardizes the cyber security of an information system or the information the system processes, stores or transmits; or
- violates the security policies, security procedures or acceptable use policies, whether resulting from malicious activity or not.”

Cyber incidents can thus be accidental or malicious. But we are interested here primarily in malicious cyber incidents, because they are more numerous. For the sake of precision, the difference between a cyber-attack and a cyber incident is that the attack precedes the incident. Although, in Serbia, the term cyber-attack is used to describe both the attack and the incident. There are several actors of cyber threats: national, criminal, terrorist, hacktivists or insiders, with different motives (see table 1). North Korea is often considered as a sponsor of cyber groups that are involved in financial theft, money laundering and extortion campaigns (Varga, Brynielsson, & Franke, 2021; Cybersecurity & Infrastructure Security Agency, 2020). Criminal cyber groups are still the most common threat actors, and some of the well-known are Carbanak, Silence, Lazarus, OldGremlin and Black Shadow.

Table 1:

Threat actor	Motivation
National	Geopolitical and ideological
Criminal	Enrichment
Terrorist groups, hacktivists	Ideological, discontent
Insider threats	Greed, disgruntlement

Source: ESRB (European Systemic Risk Board, 2020).

There are several types of cyber incidents, and the most common types with a brief description are listed in Table 2. However, there are several common characteristics of different types of cyber incidents. First, they are hard to detect. The research, which included financial institutions around the world in the period from 2002-2019, concluded that it takes an average of 251 days from the moment of occurrence to the moment of detecting losses caused by cyber incidents (Aldasoro, Gambacorta, Giudici, & Leach, 2020a). Second, due to their anonymity

and irreversibility of transactions, cryptocurrencies have become established as a method of paying cyber attackers by victims of attacks (EUROPOL, 2020). Third, financial institutions are not always willing to report cyber incidents due to reputational risk (Britz, 2013; Varga, Brynielsson, & Franke, 2021).

Table 2:

Type of cyber incident	Short description
Malware	Software designed to create damage(for example, computer viruses, Trojans...)
Man-in-the middle	Insertion in the middle of a two-party transaction
Cross-site scripting	Abuse of web application vulnerability that the victim, the user of the application otherwise trusts
Phishing	Imitating a trustworthy entity in a digital communication, to gain a victim’s trust
Password cracking	Identification of an unknown password
A zero-day exploit	Abuse of discovered software or hardware vulnerability
Distributed Denial of Service(DDoS)	Multiple attack on a target(for example a server, website or network) that causes denial of service for the users

Source: BIS bulletin no. 37 (BIS, 2021) and Aldasoro, Gabacorta, Giudici & Leach (2020b).

At the official web page of Carnegie Endowment for International Peace, there is a database containing relevant cyber incidents connected with financial institutions from around the world (so called: Timeline of Cyber Incidents Involving Financial Institutions - Carnegie Endowment for International Peace). The Carnegie Endowment for International Peace is an international analytical think tank that was founded in 1910. Types of cyber incidents recorded in this database are data breach, theft, espionage, and disruption. Here are a few worldwide examples of cyber incidents:

- In January 2021, the central bank of New Zealand suffered a data breach.
- In December 2020, an Israeli insurance company was under attack of Black Shadow cybercriminal group, which demanded 200 bitcoin in exchange for stolen data.
- In September 2020, several Hungarian banks were disrupted due to the DDoS attack.
- In August 2020, a bank from Morocco suffered a breach of customer accounts and unauthorized execution of transactions.
- In March 2020, a criminal cyber group called OldGremlin entered networks of several Russian banks, encrypted data and demanded a ransom.

Based on publicly available records of the National CERT of the Republic of Serbia (CERT is an acronym for Computer Emergency Response Team), the most common cyber incidents connected to financial institutions in our country relate to malicious phishing campaigns aimed at bank clients (<https://cert.rs/obavestjenja.html#613>). Media reported in May 2017 that there was an attempt to cause material damage to the Institute for Manufacturing Banknotes and Coins, which operates within the National Bank of Serbia, through a malicious phishing message (Tanjug, 2017; BizLife, 2017).

In fact, all those sectors that are critical to a country's economy, such as oil pipelines, electricity supply, the banking sector, etc., should be subject to national security when it comes to cyber incidents (Aldasoro, Gambacorta, Giudici, & Leach, 2020b; Brenner, 2017).

Systemic Cyber Risk

There is a high level of interconnectedness across financial institutions, and particularly across their IT systems. This contributes to the higher speed and wider transmission of the negative consequences of a potential cyber incident. However not every cyber incident is of a systemic nature. The Carnegie Endowment for International Peace report proposes several specific conditions that should be cumulatively met to categorize a cyber incident into a systemic one (Brauchle, Göbler, Seiler, & von Busekist, 2020):

- focus on a systemically important financial institution or several financial institutions (functional channel);
- duration of the incident lasts 2 hours and/or is long enough to prevent end-of-day settlement;
- direct and indirect financial loss exceeds the level of the bank's capital (financial channel);
- loss of confidence measured by the duration of the news of the incident, the number of media involved and the geographical area they cover (confidence channel).

The European Systemic Risk Board analyzed several hypothetical systemic cyber risks (European Systemic Risk Board, 2020), among them: (i) payment system disruption of a domestic systemically important bank and (ii) wiping of the account balance data followed by unauthorized payments. In both cases, the longer cyber-attack lasts, the greater the negative consequences are. A general loss of confidence triggers the systemic character of a cyber incident. "For instance, if – in the aftermath of a successful malicious cyber incident – the customers of a bank were to find all account balances to be zero or unavailable for a prolonged period of time, and the institution were to be unable to resolve the situation within a reasonable time frame, it is conceivable that panic could start to spread. As a complicating factor, in such an instance fake news and disinformation may spread via social media, potentially as part of the incident, further destabilizing the markets and society." (European Systemic Risk Board, 2020, p. 38).

There is an opinion that the transfer of the IT function of financial institutions to the cloud can also be a source of systemic cyber risk (Danielsson & Macrae, 2019; Aldasoro, Gambacorta, Giudici, & Leach, 2020b). Given the trend of homogenization around the largest cloud vendors, any cyber or other incident on the cloud can affect multiple financial institutions at the same time. We remember the fire in March 2021, when out of four OVH cloud data centers in Strasbourg, one was destroyed and the other damaged. Millions of websites were out of order, including those from various government agencies, banks, newspapers, shops, etc. OVH cloud is the largest European cloud supplier. Danielsson and Macrae (2019) suggest regulating the operations of cloud providers, as the question is if a private cloud provider would give priority to customers from their own or another country, whether it would give priority to the government or financial institutions - in case of solving the consequences of a malicious cyber incident.

