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DETERMINANTE DEVIZNIH REZERVI I OPTIMALNI NIVO DEVIZNIH REZERVI U BOSNI I HERCEGOVINI

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Rezime: Istraživanje je dalo odgovor na pitanje šta utiče na bosanskohercegovačke devizne rezerve i koja je donja granica optimalnog nivoa deviznih rezervi Centralne banke Bosne i Hercegovine (CBBH). Višak deviznih rezervi smo definisali kao razliku između stanja deviznih rezervi i donje granice optimalnog nivoa deviznih rezervi. Devizne rezerve su u najvećem dijelu analiziranog perioda značajno iznad donje granice optimalnog nivoa deviznih rezervi. U 2022. godini u scenariju varijabilnog deviznog kursa bez uzimanja u obzir stepena evrizacije bh. bankarskog sektora višak deviznih rezervi je najveći. Višak je najniži u režimu fiksnog deviznog kursa u kojem smo preko novčane mase dopustili visok uticaj evrizacije na optimalne devizne rezerve. Čak i u ovome najkonzervativnijem scenariju višak deviznih rezervi je 1,9 mlrd. KM ili oko 4% nominalnog GDP iz 2022. godine. Izmjene u bh. monetarnom režimu, dopuštanje CBBH da kreditira rezidente i eventualni prelaz na varijabilni devizni kursa, moguće je izvršiti uz zadržavanje zadovoljavajućeg nivoa devizne likvidnosti CBBH.

Ključne reči: politika deviznih rezervi, monetarna politika, valutni odbor, varijabilni devizni kurs

JEL klasifikacija: E52, F31

Uvod

Nakon što je dokazano da Centralna banke Bosne i Hercegovine (CBBH), iako funkcioniše na principima valutnog odbora, ipak vodi diskrecionu monetarnu politiku (Jović, 2020), pri čemu se poslovni ciklus u Bosni i Hercegovini (BH) razlikuje od poslovnog ciklusa u području rezervne valute - zoni evra (Jović, 2021), nastavljamo istraživanja na temu nužnosti transformacije bosanskohercegovačkog monetarnog režima.

Devizne rezerve, služeći kao pokriće za uvoz robe i izmirenje obaveza po ino dugovima, obavljaju funkciju čuvara devizne likvidnosti ekonomskog sistema. Potreba utvrđivanja optimalnog nivoa deviznih rezervi proizilazi iz toga što pored koristi od držanja deviznih rezervi, postoje i troškovi držanja deviznih rezervi. Predmet istraživanja su bosanskohercegovačke devizne rezerve, a cilj nam je da utvrdimo njihov optimalni nivo ili nivo prema kome bi one trebale konvergirati, s obzirom na karakteristike bosanskohercegovačkog ekonomskog sistema.

Mi pretpostavljamo, to je naša radna hipoteza, da su devizne rezerve Centralne banke Bosne i Hercegovine (CBBH), iznad optimalnog nivoa koji je potreban sa aspekta deviznih obaveza bh. nebankarskog i bankarskog sektora. Sa aspekta valutnog odbora, ovakva hipoteza dovodi u sumnju potrebu pune pokrivenosti monetarne pasive sa neto deviznom aktivom, tj. održavanje koeficijenta pokrića monetarne pasive iznad jedan.

U prvom dijelu rada dajemo prikaz razvoja ideje potrebnih ili optimalnih deviznih rezervi u formi kratkog pregleda teorijskih stavova na tu temu i empirijskih istraživanja ovoga problema. Način dokazivanja hipoteze istraživanja i korišćene baze podataka objašnjeni su u metodologiji istraživanja, na koju se nadovezuje prezentovanje rezultata istraživanja i polemika na temu dobijenih rezultata. Glavni metodološki alati istraživanja su višestruki regresioni modeli i metode određivanja adekvatnih rezervi (IMF, 2015). U završnim dijelovima istraživanja razmatramo još jednom dobijene zaključke istraživanja i izvlačimo preporuke za donosioce ekonomskih odluka i za buduća istraživanja na ovu temu.

Literarni pregled

Tradicionalni načini mjerenja prikladnog nivoa deviznih rezervi i odatle njihovih determinanti sljede vrlo jednostavno, linearno i logično pravilo. Zahtjev za tromjesečno pokriće uvoza deviznim rezervama (Krušković, 2014) je među prvim pravilima te vrste (IMF, 2011), kao i prijedog da devizne rezerve budu minimalno jednake kratkoročnom dijelu spoljnog duga. Ovi prijedlozi su nastali u miljeu direktnih ili indirektnih predstavnika zemalja izvoznica kapitala koje su bile zainteresovane prije svega da kroz veličinu deviznih rezervi obezbjede da zemlja dužnik ima dovoljno deviznih resursa za plaćanje njihovih potraživanja. Varijable koje determinišu pokrivenost uvoza deviznim rezervama su stopa rasta realnog GDP, devizni kurs, oportunitetni troškovi držanja deviznih rezervi i vještačka varijabla, koja razdvaja period prije i poslije azijske krize (Hakim, 2013). Od ranih 90-ih dolazi do brzog rasta deviznih rezervi (Rodrik, 2006) i njihovo učešće se povećava na 30% GDP i 8 mjeseci uvoza.

Najsadržajniji pregled determinanti deviznih rezervi zajedno sa njihovom evolucijom pronašli smo u jednom istraživanju Banke za međunarodno poravnanje (Cantu & Yavuz, 2019). Sve do 2000-ih, predostrožnost, u vezi sa deficitom tekućeg računa, veličinom finansijskog sektora i finansijskom otvorenošću, bila je glavna determinanta deviznih rezervi. Veličina deficita tekućeg računa i veličina finansijskog sektora su u direktnoj korelaciji sa veličinom deviznih rezervi. Finansijska otvorenost je statistički signifikantan faktor deviznih rezervi, osim u slučaju razvijenih evropskih zemalja i zemalja izvoznica nafte gdje je uspostavljena inverzna, ali statistički neznačajna veza. Kasnije se glavni motivi držanja deviznih rezervi prenose na varijable koje se tiču deviznog kursa, prije svega njegove stabilnosti i stepena njegove precijenjenosti. Politika monetarnog sidra, koja se najčešće vodi u okviru precijenjenog kursa, zahtjeva viši nivo deviznih rezervi za odbranu ciljanog deviznog kursa. Treća grupa varijabli koja utiče na devizne rezerve tiče se veličine ekonomskog sistema. Veća populacija očekivano vodi ka većim deviznim rezervama, mada ta veza nije jaka u azijskim zemljama i generalno u periodu prije globalne finansijske krize (2007 – 2009). Glavne determinante druge najveće svjetske ekonomije Kine, su promijene u uvozu i kratkoročnom dugu (Misztal, 2021). Istraživanje je pronašlo da je nivo kineskih deviznih rezervi iznad optimalnog nivoa mjereno metodologijom koju je razvio MMF. Ova međunarodna ustanova je u zadnjih četvrt stoljeća nekoliko puta razvijala i unapređivala metodologiju za određivanje optimalnih deviznih rezervi. Odmah u početku, (IMF, 2001) su preovladavali stavovi da stara pravila prsta (poput tri mjeseca pokrivenosti uvoza sa deviznim rezervama) moraju biti odbačena u korist kratkoročnog spoljnog duga, očekivanog odliva kapitala, režima deviznog kursa i razlike u kamatnim stopama. Taj prijedlog se zasniva na podijeli indikatora optimalnog nivoa deviznih rezervi na: indikatore inostranog duga, indikatore trgovine, indikatore novca i makroindikatore (Krušković, 2014, str. 73). Kasnije preporuke (IMF, 2011) (IMF, 2013) (IMF, 2015) išle su u pravcu testiranja i određivanja varijabli i njihovog uticaja (pondera) na nivo deviznih rezervi. Kao najpouzdanije determinante optimalnog nivoa deviznih rezervi izolovani su kratkoročni spoljni dug, ostale obaveze prema nerezidentima, novac u širem smislu (M2) i izvoz (više o ovome u metodološkoj osnovi rada). Istraživanja koja su se bavila deviznim rezervama Bosne i Hercegovine, tj. centralne banke Bosne i Hercegovine, vrlo su rijetka, a u jednom od njih (Šoja & Galijašević, 2017) je istraživan optimalni nivo deviznih rezervi (2005 – 2015), i njihova otpornost na ekstremni interni i eksterni šok. Zaključeno je da je nivo deviznih rezervi iznad optimalnog nivoa, ali da u slučaju ekstremnog šoka devizne rezerve ne bi bile dovoljne.

Metodologija i podaci

MMF je u više navrata predlagao i analizirao načine izračunavanja potrebnog nivoa deviznih rezervi određenih na bazi determinanti deviznih rezervi. U jednom od posljednjih istraživanja ove vrste (IMF, Assessing Reserve Adequacy – Specific Proposal, 2015) za ključne varijable, kratkoročni spoljni dug, ostale obaveze (spoljni dug sa dospjećem iznad godinu dana i akcijski kapital u vlasništvu nerezidenata), M2 i izvoz, predloženi su konačni ponderi zavisno od toga da li je ekonomski sistem u režimu fiksnog ili varijabilnog deviznog kursa i da li je implementirana kontrola kretanja kapitala. Ponderi za ove varijable su generalne prirode i ne moraju odgovarati svakoj zemlji pojedinačno, pa je zato bilo nužno da se upotrebljivost predloženih varijabli za određivanje potrebnog nivoa deviznih rezervi provjeri u slučaj Bosne i Hercegovine.