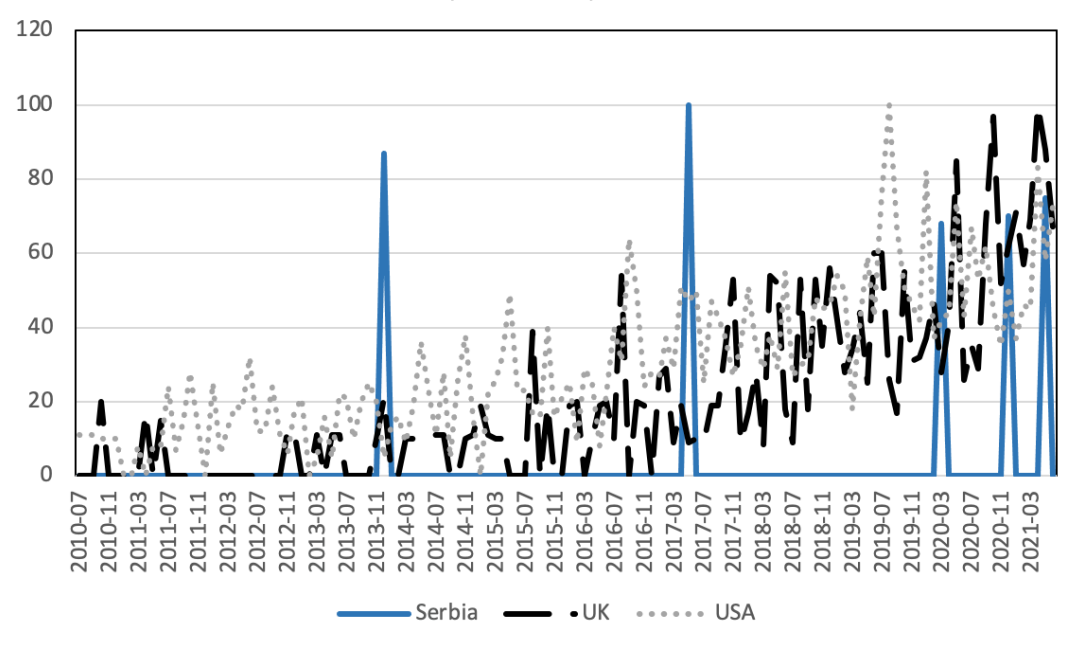
One of the important tasks for increasing the level of cyber security is the introduction of standards and regulations at the national and international level. Setting standards and regulations in the area of cyberspace is important because "an individual company does not fully internalize the harm to public trust in the entire system when its customers' data are breached, and may thus invest less in cyber security than what would be in the public interest. This concern has special resonance in the financial system, where maintaining public confidence is crucial" (Carrière-Swallow & Haksar, 2021, p. 13). Some central banks, such as the central bank of France, have special units (The Paris Resilience Group or le groupe de place Robustesse) dedicated to simulating various shock scenarios, from natural disasters to triggered crises such as a cyber-attack. The goal of these units is to maintain credibility in institutions and strengthen resilience in the event of major operational crises (Donas, 2021).

Since cyber-attacks occur beyond the concepts of physical borders between countries, because they take place in a virtual cyberspace, international cooperation and data exchange is very important. In November 2020, the Carnegie Endowment for International Peace and the World Economic Forum published an International Strategy to Better Protect the Global Financial System against Cyber Threats. In a large number of countries, including ours, CERT teams have been established with the aim of promptly responding to possible cyber incidents. Equally strategically important is the precise distribution of responsibilities within the country, as well as the demarcation of national jurisdictions in the event of a cyber-attack. Only a few countries in the world have a clear division of roles and responsibilities between important actors in protecting the system from cyber-attacks. Unfortunately, a fragmented approach dominates in most countries (Maurer & Nelson, 2021).

Precisely because of all the limitations for achieving better cyber security, perhaps the most important thing is to raise public awareness. Applying a similar approach to Aldasoro, Gambacorta, Giudici & Leach (2020b), I compared the trend of public awareness of cyber incidents in the USA, the United Kingdom and Serbia (Figure 2). It can be noticed that in the USA and the United Kingdom, public awareness is continuously growing, especially since 2017, when the

global WannaCry cyber incident took place. In Serbia, however, public awareness is occasionally increasing, caused by events related to cyber-attacks. An interesting comparative analysis of cybersecurity awareness campaigns in the UK and Africa highlighted two conclusions: (i) that campaigns take into account specific cultural aspects, as campaigns in the UK use a more individualistic approach and campaigns in Africa a collectivist approach; (ii) that there are a large number of ongoing campaigns in the United Kingdom while in Africa there are a limited number of campaigns, possibly due to lack of resources (Bada, Sasse, & Nurse, 2015). In the United States, the national campaign is called STOP. THINK. CONNECT, and October 2021 has been declared the month of cyber security awareness. It can therefore be concluded that there is room and need to raise public awareness about cyber risks in our country. It is often stated that the question is not whether a systemic cyber-attack will happen but when it will happen (Maurer & Nelson, 2021; Donas, 2021).

Figure 2: Public Awareness, Serbia, the United Kingdom and the USA, July 2010 - July 2021



Source: Google Trends.

Notes: Search words are “cyber-attack” for Serbia and “cyber incident” for the United Kingdom and the USA. Relevant events in Serbia: (1) December 2013, the announcement of the Albanian cyber group Anonymous that they would carry out attacks on the websites of several Serbian public institutions; (2) May 2017, the global WannaCry cyber incident; (3) March 2020, the public utility company Informatika was the target of a successful malicious cyber incident; (4) December 2020, the United States accuses Russia of a series of cyber-attacks; (5) May 2021, Norway donated to Serbia a platform for simulating cyber-attacks.

National cybersecurity capacity building involves the development of managerial, technical, social, legal, policy, and regulatory initiatives to enhance the resilience of a nation to cybersecurity breaches, cybercrime, and terrorism (Dutton, Creese, Shillair, & Bada, 2019). “Serbia

performs well across many areas of cybersecurity capacity and has a strong understanding of existing gaps and opportunities for capacity building”, according to a report of the First Cybersecurity Capacity Maturity Model Assessment concerning our country, and conducted by the World Bank (World Bank Press Release, 2020). The report suggests to the government of our country to focus, inter alia, on the challenge of retaining experts in the field of cyber security. In building an effective system of protection against cyber-attacks, it is important to have a well-educated workforce. The needs are growing for the employment of workforce not only with technical knowledge, but also non-technical knowledge in the field of challenges financial system face, business continuity or human resources (Maurer & Nelson, 2021; Donas, 2021; Uddin, Ali, & Hassan, 2020). The central bank of France, for example, cooperates with schools to train the various types of workforce needed in the field of cyber security (Donas, 2021). Some of the workers laid off during the pandemic could be also retrained for the required new occupations.

Conclusion

In certain critical infrastructure areas, including the banking sector, cyber security is increasingly becoming a national security issue. This is because the negative consequences of malicious cyber incidents on financial institutions can be systemic in nature. Given that the number and sophistication of cyber-attacks is constantly growing, the cyber security system needs to be constantly improved as well. In Serbia, in particular, there is room to improve public awareness of cyber risks. Leaving aside the media, certain institutions of public importance can contribute to this task. Serbia has a highly qualified workforce, but the problem is that it traditionally represents a country that is a source of human migration. Retaining highly educated staff is a particular challenge for the public authorities of migrant countries. Future domestic scientific research and recommendations should be focused not only on stopping the “brain drain” but also on creating conditions for their return to the country.