Vezu između bh. deviznih rezervi sa jedne strane i predloženih varijabli sa druge strane, uključujući i ostale portfolio obaveze i ostale investicije, ocijenili smo i testirali primjenom višestrukog lineranog regresionog modela sa varijablama godišnje i kvartalne frekvencije, kao i pomoću Grejndžerovog testa (Granger test), u kojem je nulta hipoteza predstavljena kao tvrdnja da između varijabli nema kauzaliteta. Vezu između deviznih rezervi i kratkoročnog duga smo dokazivali kvantitativnim i kvalitativnim metodama. U ocijeni deviznih rezervi MMF je ponudio četiri varijable kao glavne determinante deviznih rezervi, koji mogu, ali ne moraju odgovarati tražnji za deviznim rezervama u svakoj zemlji, a pogotovo ne moraju odgovarati optimalnom nivou deviznih rezervi u BH koja funkcioniše kao valutni odbor bez funkcije ustanove krajnjeg utočišta (eng. lender of last resort). U prvom istraživanju IMF 2011, ponderi za kratkoročni dug, ostale portfolio investicije, M2 i izvoz za zemlje sa kontrolom kretanja kapitala bili su 30%, 15%, 10% i 10%, a za varijabilni devizni kurs za iste varijable određeni su ponderi 30%, 15%, 5% i 5%. U pomenutom istraživanju MMF-a predlaže se da se ostale portfolio obaveze zamjene sa ostalim obavezama, a ukazuje se i na veliki uticaj dolarizacije na izbijanje bankarskih kriza i potrebu korigovanja pondera u visoko dolarizovanim ili visoko evrizovanim ekonomijama. Krenuvši od prvobitno preporučenog modela za zemlje sa fiksnim deviznim kursem i bez kontrole kretanja kapitala odredili smo optimalne devizne rezerve (OR) na još tri načina.

Da bismo ocijenili nivo ka kojem bi trebale konvergirati devizne rezerve Bosne i Hercegovine konstruisali smo četiri modela (Tabela 1). Prvi model (ARA I) na osnovu preporuke MMF-a (IMF, 2015, str. 19) za zemlje sa fiksnim deviznim kursom i bez kontrole kretanja kapitala donja granica optimalnih deviznih rezervi se određuje kao zbir ponderisanog iznosa (stranog) kratkoročnog duga, ostalih obaveza, novca u širem smislu (M2) i izvoza, sa preporučenim ponderima od 30%, 20%, 10% i 10% respektivno. Drugi model (ARA II), formiran takođe na bazi IMF, 2015, zadržava pondere za kratkoročni dug (30%) i ostale obaveze (15%), dok ponder za M2 udvostručavamo (20%) zbog visokog stepena evrizacije bh. bankarskih pasiva, a ponder za izvoz (10%) ostaje isti. Uvažavajući visok stepen evrizacije bankarskog sektora BH, u kojem eurski depoziti stanovništva čine 48% ukupnih depozita stanovništa, kao i činjenicu da CBBH nema ugovorenu kreditnu liniju sa ECB, uvećali smo ponder za M2 za duplo, a ostale pondere ostavili na istom nivou i tako formirali drugi model, koji se takođe odnosi na režim fiksnog deviznog kursa, bez kontrole kretanja kapitala. Ova dva modela podrazumijevaju zadržavanje postojećeg monetarnog režima (fiksni devizni kurs, odsustvo LOLR i automatska kupoprodaja konvertibilne marke), dok druga dva modela podrazumijevaju prelazak na varijabilni devizni kurs i pojavljivanje CBBH kao povjerioca (kreditora) bh. rezidenata. Treći (ARA III) i četvrti (ARA IV) model određuju optimalan nivo deviznih rezervi u slučaju da CBBH pređe na režim varijabilnog deviznog kursa, bez kontrole kretanja kapitala. U ARA III su unijeti prijedlozi MMF-a (IMF, 2015, str. 19) po kojem su ponderi u režimu varijabilnog deviznog kursa za kratkoročne obaveze, ostale obaveze, M2 i izvoz 30%, 15%, 5% i 5% respektivno. U zadnjem modelu, ARA IV, koji takođe polazi od varijabilnog deviznog kursa, zadržali smo pondere za kratkoročni dug i ostale obaveze (30% i 15%), a zbog visoke evrizacije i ovisnosti od uvoza (i visokog i hroničnog spoljnotrgovinskog deficita), čija je aproksimacija izvoz, učetvorostručili smo ponder za M2 i postavili ga na 20% (po uzoru na ARA II) i udvostručili ponder za izvoz u odnosu na ARA III (10%). Pondere za kratkoročni dug i ostale obaveze nismo mijenjali jer varijabilni devizni kurs omogućava fleksibilno upravljanje javnim dugom, a pretpostavili smo da se kroz kroz kreditiranje u domaćoj valuti od strane CBBH dodatni dio deviznih rezervi može iskoristiti za otplatu spoljnjeg duga.

Tabela 1 - Modeli za ocijenu donje granice optimalnog nivoa deviznih rezervi

	Ponderi				Devizni kurs
	Kratkoročni dug	Ostale obaveze	M2	Izvoz	
ARA I	30%	20%	10%	10%	Fiksni
ARA II	30%	20%	20%	10%	Fiksni
ARA III	30%	15%	5%	5%	Varijabilni
ARA IV	30%	15%	20%	10%	Varijabilni

Izvor: IMF i Autor, zatamnjeno su označeni ponderi koji su izmjenjeni u odnosu na inicijalni prijedlog MMF-a

Skraćenice korišćene u radu su: A – godišnji nivo, ARA - ocijena adekvatnog nivoa deviznih rezervi (eng. assessing reserve adequacy), BH – Bosna i Hercegovina, bh. – bosanskohercegovački, Centralna banka BH – CBBH, C – konstanta u regresionom modelu, D – prva diferencija, DIR– razlika u stranoj i bh. kamatnoj stopi, E – izvoz, FTP – bh. spoljnotrgovinski partneri (eng. foreing trade partners), GDP – bruto domaći proizvod, I – import, LOLR – institucija posljednjeg utočišta (eng. lender of last resort), M2 - novac u širem smislu (novac izvan banaka, depoziti po viđenju i oročeni depoziti), OI – ostale portfolio investicije, OL - ostale obaveze (eng. other liabilities), OR– optimalne devizne rezerve (eng. optimal reserves), PI - portfolio investicije, Q – kvartalni nivo, REER – realni efektivni devizni kurs, R – devizne rezerve, RM – regresioni model, VOL – volatilnost (standardna devijacija).