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ZAJEDNO SMO JAČI

Darko Šehović,
Rukovodilac Centra za prevenciju incidenata u IKT sistemima
finansijskih institucija FIN-CSIRT Udruženja banaka Srbije

Na pragu treće dekade 21. veka 4. industrijska revolucija nije više novost, različiti digitalni servis dostupni su nam na klik, točak digitalizacije okreće se sve većom brzinom, a progres koji je započet čini se nezaustavljivim. Broj digitalnih usluga i servisa kreiranih potrebama pandemijom zaključenih građana višestruko se umnožio, a sa njime i broj korisnika koji ga koriste. Ako tome dodamo da je i broj zaposlenih koji po prvi put obavljaju svoje poslovne aktivnosti iz svoje kućne mreže znatno veći, možemo da zaključimo da se količina poslovnih operacija koja se obavi u sajber prostoru višestruko puta povećala. Zadovoljstvo zbog lakoće obavljanja najrazličitijih poslova iz udobnosti svoga doma dodatno je opravdana usled masovnih zaključavanja kojim nas je izložila pandemijska situacija globalnih razmera, ali pored blagodeti koje su ove promene donele moramo da se osvrnemo i na negativan segment kao što su pojava novih rizika i veća količina podataka izložena pretnjama iz sajber prostora. Da pretnje nisu prazna puška možemo da se uverimo prostom analizom broja incidenta koji su ugledali svetlo dana, a koji se u različitim medijima pojavljuju skoro pa na nedeljnom nivou. Količina kompromitovanih podataka je imponantna, kao i profili i veličine kompanija koje zasigurno ne spadaju u red onih koje nemaju dovoljno resursa ili znanja da zaštite svoje informacije i sisteme.

Finansijske institucije su se uvek snažno oslanjale na informacione tehnologije, pa su u ovom segmentu odavno bile sveprisutne, nudeći svojim klijentima mogućnost da osnovne operacije obave posredstvom kućnih računara i interneta (internet bankarstvo), a sa sve većim zaokretom ka pametnim telefonima i različitim uslugama posredstvom mobilnog bankarstva. Broj digitalnih usluga koje danas nude finansijske institucije poput prodaje polisa osiguranja, brzih keš kredita i sl. konstantno se uvećava uz očekivani nastavak ovakvog trenda. Trend digitalizacije već nam je doneo i finansijske institucije koje svoje poslovanje zapravo zasnivaju u potpunosti na onlajn servisima. Danas se tradicionalna banka sve više okreće fintek zajednicama i idejama koje one generišu usvajajući ih i integrišući u svoje sisteme i samim tim transformišući se jednim delom u fintek kompanije.

Finansijski sektor, kao tipičan predstavnik kritične infrastrukture, neophodan je za normalno funkcionisanje ekonomskih operacija u zemlji i, kao takav, regulisan je i kontrolisan od strane Narodne banke Srbije, dok je po slovu Zakona o informacionoj bezbednosti svrstan u IKT sisteme od posebnog značaja i time dodatno uređen. Nažalost, finansijski sektor nije isključivo pod lupom regulatora i zakonodavca, već se nalazi i na nišanu različitih kriminalnih grupa i kriminalnih organizacija širom sajber sveta. Prihodi koji se ostvaruju od kriminalnih aktivnosti u sajber okruženju uveliko prelaze zarade

iz nekih drugih tradicionalnih oblika kriminala, poput trgovine drogom ili oružjem, što iz godine u godinu povećava broj počinitelja i krivičnih dela koja se izvrše, a time posledično i količinu finansijskih podataka koja se može naći na crnim tržištima dubokog interneta. Kompleksne kriminalne strukture i sofisticiranost pretnji koje se ispoljavaju u sajber okruženju uveliko je teme sajber bezbednosti doneo na agende upravnih i izvršnih odbora širom planete. Evropska komisija, Evropska agencija za sajber bezbednost, kao i Evropska centralna banka takođe se fokusiraju na ovu temu u pokušaju da obezbede što bolju otpornost finansijskih institucija i digitalnih servisa koje pružaju građanima.

I pored svih do sada uloženi napori različitih država, regulatora i samih finansijskih institucija, svedoci smo konstantnih incidenata koji se događaju u sajber prostoru. I najveće svetske grupacije trpe napade i doživljavaju različite incidente, ukazujući na jasan trend i na potrebu za novim strategijama odbrane informacionih sistema i informacija koje se u njima nalaze. Pretpostavka da se incident već dogodio i pokušaj uočavanja aktivnosti povezanih sa obrascima ponašanja poznatih kriminalnih grupa predstavlja novu taktiku u odbrani informacionih sistema, donoseći nam još jedan globalno popularan termin – sajber otpornost (cyber resilience) koji po jednoj od mnogobrojnih definicija oslikava sposobnost sistema da se u što kraćem roku oporavi od incidenta i nastavi obavljanje ključnih poslovnih funkcija.

Nasuprot velikim korporacijama i njihovim složenim informacionim sistemima, značajan deo sajber napada svakodnevno se odvija daleko od sistema finansijskih institucija i usmeren je na najslabiju kariku u lancu finansijskih operacija, na krajnjeg korisnika. Korisnik finansijskih usluga ne raspolaže sofisticiranom opremom, najnovijim softverom i timovima eksperata iz oblasti sajber bezbednosti, već je prepušten svom znanju i praksi poslovanja na koju je navikao u svom okruženju. Znajući ovo, napadači usmeravaju napade koristeći poznate slabosti i različite tehnike socijalnog inženjeringa sa ciljem obmane korisnika i kompromitacije njihovih podataka. Nažalost, stepen uspeha ovih napada je generator sve novijih i brojnijih kampanja kojima su izloženi korisnici finansijskih usluga, a čiji uzlazni trend nažalost očekujemo i u budućnosti.

Prateći trendove i globalne rizike u domenu sajber bezbednosti, svesni smo da će finansijske institucije u sve većoj meri biti izložene postojećim i rizicima u nastajanju, kao i da se učesnici u kriminalnim radnjama, sa druge strane, svakodnevno usavršavaju i grupišu sa ciljem smanjivanja svojih rizika, postizanja višeg nivoa efikasnosti, boljim povratom uloženi sredstava i zarad kreiranja novih „poslovnih“ modela. Činjenica da je odliv stručnog kadra već duže vreme prisutan, a priliv novog još daleko od dovoljnog za obezbeđivanje normalnog funkcionisanja službi koje se bave informacionom i sajber bezbednošću, još jedan je signal za uspostavljanje različitih mehanizama za umanjivanje štetnih efekata ovih pojava.

Kao jedan od odgovora na navedene rizike i pretnje, pored redovnog ulaganja u softver i hardver koji je u stanju da detektuje i/ili onemogući nove napade, bila je i prirodna reakcija u vidu grupisanja i udruživanja finansijskih institucija u cilju brže reakcije na novonastale pretnje i rizike.

Banke koje posluju na našem tržištu već 100 godina okupljaju se u okviru svog Udruženja u cilju sprovođenja različitih aktivnosti, pa je bilo logično da se i oblast sajber bezbednosti obuhvati, pored ostalih tradicionalnih stručnih oblasti kojima su se članice od ranije bavile. Godine 2014, na inicijativu banaka, formiran je Odbor za bezbednost koji je obuhvatio oblasti fizičko-tehničke i informacione bezbednosti. Odbor je u samom začetku definisao neke postulate rada kao što su razmena znanja i informacija na opštu korist i premise „nema konkurencije među članovima, već samo zajedničkog interesa“. Ovaj zajednički stav bio je prirodan odgovor na sve veće pretnje i izazove sa kojima su se

banke tih godina susretale, kao i na sve bolju organizovanost napadača sa druge strane. Osnivanje je potpomognuto i regulativom Narodne banke Srbije u vidu Odluke o minimalnim standardima upravljanja informacionih sistema finansijske institucije, koja je, između ostalog, identifikovala potrebu za formalnijim uređenjem poslova informacione bezbednosti u finansijskim institucijama, kao i činjenicom da je u izradi u EU bila NIS direktiva kao prvi dokument kojim se uređivala oblast sajber bezbednosti, a da se sličan posao očekivao i kod nas. Ubrzo po osnivanju, usledio je razvoj platforme za razmenu informacija o incidentima i učvršćivanje saradnje na različitim nivoima, uspostavljanje prisustva u zemlji i regionu, različite aktivnosti u domenu informacione i sajber bezbednosti. Uspostavljanje saradnje sa ključnim zainteresovanim stranama i pozicioniranje Odbora kao reprezenta finansijskog sektora u domenu sajber bezbednosti obezbedilo je učešće u različitim projektima od nacionalnog interesa, kao što su: izrade predloga strategija, nacrti zakona, učešća u različitim ekspertskim grupama, sajber vežbama, simulacijama i dr. Jedan od identifikovanih pravaca delovanja bilo je i informisanje korisnika finansijskih usluga o najboljoj praksi informacione bezbednosti, aktuelnim pretnjama i rizicima, kao i preventivnim aktivnostima u cilju postizanja višeg stepena bezbednosti. Jedan deo sajta Udruženja sublimirao je različite informacije iz ovih oblasti i prezentovao ih javnosti, u cilju bolje informisanosti. U svrhu podizanja internih kapaciteta članova, organizovani su različiti treninzi, seminari i konferencije na temu informacione i sajber bezbednosti. Ova oblast našla se kao obavezna, a često i vodeća, na mnogim skupovima koje je Udruženje nakon toga organizovalo.

Ideja formiranja finansijskog CERT-a korene vuče se od samog početka formiranja Odbora za bezbednost i kao takva uvek je bila prisutna među članovima Odbora. Međutim, okruženje 2014. godine nije bile zrelo za ovakvu ideju, pa je ona čekala svoj trenutak koji je došao nakon šire primene Zakona o informacionoj bezbednosti, osnaživanja Nacionalnog CERT-a, formiranja mreže samostalnih CERT-ova i Posebnih CERT-ova širom zemlje. Kapaciteti i spremnost učesnika sedam godina kasnije umnogome se poboljšala u odnosu na početnu godinu rada Odbora. Menadžment Udruženja je prepoznao ideju i potrebu da se dalje razvija i prilagodio je svoju organizaciju potrebama novog posla. Centar za prevenciju incidenata u IKT sistemima finansijskih institucija formiran je 2021. godine i u skladu sa Zakonom o informacionoj bezbednosti registrovan je u Ministarstvu trgovine, turizma i telekomunikacija kao Poseban CERT pod nazivom FIN-CSIRT. Ovim potezom je otvoren put ka uspostavljanju prvog sektorskog CERT-a u zemlji i okruženju. Strateški planovi FIN-CSIRT-a su da obezbedi formalnu razmenu najkorisnijih informacija o pretnjama i incidentima u oblasti sajber bezbednosti finansijskog sektora, uspostavi komunikaciju ka svim ključnim akterima u zemlji i inostranstvu i kreira ažuran i efikasan kanal informisanja korisnika finansijskih usluga o aktuelnim pretnjama. Plan razvoja predviđa da u prvoj fazi članstvo u FIN-CSIRT-u bude ponuđeno svim članovima Udruženja banaka Srbije u cilju uspostavljanja funkcionalnog sistema, a u narednoj fazi i ostalim finansijskim institucijama koje posluju u zemlji kako bi se obezbedila bolja sajber otpornost čitavog finansijskog sektora. Neki od benefita budućih članova biće svakako mogućnosti razmene iskustva i informacija o aktuelnim rizicima i pretnjama sa kolegama iz finansijskog sektora, kao i prilika da se proaktivno deluje, uz uvid u lokalnu bazu znanja koju će FIN-CSIRT imati na raspolaganju. Formiranje lokalne baze znanja o pretnjama imaće višestruke koristi, kako po bolju otpornost samih finansijskih institucija, tako i za upotrebu u cilju kontinuirane edukacije korisnika finansijskih usluga, generisanu znanjem koje dolazi sa terena i informacijama koje daju odgovore na aktuelne pretnje koje se dešavaju ili se očekuju u bliskoj budućnosti. Informisan korisnik finansijskih usluga biće sve manje slaba karika u lancu, a sve više pomoćnik u detekciji i borbi sa uvek dovrtljivim i inovativnim napadačima.

Posmatrajući iskustva postojećih finansijskih CERT-ova svesni smo činjenice da će pomoć i koristi imati, kako male finansijske institucije, tako i one veće, sa obzirom na to da potencijalni napadači često ne biraju metu po veličini i da su pretnje kojima smo izloženi univerzalne.

Kako bi izbegli dečije bolesti u početnim fazama uspostavljanja i sa željom da svojim članovima obezbede što veću vrednost, za partnera i mentora u ovom procesu, Udruženje se obratilo Finansijskom CERT-u Italije (FIN-CERT) sa kojim je u ranoj fazi projekta uspostavilo tesnu saradnju i razmenu znanja. Saveti kolega iz Italije umnogome su doprineli pravilnom odabiru tehnologija koje će biti korišćene u daljem radu FIN-CSIRT-a. Kao jedan od prvih Finansijskih CERT-ova u Evropi, Italija je poslužila kao model i savetnik Evropskoj centralnoj banci u pripremi metodologije za razmenu informacija o incidentima koja je doneta u septembru 2020. godine u dokumentu pod nazivom Cyber Information Intelligence Sharing Initiative (CIISI-EU). CIISI-EU inicijativa uspostavljena je i podržana od strane nekih od najznačajnijih učesnika u finansijskom sistemu Evrope, kao što su predstavnici Evropske centralne banke, vodećih bankarskih grupacija, EUROPOL-a, ENISE, SWIFT, Masterkarda, Vize i dr. Ova metodologija biće inkorporirana i u pravilu rada našeg finansijskog CERT-a.

Imajući potrebu za uključivanjem svih ključnih aktera u samom startu, Udruženje banaka Srbije se obratilo predstavnicima ključnih institucija, kao što su Narodna banka Srbije, Ministarstvo unutrašnjih poslova, Nacionalni CERT, kao i drugim zainteresovanim stranama, informišući ih o planovima za uspostavljanje i strateški razvoj FIN-CSIRT-a u zemlji i regionu. Svesni činjenice da samo u pravom sastavu i uz pomoć zajedničkih napora možemo obezbediti uspešno i kvalitetno okruženje za funkcionisanje novoformiranog CERT-a, željno očekujemo i dočekujemo nove članove i iskreno se nadamo i utiremo put ka bezbednijem digitalnom okruženju za korisnike finansijskih usluga u našoj zemlji.