Rezultati i diskusija

Pretpostavku o uticaju bh. kratkoročnog stranog duga na devizne rezerve i njihov optimalni nivo ne izvodimo pomoću modela, već iz stručnih prijedloga, koji su dio prakse MMF-a u optimizaciji deviznih rezervi. Italijanski ministar finansija Guidotti je predložio da devizne rezerve trebaju odgovarati jednogodišnjim obavezama po spoljnjem dugu, tj. kratkoročnom dijelu spoljnog duga. Kasnije je ovaj prijedlog dopunio i razradio bivši guverner Federalnih rezervi Alan Greenspan, pa je ovaj pristup određivanju optimalnih rezervi nazvan pravilo Greenspan-Guidotti (IMF, 2011, p. 13).

Zbog načina na koji funkcioniše bh. valutni odbor veza između deviznih rezervi i novčane mase je u nivou i u prvoj diferenciji vrlo jaka, skoro savršena (Tabela 2 i Tabela 3). Kako bh. emisiona banka emituje bh. novac, konvertibilnu marku, samo kroz otkup deviza od banaka primarni novac (monetarna baza) se povećava samo kroz rast deviznih rezervi. Rast likvidnosti u domaćoj valuti povećava kreditni potencijal banaka i svaka promjena u kreditima, kroz proces kreditno depozitne multiplikacije, vodi ka promjenama u novčanoj masi iz čega se izvodi veza između deviznih rezervi i monetarnog agregat M2. Uticaj ide i u suprotnom smjeru jer rast primarnih depozita (polog gotovog novca) i sekundarnih depozita (koji nastaju odobravanjem kredita) povećava direktno tražnju za devizama nebankarskih sektora i indirektno tražnju za deviznim rezervama.

Tabela 2 - Elastičnost deviznih rezervi (R/GDP) u odnosu na novčanu masu u širem smislu (M2/GDP) u nivou, 2000 – 2022. (RM 1)

	Koeficijent	Standardna greška	T-statistika	Vjerovatnoća
C (Konstanta)	0,12	0,016	0,74	0,46
M2/GDP	0,467	0,026	17,45	0,00

Izvor: Autor

Dvosmjerni kauzalitet pokazuje i Grejndžerov test uzročnosti, koji nije moguće odbaciti, za nulte hipoteze da devizne rezerve ne utiču na M2, te da novčana masa ne utiče na devizne rezerve. Vjerovatnoće za dobijenu vrijednost F statistike (3 i 2) su 0,08 i 0,17 za pretpostavku da devizne rezerve ne utiču na novčanu masu, odnosno da novčana masa ne utiče na devizne rezerve. S obzirom da je vrijednost Durbin-Votsonove statistike značajno ispod dva (0,91), što ukazuje na pozitivnu autokorelaciju i potencijalno besmislenu regresiju (eng.spurious regression), iako je uspostavljena veza u skladu sa načinom rada valutnog odbora, razvili smo i jednačine sa stacionarnim varijablama, preko određivanja prve razlike u nivou. Jednačina sa varijablama bez jediničnog korijena I(1) ne pokazuje postojanje autokorelacije (vrijednost Durbin-Votsonove statistike blizu dva), a regresor uz novčanu masu je signifikantan na nivou ispod 1%. Grejndžerov test, u oba slučaja, daje vjerovatnoću za dobijenu F statistiku (0,28 i 0,15) čime je ponovo potvrđen dvosmjerni kauzalitet između varijabli. Prema modelu u prvoj diferenciji prirast novčane mase za 1% u odnosu na GDP povećava devizne rezerve za 0,76% u odnosu na GDP.

Tabela 3 - Devizne rezerve vs. M2, prva diferencija, 2000 – 2022. (RM 2)

Varijabla	Koeficijent	Standardna greška	T-statistika	Vjerovatnoća
C	-0,0057	0,0027	-2,091945	0,0494
D_M2/GDP	0,7646	0,0498	15,33440	0,0000

Izvor: Autor

Statistički signifikantan i visok uticaj novca na devizne rezerve izolovan je i na podacima sa kvartalnom frekvencijom (Tabela 4). Povećanje M2 za 1% GDP vodi ka povećanju deviznih rezervi od 0,49% GDP. Uticaj varijabiliteta (volatilnosti) u REER i GDP najznačajnijih trgovinskih partnera, kao i kamatne diferencije na devizne rezerve je takođe statistički signifikantna i očekivanog znaka, ali je izuzetno niskog intenziteta. Između portfolio investicija (PI/GDP) i deviznih rezervi, nije uspostavljena statistički jaka veza, a međuzavisnost između uvoza i deviznih rezervi je ne samo izrazito signifikantna (na nivou od 1%), već je i izuzetno intenzivna, čak i veća od uticaja M2 na devizne rezerve. Pozitivna korelacija između uvoza i deviznih rezervi samo je djelimično nelogična, jer visok odnos uvoza i deviznih rezervi reflektuje otvorenost privrede (Beaufort & Kapteyen, 2001) i zato se može očekivati čak i pozitivan uticaj rasta uvoza na devizne rezerve (Cooper, 1968) iako se u klasičnim modelima uvijek identifikuje negativna veza (Heller, 1966).

Tabela 4 - Uticaj odabranih varijabli i M2 na devizne rezerve CBBH, 2005 – 2022. godina (RM3)

	RM 3	RM 4
C	-0,56 (-4,44) ***	-0,64 (-4,9)***
I/ GDP (-1)	0,78 (3,96) ***	0,934 (4,5)***

M2/GDP	0,49 (22,81) ***	0,49 (23,5)***
PI/GDP	1,38 (1,55)	
REER_volatilnost	0,05 (3,32)***	0,05 (3,25)***
STP_GDP_volatilnost	0,02 (4,42) ***	0,018 (3,86)***
DIR	-0,08 (-4,16) ***	-0,075 (-4,27)***
Vještačka varijabla za krizu (-1)		0,07 (2,39)**
R2	0,97	0,93

Izvor: Autor

Napomena: Devizne rezerve su predstavljene kao odnos deviznih rezervi i GDP. U zagradi je t statistika. *** signifikantno na nivou od 1%, ** signifikantno na nivou od 5%, * signifikantno na nivou od 10%.

U ARA modelima po metodologiji MMF-a ne postoji varijabla uvoz, a jedan dio uvoza se uvijek koristi za proizvodnju izvoznih proizvoda, pa izvoz može biti dobra aproksimacija uvozne tražnje za deviznim rezervama. Razvijeni regresioni modeli, sa izvozom, ili varijabilitetom izvoza kao nezavisno promjenljivim varijablama u jednačini deviznih rezervi potvrđuju ispravnost ovakvog načina ekonomskog rezonovanja (Tabela 5). Varijable vezane za izvoz u svim jednačinama imaju očekivani pozitivni znak, odnosno negativni znak ako se radi o varijabilitetu izvoza i statistički su signifikante na nivou ispod 1%. Uticaj izvoza na devizne rezerve visok je bez obzir da li se ova varijabla uvodi u model sa, ili bez vremenskog pomaka. Povećanje izvoza i M2 vode ka relativnom rastu deviznih rezervi u odnosu na GDP, pod uslovom da je sve ostalo jednako (RM 4, RM 5 i RM 6). U jednačinama sa izvozom su i sve ostale varijable statistički signifikantne osim portfolio investicija i zato smo ih zamijenili sa ostalim investicijama iz platnog bilansa.

Tabela 5 - Uticaj odabranih varijabli i izvoza na devizne rezerve CBBH, 2005 – 2022. god.

	RM 5	RM 6	RM 7
C	-0,21 (-2,70) ***	-0,26 (-3,27)***	-0,29 (-3,54)***
E/GDP	0,56 (2,20)**		
E/GDP(-1)		0,75 (2,83)***	0,89 (3,25)***
M2/GDP	0,44 (15,48) ***	0,43 (15,10) ***	0,43 (15,02)
REER_VOL	0,06 (3,86) ***	0,76 (0,82) ***	0,07 (4,41)***
PI/GDP		0,07 (4,28)	
STP_VOL_A	0,02 (3,43) ***	0,02 (3,84) ***	0,02 (3,50)***

DIR	-0,07 (-3,37) ***	-0,06 (-3,35) ***	-0,06 (-3,36)***
Kriza (-1)			0,05 (1,15)
R^2	0,91		

Izvor: Ibid

Ostale portfolio investicije (OI) su predložene (IMF, 2015) kao bitna varijabla za tražnju i nivo deviznih rezervi (Tabela 6). Očekivano, njihov uticaj na devizne rezerve je pozitivan i uz to statistički značajan (RM 8 i RM 9). Rast prve diferencije u ostalim investicijama u odnosu na GDP za 1.p.p. povećava devizne rezerve (razliku u količniku deviznih rezervi i GDP) za 0,47 p.p.

Tabela 6 - Uticaj odabranih varijabli i ostalih portfolio investicija na devizne rezerve CBBH, 2016 – 2022. god.

	RM 8	RM 9
C	-0,34 (-2,10)**	-0,12 (-1,39)*
E/GDP	0,48 (2,13) **	0,22 (1,40)
D_M2/GDP	0,48 (17,17)***	0,45 (16,26)***
D_OI/GDP	0,47 (5,14) ***	0,42 (4,41)***
D_REER_VOL	0,03 (1,79)*	
STP_VOL_A	0,01 (2,33) **	0,004 (1,9)*
DIR	-0,04 (-1,69) *	-0,04 (-1,97)**
I_VOL_Q	0,01 (1,68)*	
R^2	0,94	0,93

Izvor: Ibid

U IMF 2015, preporučeno je da se umjesto ostalih portfolio investicija, u određivanju optimalnog nivoa deviznih rezervi, koriste ostale obaveze prema nerezidentima. Grejndžerov test, kao i u slučaju odnosa deviznih rezervi i novčane mase, ne pruža moćnost odbacivanja nulte hipoteze o nepostojanju obostranog uticaja između deviznih rezervi i ostalih obaveza na nivou signifikantnosti od 5%, osim u jednom slučaju.