WE ARE STRONGER TOGETHER

Darko Šehović,
Head of ICT System Incident Prevention Centre for Financial
Institutions, FIN-CSIRT of the Association of Serbian Banks

On the threshold of the third decade of the 21st century, the industrial revolution is no longer news, different digital services are available to us a click away, the wheel of digitisation is turning at an increasing rate, and the progress that has begun seems unstoppable. The number of digital services and services created by the needs of those in pandemic lockdown has multiplied, and with it the number of users. If we add to that the significantly higher number of employees performing their business activities from their home network for the first time, we can conclude that the amount of business operations performed in cyberspace has increased manyfold. Satisfaction with the ease of performing a variety of tasks from the comfort of your home is further justified by the mass lockdowns caused by the global pandemic, but aside from the benefits that these changes have brought, we must also look at the negative segment, such as the emergence of new risks and the greater amount of data exposed to threats from cyberspace. Those are not empty threats, as we can determine by simply analysing the number of incidents that have seen the light of day - which appear in different media almost weekly. The amount of compromised data is imposing, as is the profile and size of companies that are certainly not among those that do not have enough resources or knowledge to protect their information and systems.

Financial institutions have always relied heavily on information technologies, and in this segment they have long been present, offering their clients the ability to perform basic operations through home computers and the Internet (internet banking) and with a growing shift towards smartphones and various mobile banking services. The number of digital services offered by financial institutions today, such as the sale of insurance policies, quick cash loans, etc., continuously increases with the expectation of a continuation of this trend. The trend of digitization has already brought us financial institutions that actually base their business entirely on online services. Today, the traditional bank is increasingly turning to fintech communities and the ideas they generate, by adopting and integrating them into their systems and transforming them, in part, into fintech companies.

The financial sector, as a typical representative of critical infrastructure, is necessary for the normal functioning of economic operations in the country, and it is, as such, regulated and controlled by the National Bank of Serbia, while according to the Law on Information Security it is classified as an ICT system of particular importance and thus further regulated. Unfortunately, the financial sector is not

only under scrutiny from regulators and lawmakers, but also targeted by various criminal groups and criminal organizations around the cyber world. Revenues generated from criminal activities in the cyber environment largely exceed earnings from some other traditional forms of crime, such as drug or weapons trafficking, which increases the number of perpetrators and crimes committed year after year, and consequently the amount of financial data found in internet black markets. The complex criminal structures and sophistication of threats that are manifested in the cyber environment have largely brought the topic of cybersecurity to the agendas of boards and executive committees around the globe. The European Commission, the European Agency for Cyber Security, as well as the European Central Bank are also focusing on this topic in an effort to ensure the best resilience of financial institutions and digital services they provide to citizens.

Despite all the efforts made so far by different countries, regulators and financial institutions, we are witnessing a constant increase of incidents that occur in cyberspace. Even the world's largest companies suffer attacks and experience different kind of incidents, pointing to a clear trend and highlighting the need for new strategies to defend information systems and the information contained in them. The assumption that an incident has already occurred and an attempt to spot activities related to the behaviour of known criminal groups is a new tactic in defending information systems, bringing to us another globally popular term - cyber resilience, which, according to one of the many definitions reflects the system's ability to recover from the incident as soon as possible and continue to perform key business functions.

In contrast to large corporations and their complex information systems, a significant proportion of cyberattacks take place daily, away from the financial institutions' systems, and are aimed at the weakest link in the financial operations chain, i.e., the end user. The user of financial services does not have sophisticated equipment, the latest software and teams of experts in the field of cybersecurity, and is left to their own knowledge and practice of doing business that they are accustomed to in their environment. Knowing this, the attackers direct their attacks using known weaknesses and various social engineering techniques to deceive users and compromise their data. Unfortunately, the level of success of these attacks is a generator of increasingly new and numerous campaigns exposing financial service users - and whose upward trend we unfortunately expect in the future.

Following trends and global risks in the field of cybersecurity, we are aware that financial institutions will increasingly be exposed to existing and emerging risks, and that participants in criminal activities, on the other hand, are being trained and are grouping together daily, with the aim of reducing their risks, and achieving a higher level of efficiency and better returning funds invested, as well as for the sake of creating new "business" models. The lack of professional staff has been present for a long time - and the income of new ones is way far from sufficient to ensure the normal functioning of information and cybersecurity services, and it is, in and of itself, another signal for the establishment of different mechanisms to mitigate the harmful effects of those trends.

As one of the responses to these risks and threats, in addition to regularly investing in software and hardware that is able to detect and/or disable new attacks, there was also a natural reaction in the form of grouping and merging financial institutions in order to respond more quickly to emerging threats and risks.

Banks that have been operating on our market for 100 years are gathered within their Association, in order to carry out different activities, so it was logical to include the field of cybersecurity among other traditional professional areas that the Association's members have dealt with before. In 2014, at

the banks' initiative, the ASB Security Committee was formed, which covered the areas of physical, technical and information security. The Committee has defined some postulates of work at its onset, such as the exchange of knowledge and information for the general benefit, and the premise of "there is no competition among members, only common interest". This common stance was a natural response to the growing threats and challenges that the banks have faced in those years, as well as to the increasing organisation of attackers, on the other hand. The Committee was supported by the regulation of the National Bank of Serbia in the form of the Decision on Minimum Standards of Management of Information Systems and Financial Institutions, which, among other things, identified the need for the more formal regulation of information security operations in financial institutions. It was also supported by the fact that the NIS directive was being drafted in the EU as the first document regulating the area of cybersecurity, and that a similar directive was expected in our country. Shortly after its establishment, it was followed by the development of a platform for the exchange of information on incidents and consolidation of co-operation at different levels, establishing a presence in the country and the region, and launching various activities in the field of information and cybersecurity. Establishing cooperation with key stakeholders and positioning the Committee as a representative of the financial sector in the field of cybersecurity has secured participation in various projects of national interest, such as drafting proposal strategies, draft laws, participating in various expert groups, cyber exercises, simulations, etc. One of the identified directions of activities informing financial service users about the best practice of information security, current threats and risks, as well as preventive activities in order to achieve a higher level of security. One part of the Association's website compiled different information in these areas and presented it to the public for their notice. Various trainings, seminars and conferences on IT and cybersecurity were organised for the purpose of raising members' internal capacities. The field has become mandatory - and is often a leading topic - at many of the gatherings the Association has since organised.