Za varijable u nivou (R - devizne rezerve, OL – ostale obaveze) za nultu hipotezu, da devizne rezerve ne utiču na ostale obaveze, F statistika testa je 0,21, vjerovatnoća 0,81 čime se demonstrira dvosmjerna veza između varijabli (Tabela 7). Kao što je i očekivano, sa visokim stepenom pouzdanosti (F statistika 2,54, a vjerovatnoća 12%) nije moguće odbaciti nultu hipotezu da ostale obaveze ne utiču na nivo deviznih rezervi. Relativni nivo deviznih rezervi (R/GDP) utiče na ostale obaveze (OL/GDP), ali kod ovako definisanih varijabli, kao što smo prethodno naveli, izostaje uticaj ostalih obaveza na devizne rezerve. Mogući razlog je što ostale obaveze pored srednjoročnog i dugoročnog duga prema nerezidentima sadrži i akcijske udjele nerezidenata u bh. akcionarskim društvima.

Taj kapital, kao kvazi obaveza prema nerezidentima, u BH zbog niske likvidnosti finansijskih tržišta u BH uopšte nije pokretljiv. Zato bi niska mobilnost dioničkog kapitala u ovakvoj vrsti specifikacije Grejndžerov testa mogla objasniti odsustvo uticaja ostalih obaveza prema nerezidentima na devizne rezerve. S druge strane varijable u prvoj diferenciji ponovo potvrđuju dvosmjerni kauzalitet između deviznih rezervi, jer sa visokim stepenom pouzdanosti nije moguće odbaciti nultu hipotezu po kojoj ostale obaveze ne utiču na devizne rezerve (Tabela 8). Iz ovih razloga, iako je akcijski kapital u BH niskog stepena mobilnosti, a finansijsko tržište plitko, ostale obaveze prema nerezidentima smo zadržali u modelima za ocjenu optimalnog nivoa deviznih rezervi.

Tabela 7 - Međuzavisnost između deviznih rezervi (R) i ostalih obaveza prema nerezidentima u nivou (OL), Grejndžerov test

Nulta hipoteza	Broj opservacija	F statistika	Vjerovatnoća
R ne utiču na OL	17	0,21409	0,8103
OL ne utiču na R		2,54967	0,1195
R/GDP ne utiču na OL/GDP		2,38698	0,1341
OL/GDP ne utiču na R/GDP	17	5,64964	0,0187

Izvor: Ibid

Tabela 8 - Međuzavisnost između deviznih rezervi (R) i ostalih obaveza prema nerezidentima u prvoj diferenciji (OL), Grejndžerov test

Nulta hipoteza	Broj opservacija	F statistika	Vjerovatnoća
D_R utiče D_OL		1,2002	0,3377
D_OL ne utiče na D_R	16	1,1856	0,3418
D_R/GDP ne utiče na D_OL/GDP		1,73106	0,222
D_OL/GDP ne utiče na D_R/GDP	16	1,64836	0,2365

Izvor: Ibid

OR dobijene na osnovu četiri ARA modela imaju istu dinamiku, ali i značajnu razliku u nivou optimalnih deviznih rezervi zbog različitih pondera za četiri ključne varijable (Tabela 9). U prosjeku, u periodu 2016 – 2022. god. OR variraju u intervalu od 7,6 mlrd. KM do 14,1 mlrd. KM sa značajnim odstupanjima između modela. Najviši nivo OR (14,1 mlrd. KM) daje model ARA II koji pretpostavlja djelovanje CBBH u režimu fiksnog deviznog kursa i višeg nivoa evrizacije pasiva bh. banaka koji je predstavljen kroz dvostruko veći ponder za novac u odnosu na inicijalnu pretpostavku MMF-a (ARA I). Fleksibilna monetarna politika predstavljena ne samo kroz varijabilni devizni kurs, već i mogućnost pozajmljivanja novca bh. rezidentima od strane CBBH (ova aktivnost je u postojećem modelu valutnog odbora zabranjena) OR spušta na najniži nivo, koji je na kraju 2022. godine 7,6 milijardi KM (ARA III). Između ove dvije krajnosti nalaze se OR u režimu fiksnog deviznog kursa i početno predloženih pondera za M2 i izvoz od 10% (ARA I).

Ekstremna varijanta varijabilnog deviznog kursa (ARA IV) sa značajno uvećanim ponderima i za M2 (učetvorostručen) i za izvoz (udvostručen ponder) se po nivou OR približava modelu sa fiksnim deviznim kursem u kojem je stavljen naglasak na evrizaciju (ARA II). U svim modelima tokom 2013. i 2017. godine zbog uvećanja M2 OR bilježe ekscesivan rast. Najveći doprinos rastu OR u 2020. godini i pored M2 daju ostale obaveze, a u 2021. godini OR su pod uticajem rasta izvoza.

Tabela 9 - Optimalne devizne rezerve CBBH (u mlrd. KM)

	2016.	2017.	2018.	2019.	2020.	2021.	2022.
ARA I	7,4	7,6	8,3	8,6	8,4	9,8	10,8
ARA II	9,4	9,8	10,7	11,2	11,2	13,0	14,1
ARA III	5,2	5,3	5,9	6,1	5,9	6,8	7,6
ARA IV	8,8	9,2	10,2	10,7	10,7	12,4	13,5
Prosjek	7,7	8,0	8,8	9,1	9,1	10,5	11,5

Izvor: Autor

Dobijeni rezultati se naravno odražavaju na višak deviznih rezervi koje CBBH drži iznad optimalnog nivoa deviznih rezervi. Višak je u prosjeku od 2016. do 2022. god. padao u interval od 1,8 mlrd. KM do 5,8 mlrd. KM (Tabela 10). Najviši višak deviznih rezervi ima monetarni režim sa varijabilnim deviznim kursem koji zanemaruje visok stepen evrizacije bh. bankarskog sektora (ARA III). Varijabilni devizni kurs i relativno nizak ponder za M2 (ARA III) višak deviznih rezervi postavljaju na nivo koji je duplo viši od optimalnih deviznih rezervi (Tabela 11). Čak i postojeći režim fiksnog deviznog kursa, bez naglašavanja visoke evrizacije bh. bankarskih pasiva (ARA I) pretpostavlja da su devizne rezerve CBBH za 5,3 mlrd. ili za skoro 50% više od optimalnih deviznih rezervi (2022). Modeli IMF koje u kojima smo stavili mnogo veći naglasak na evrizaciju, od početnog prijedloga MMF-a (ARA II), ili u kojima smo pored evrizacije uzeli u obzir hronični spoljnotrgovinski bh. debalans (ARA IV) daju značajno manji višak rezervi, ali i dalje ukazuju na previsok nivo deviznih rezervi. Višak deviznih rezervi od 1,9 mlrd. KM (ARA III) je 4% nominalnog GDP BH u 2022. godini i sa njim može biti otplaćeno 17% kratkoročnog spoljnog duga. Nalazi istraživanja su u skladu sa jedinim prethodnim ove vrste (Šoja & Galijašević, 2017), koji je primjenom drugačijih metodologija takođe zaključio da je nivo deviznih rezervi CBBH iznad optimalnog nivoa (osim u okolnostima ekstremnog šoka).

Tabela 10 - Višak deviznih rezervi CBBH u odnosu na optimalne devizne rezerve (u mlrd. KM)

	2016.	2017.	2018.	2019.	2020.	2021.	2022.
ARA I	2,2	3,0	3,3	4,0	5,4	6,5	5,3
ARA II	0,2	0,8	0,9	1,4	2,6	3,4	1,9
ARA III	4,3	5,3	5,8	6,5	7,9	9,5	8,5
ARA IV	0,7	1,3	1,4	1,9	3,2	3,9	2,5
Prosjek	1,8	2,6	2,8	3,5	4,8	5,8	4,6

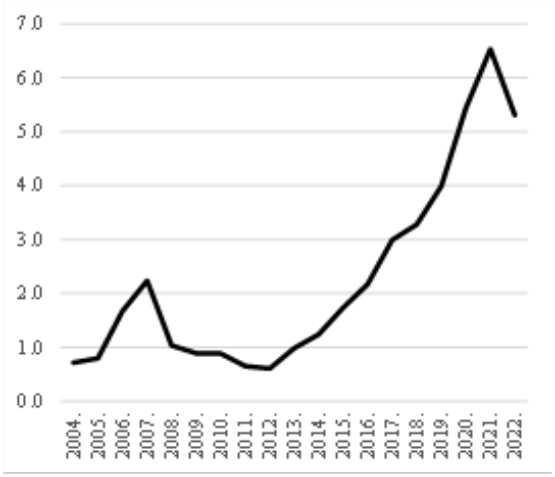
Tabela 11 - Višak deviznih rezervi CBBH u odnosu na optimalne devizne rezerve, u %

	2016.	2017.	2018.	2019.	2020.	2021.	2022.
ARA I	30	40	39	46	64	66	49
ARA II	2	8	8	12	23	26	14
ARA III	83	99	98	108	134	140	113
ARA IV	8	14	14	18	30	32	19
Prosjek	31	40	40	46	63	66	49

Izvor: Autor

Analiza u dužem vremenskom periodu, od 2004, (Grafikoni 1 - 4) pokazuje da je višak deviznih rezervi dostigao minimum u 2012. godini, kao i da su u toj godini u dva od četiri načina modeliranja deviznih rezervi, devizne rezerve bile ispod optimalnih deviznih rezervi (ARA II i ARA IV), te da od te godine započinje trend rasta viška rezervi koji traje bez prestanka sve do 2021. godine. Pad viška deviznih rezervi u 2022. godini prouzrokovan je kao prvo padom tržišne vrijednosti deviznih rezervi uslijed rasta kamatnih stopa. Sa druge strane na višak deviznih rezervi je djelovao rast OR koji se u potpunosti odvija pod uticajem rasta kratkoročnog spoljnog duga. U prosjeku u 2022. god. višak deviznih rezervi je za godinu dana smanjen za petinu.