The idea of forming a financial CERT has originated soon after the founding of the ASB Security Committee and has always been relevant for its members. However, the environment in 2014 was not quite ready for this idea, so we waited for the right moment, which came after the wider implementation of the Law on Information Security, the empowerment of the National CERT, and the formation of a network of other, independent, CERTs around the country. The capacity and readiness of participants seven years later has improved greatly compared to the initial year of the Committee's work. The top management of the Association acknowledged the idea and the need to further develop and adapt its internal organisation to the needs of the new job. In 2021, the Centre for Incident Prevention in ICT Systems of Financial Institutions was established, and, in accordance with the Law on Information Security, it was registered with the Ministry of Trade, Tourism and Telecommunications as a Special CERT registered under the name FIN-CSIRT. This move opened the way for the establishment of the country's first sectoral CERT. FIN-CSIRT's strategic plans are to provide a formal exchange of the most useful information about threats and incidents in the area of financial sector cybersecurity, to establish communication between key stakeholders, locally and abroad, and to create an up-to-date and efficient channel of informing financial service users about ongoing threats. In the first phase, membership in FIN-CSIRT will be offered to all members of the Association of Serbian Banks, in order to establish a functioning system, and in the next phase it will be offered to other financial institutions operating in the country, with a core intention to ensure a better cyber resilience of the financial sector in general. Some of the benefits for future members will certainly be the opportunities to exchange experience and information about ongoing risks and threats with colleagues in the financial sector, as well as an opportunity to act proactively with insight into the local knowledge base that FIN-CSIRT will

have at their disposal. The formation of a local knowledge base on threats will have multiple benefits, both for the better resilience of the financial institutions themselves, and for use for the purpose of continuously educating financial services users, generated by knowledge that comes from the field and information that answers to current threats that occur or are expected to occur in the near future. Informed financial services users will be less and less of a weak link in the chain - and will become something like assistants in detecting and combating ever-ingenious and innovative attackers.

Looking at the experiences of existing financial CERTs around globe we are aware that it will bring benefits to both small and larger financial institutions, as potential attackers often do not choose a target by size, and as the threats we are exposed to are universal.

In order to avoid "growing pains" in the early stages of establishment, and with the desire to provide their members with as much value as possible, the Association found a partner and mentor in this process in the Financial CERT of Italy (CERTFIN) with which it had established close cooperation and exchange of knowledge in the early stages of the project. Advice from Italian colleagues contributed greatly to the proper selection of technologies to be used in the further work of FIN-CSIRT. As one of the first financial CERTs in Europe, Italy has served as a role model to the European Central Bank in preparing a methodology for exchanging information about latest initiatives, which was issued in September 2020 in a document titled Cyber Information Intelligence Sharing Initiative (CIISI-EU). The CIISI-EU initiative was established and supported by some of the most important participants in the Financial System of Europe, such as representatives of the European Central Bank, leading bank groups, EUROPOL, ENISE, SWIFT, Mastercard, Visa, etc. This methodology will be incorporated into the work of our financial CERT.

Having felt the need to include all key stakeholders from the very beginning, the Association of Serbian Banks contacted representatives of key institutions such as the National Bank of Serbia, Ministry of Internal Affairs, National CERT and other potential interested parties informing them of its plans to establish and strategically develop FIN-CSIRT in the country and in the region. Aware of the fact that we can only provide a successful and useful environment for the functioning of the newly formed CERT in the right constituency and with the help of joint efforts, we eagerly await and welcome new members and sincerely hope that our joint efforts will pave the way for a safer digital environment for financial services users in our country.

BAROMETAR/BAROMETER

Januar 2021 – Novembar 2021. / January 2021 – November 2021

1. Promet / Turnover

Mesec/ Month	Listing	Open Market	Regulisano tržište/ Regulated market	MTP/ MTF	Ukupno/ Total	Broj transakcija/ Number of transactions
Novembar 2021	2.972.330.624	37.088.592,00	3.009.419.216	60.560.485,00	3.069.979.701	1.669,00
Oktobar 2021	5.741.634.936	42.180.961,00	5.783.815.897	1.806.541.872,00	7.590.357.769	1.455,00
Septembar 2021	4.317.271.039	61.870.838,00	4.379.141.877	20.831.970,00	4.399.973.847	1.375,00
Avgust 2021	1.170.804.576	38.939.053,00	1.209.743.629	477.848.321,00	1.687.591.950	1.484,00
Jul 2021	1.613.119.599	41.696.072,00	1.654.815.671	46.265.397,00	1.701.081.068	1.148,00
Jun 2021	3.621.882.419	565.050.460,00	4.186.932.879	105.562.078,00	4.292.494.957	1.770,00
Maj 2021	364.708.913	181.873.825,00	546.582.738	164.023.381,00	710.606.119	1.657,00
April 2021	4.741.499.773	95.863.461,00	4.837.363.234	219.210.473,00	5.056.573.707	2.051,00
Mart 2021	1.384.264.827	144.884.876,00	1.529.149.703	198.744.779,00	1.727.894.482	1.810,00
Februar 2021	5.088.160.062	44.949.749,00	5.133.109.811	155.648.215,00	5.288.758.026	1.857,00
Januar 2021	1.347.760.980	16.481.850,00	1.364.242.830	26.775.647,00	1.391.018.477	1.038,00
Decembar 2020	4.574.035.074	288.316.813,00	4.862.351.887	144.728.160,00	5.007.080.047	1.923,00
	36.937.472.822	1.559.196.550,00	38.496.669.372	3.426.740.778,00	41.923.410.150	19.237,00

*RSD

2. Indeksi / Indices

Januar/January 2021. Novembar/November 2021		BELEX15	BELEXline
	Poslednja vrednost / Last value	810,12	1.680,71
	Promena (abs) / Change (abs)	61,51	114,68
	Promena (%) / Change (%)	8,22%	7,32%
	Najviša vrednost / Maximum value	821,2	1.721,16
	Najniža vrednost / Minimum value	722,66	1.523,61
	Istorijski max / History maximum value	3.335,2	5.007,34
	Istorijski min / History minimum value	347,46	841,99
	Vrednost prometa / Value of turnover	1.808.643.369	2.854.502.138

3. Tržišna kapitalizacija / Market Capitalisation

	AVGUST	SEPTEMBAR	OKTOBAR	NOVEMBAR
Ukupna tržišna kapitalizacija/ Total market capitalisation	518.286.382	517.397.301	510.417.751	509.821.537
Regulisano tržište/Regulated Market	295.456.118	295.949.570	290.210.743	297.142.981
Listing	224.772.287	225.465.864	226.278.738	233.031.076
Prime Listing – akcije/ Prime Listing – shares	156.455.280	155.623.904	155.982.458	159.893.134
Standard Listing – akcije/ Standard Listing - shares	68.317.007	69.841.960	70.296.280	73.137.942
Open Market	70.683.831	70.483.706	63.932.005	64.111.905
MTP/MTF	222.830.264	221.447.731	220.207.008	212.678.555
BELEX15	265.293.887	265.478.970	259.964.425	266.431.783
BELEXline	276.600.391	276.826.182	271.534.416	278.029.464

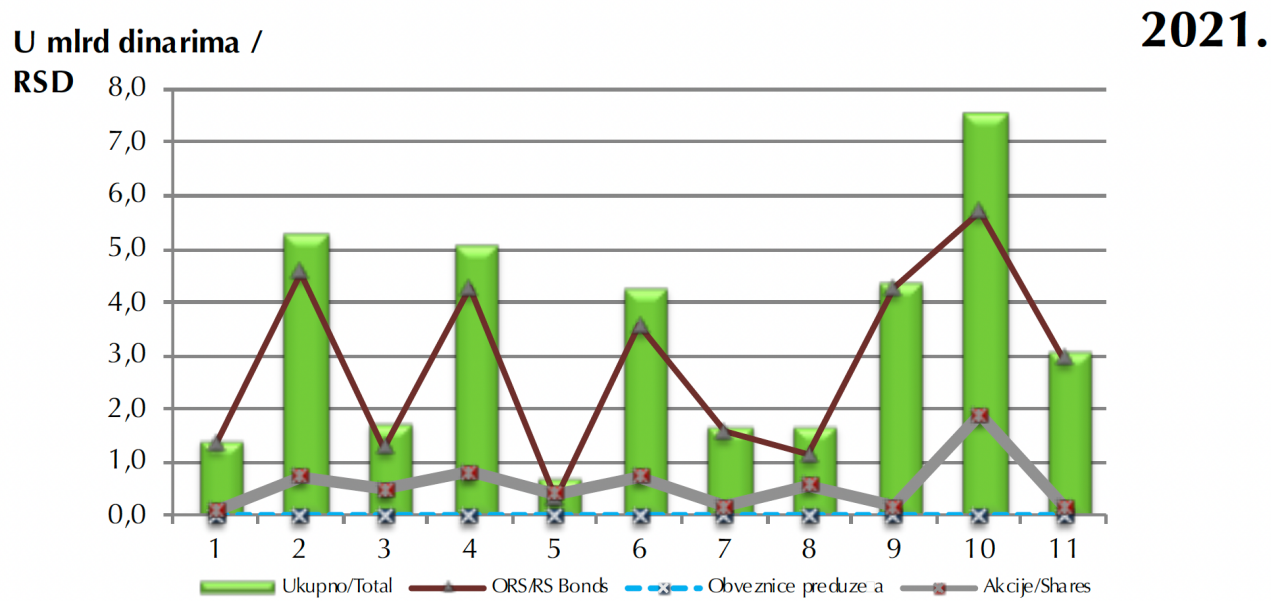
*u hiljadama RSD / in RSD thousands

4. Učešće stranih investitora / Foreign Investors Participation

Januar/January 2021. Novembar/November 2021	Učešće stranih investitora / Foreign Investors Participation		
	FIS	total	24,73%
		b-FIS	9,77%
		s-FIS	39,70%
	FIB		10,14%
	FIT		12,55%

Promet

2021	Ukupno/Total	ORS/RS Bonds	Obveznice preduzeća	Akcije/Shares
1	1.391.018.477	1.319.874.435	0	71.144.042
2	5.288.758.026	4.560.584.542	0	728.173.484
3	1.727.894.482	1.256.546.518	0	471.347.964
4	5.056.573.707	4.266.514.878	0	790.058.829
5	710.606.119	304.371.148	0	406.234.971
6	4.292.494.957	3.566.975.506	0	725.519.451
7	1.701.081.068	1.554.266.541	0	146.814.527
8	1.687.591.950	1.115.804.945	0	571.787.005
9	4.399.973.847	4.248.684.340	0	151.289.507
10	7.590.357.769	5.700.820.441	0	1.889.537.328
11	3.069.979.701	2.928.564.304	0	141.415.397



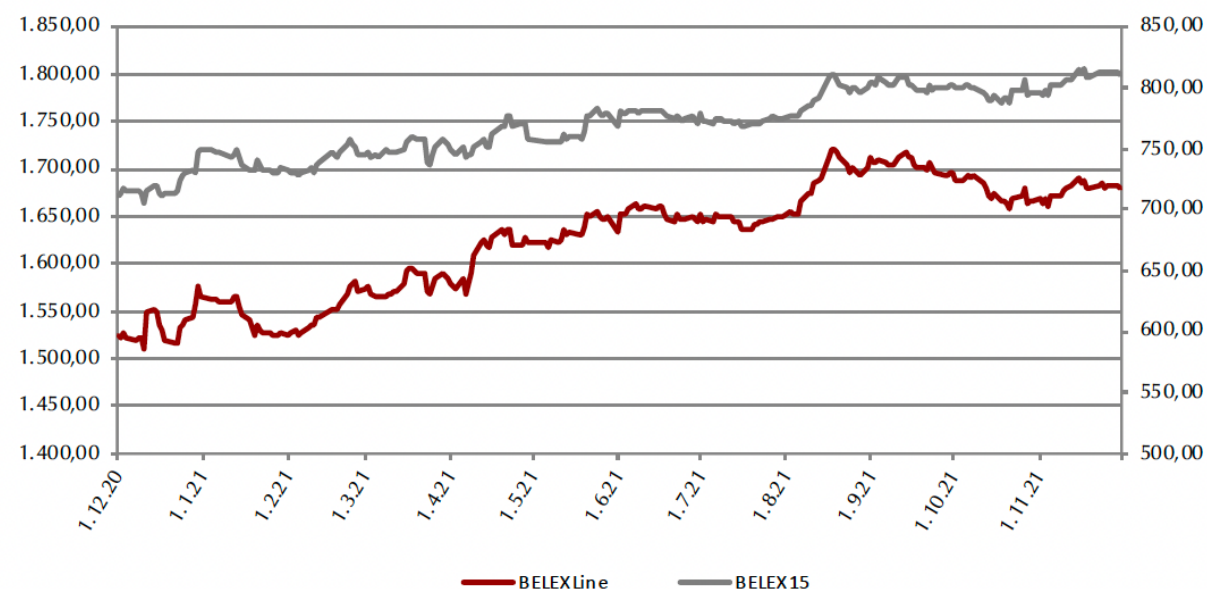
Indeks Belex15	Indeks BELEXLine	Datum	BELEX15	BELEXLine
BELEX15	BELEXLine	1.12.20	712,07	1.523,76
BELEX15	BELEXLine	2.12.20	714,32	1.522,29
BELEX15	BELEXLine	3.12.20	717,74	1.526,68
BELEX15	BELEXLine	4.12.20	715,40	1.521,29
BELEX15	BELEXLine	7.12.20	715,26	1.520,53
BELEX15	BELEXLine	8.12.20	715,45	1.521,54
BELEX15	BELEXLine	9.12.20	714,33	1.520,80
BELEX15	BELEXLine	10.12.20	705,68	1.510,51
BELEX15	BELEXLine	11.12.20	716,14	1.549,31
BELEX15	BELEXLine	14.12.20	720,51	1.551,06
BELEX15	BELEXLine	15.12.20	720,96	1.548,48
BELEX15	BELEXLine	16.12.20	713,52	1.534,63
BELEX15	BELEXLine	17.12.20	712,31	1.529,36
BELEX15	BELEXLine	18.12.20	714,16	1.520,47
BELEX15	BELEXLine	21.12.20	713,48	1.517,23
BELEX15	BELEXLine	22.12.20	715,02	1.517,97
BELEX15	BELEXLine	23.12.20	724,89	1.533,98
BELEX15	BELEXLine	24.12.20	727,56	1.536,67
BELEX15	BELEXLine	25.12.20	730,26	1.541,64
BELEX15	BELEXLine	28.12.20	731,65	1.543,27
BELEX15	BELEXLine	29.12.20	731,27	1.556,66
BELEX15	BELEXLine	30.12.20	746,57	1.575,37
BELEX15	BELEXLine	31.12.20	748,61	1.566,03
BELEX15	BELEXLine	4.1.21	749,91	1.564,18
BELEX15	BELEXLine	5.1.21	747,58	1.561,75
BELEX15	BELEXLine	6.1.21	746,94	1.561,08
BELEX15	BELEXLine	11.1.21	744,00	1.560,63
BELEX15	BELEXLine	12.1.21	745,34	1.564,37
BELEX15	BELEXLine	13.1.21	748,64	1.565,13
BELEX15	BELEXLine	14.1.21	743,13	1.554,09
BELEX15	BELEXLine	15.1.21	736,06	1.546,62
BELEX15	BELEXLine	18.1.21	732,33	1.541,70
BELEX15	BELEXLine	19.1.21	732,53	1.525,80
BELEX15	BELEXLine	20.1.21	741,23	1.534,83
BELEX15	BELEXLine	21.1.21	736,37	1.530,36
BELEX15	BELEXLine	22.1.21	733,04	1.526,86
BELEX15	BELEXLine	25.1.21	732,32	1.526,57
BELEX15	BELEXLine	26.1.21	731,56	1.525,26
BELEX15	BELEXLine	27.1.21	730,67	1.523,94
BELEX15	BELEXLine	28.1.21	730,35	1.523,61
BELEX15	BELEXLine	29.1.21	733,78	1.527,89
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BELEX15	BELEXLine	2.2.21	729,82	1.527,52
BELEX15	BELEXLine	3.2.21	731,39	1.530,04
BELEX15	BELEXLine	4.2.21	729,2	1.526,02
BELEX15	BELEXLine	5.2.21	731,44	1.528,05
BELEX15	BELEXLine	8.2.21	733,22	1.532,85
BELEX15	BELEXLine	9.2.21	734,33	1.536,77
BELEX15	BELEXLine	10.2.21	731,28	1.534,47
BELEX15	BELEXLine	11.2.21	737,62	1.544,17
BELEX15	BELEXLine	12.2.21	739,48	1.543,67

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BELEX15	BELEXLine	2.3.21	746,4	1.577,23
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BELEX15	BELEXLine	4.3.21	744,49	1.565,95
BELEX15	BELEXLine	5.3.21	743,80	1.564,81
BELEX15	BELEXLine	8.3.21	748,58	1.565,64
BELEX15	BELEXLine	9.3.21	747,54	1.567,68
BELEX15	BELEXLine	10.3.21	748,03	1.568,14
BELEX15	BELEXLine	11.3.21	747,00	1.571,85
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BELEX15	BELEXLine	15.7.21	769,02	1.636,81

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BELEX15	BELEXLine	17.8.21	810,34	1.720,31
BELEX15	BELEXLine	18.8.21	810,87	1.721,16
BELEX15	BELEXLine	19.8.21	806,66	1.716,80
BELEX15	BELEXLine	20.8.21	802,34	1.712,22
BELEX15	BELEXLine	23.8.21	800,12	1.704,68
BELEX15	BELEXLine	24.8.21	796,46	1.695,89
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BELEX15	BELEXLine	26.8.21	799,91	1.698,29
BELEX15	BELEXLine	27.8.21	796,15	1.692,88
BELEX15	BELEXLine	30.8.21	799,73	1.702,43
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BELEX15	BELEXLine	8.9.21	802,38	1.703,47
BELEX15	BELEXLine	9.9.21	803,25	1.704,39
BELEX15	BELEXLine	10.9.21	809,63	1.713,92
BELEX15	BELEXLine	13.9.21	808,25	1.717,48
BELEX15	BELEXLine	14.9.21	802,60	1.712,44
BELEX15	BELEXLine	15.9.21	802,75	1.711,87
BELEX15	BELEXLine	16.9.21	799,44	1.704,59
BELEX15	BELEXLine	17.9.21	797,61	1.702,65
BELEX15	BELEXLine	20.9.21	797,46	1.702,56
BELEX15	BELEXLine	21.9.21	795,74	1.700,32
BELEX15	BELEXLine	22.9.21	802,61	1.706,25
BELEX15	BELEXLine	23.9.21	798,71	1.701,83
BELEX15	BELEXLine	24.9.21	801,20	1.697,10
BELEX15	BELEXLine	27.9.21	800,86	1.694,08

BELEX15	BELEXLine	28.9.21	801,35	1.694,97
BELEX15	BELEXLine	29.9.21	802,37	1.696,06
BELEX15	BELEXLine	30.9.21	802,81	1.697,72
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BELEX15	BELEXLine	5.10.21	802,65	1.690,11
BELEX15	BELEXLine	6.10.21	802,70	1.694,06
BELEX15	BELEXLine	7.10.21	801,42	1.692,01
BELEX15	BELEXLine	8.10.21	800,82	1.692,73
BELEX15	BELEXLine	11.10.21	795,94	1.684,98
BELEX15	BELEXLine	12.10.21	794,09	1.679,35
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BELEX15	BELEXLine	18.10.21	788,52	1.667,32
BELEX15	BELEXLine	19.10.21	791,08	1.667,06
BELEX15	BELEXLine	20.10.21	791,01	1.664,31
BELEX15	BELEXLine	21.10.21	788,13	1.657,84
BELEX15	BELEXLine	22.10.21	798,08	1.670,12
BELEX15	BELEXLine	25.10.21	798,56	1.672,86
BELEX15	BELEXLine	26.10.21	805,85	1.678,99
BELEX15	BELEXLine	27.10.21	793,49	1.663,94
BELEX15	BELEXLine	28.10.21	795,41	1.667,59
BELEX15	BELEXLine	29.10.21	795,15	1.667,11
BELEX15	BELEXLine	1.11.21	795,91	1.668,63
BELEX15	BELEXLine	2.11.21	794,82	1.663,83
BELEX15	BELEXLine	3.11.21	798,25	1.668,24
BELEX15	BELEXLine	4.11.21	793,73	1.662,03
BELEX15	BELEXLine	5.11.21	803,42	1.671,66
BELEX15	BELEXLine	8.11.21	801,84	1.670,80
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BELEX15	BELEXLine	17.11.21	816,03	1.689,29
BELEX15	BELEXLine	18.11.21	809,26	1.680,90
BELEX15	BELEXLine	19.11.21	808,70	1.679,36
BELEX15	BELEXLine	22.11.21	812,07	1.683,59
BELEX15	BELEXLine	23.11.21	813,83	1.685,11
BELEX15	BELEXLine	24.11.21	812,47	1.680,54
BELEX15	BELEXLine	25.11.21	812,33	1.682,48
BELEX15	BELEXLine	26.11.21	812,38	1.683,70
BELEX15	BELEXLine	29.11.21	812,37	1.683,48
BELEX16	BELEXLine	30.11.21	810,12	1.680,71



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- Rad treba da bude u A4 formatu, sve margine 20 mm.
- Dužina rada najviše 10 strana uključujući grafikone, tabele, literaturu i ostale priloge. Ukoliko rad po obimu prevazilazi date propozicije, na uredništvu je odluka da li će ga publikovati ili ne.
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- Posle naslova rada napisati rezime dužine do 150 reči.
- Posle rezimea dati do 10 ključnih reči, pogodnih za indeksiranje i pretraživanje.
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