Grafikon 1 - Višak deviznih rezervi CBBH prema modelu ARA I sa fiksnim deviznim kursom (u mlrd. KM)

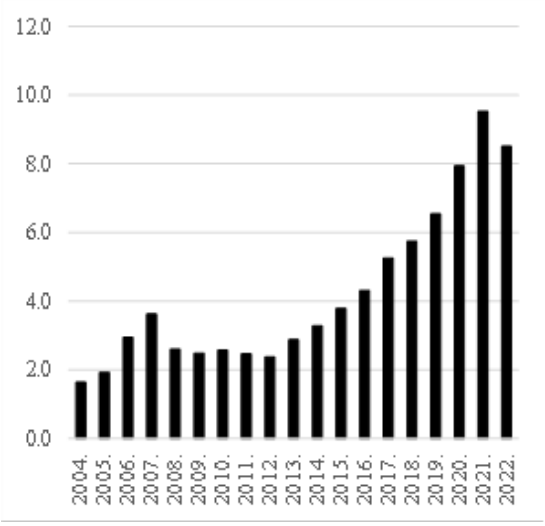


Izvor: Ibid

Grafikon 2 - Višak deviznih rezervi CBBH prema modelu ARA II sa fiksnim deviznim kursom (u mlrd. KM)

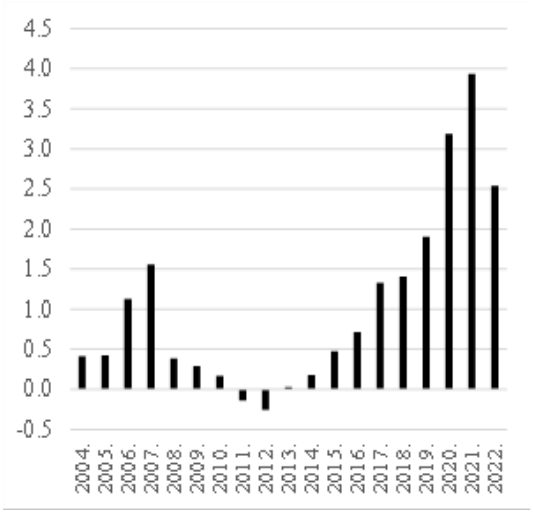
Izvor: Ibid

Grafikon 3 - Višak deviznih rezervi CBBH prema modelu ARA III sa varijabilnim deviznim kursom (u mlrd. KM)



Izvor: Ibid

Grafikon 4 - Višak deviznih rezervi CBBH prema modelu ARA IV sa varijabilnim deviznim kursom (u mlrd. KM)



Izvor: Ibid

Zaključna razmatranja

Troškovi držanja rezervi s jedne strane, i potreban nivo deviznih rezervi sa druge, su glavni motivi za traganje za optimalnim deviznim rezervama (OR). Određivanje OR se kretalo od prostih pravila poput broja mjeseci kojim bi se uvoz trebao finansirati iz deviznih rezervi do vrlo komplikovanih modela koji putem algoritma vrše optimizaciju vrijednosti deviznih rezervi.

Pomoću panel analize MMF je izdvojio ključne varijable koje utiču na nivo deviznih rezervi i zavisno od vrsta monetarnog režima i prisustva, ili odsustva kontrole kretanja kapitala, te stepena dolarizacije tj. evrizacije, predložio udjele (pondere) tih varijabli u određivanju OR. S obzirom da su predloženi modeli generalne prirode i da ne uvažavaju specifičnosti pojedinih zemalja mi smo u ovome istraživanju prvo testirali pouzdanost i jačinu veze odabranih i ostalih varijabli sa deviznim rezervama, nakon čega smo originalne (MMF-ove), i na temelju njih, modifikovane modele upotrijebili za izračunavanje donje granice OR za Bosnu i Hercegovinu.

OR u BH smo odredili kao linearnu kombinaciju kratkoročnog spoljnjeg duga, ostalih obaveza, novčane mase u širem smislu (M2) i izvoza. Pondere smo povećavali zbog visokog stepena evrizacije u BH, kao i zbog nefleksibilnosti bh. monetarne politike (odsustvo LOLR). S druge strane u modelima sa varijabilnim deviznim kursem mogućnost apresijacije deviznog kursa i smanjivanja spoljnog duga izraženog u domaćoj valuti tj. apsorpcija šoka pomoću prilagođavanja deviznog kursa, uticala je na to da ponderi za kratkoročni dug i ostale obaveze ostanu neizmjenjeni.

Zajednička karakteristika svih odabranih modela izračunavanja donje granice OR, u periodu 2016 – 2022. god., pa čak i onih u kojima su ponderi za pojedine varijable povećavani dvostruko, ili čak četvorostruko u odnosu na preporuku MMF-a, je izolovanje značajnog viška rezervi u odnosu na postojeći nivo deviznih rezervi CBBH. U prosjeku tokom ovih sedam godina višak deviznih rezervi u odnosu na donju granicu optimalnih deviznih rezervi bio je 3,7 mlrd. KM. Centralna banka je prosiječno držala 39% više deviznih rezervi nego što je to bilo optimalno.

Najniži višak deviznih rezervi je u režimu fiksnog deviznog kursa (ARA II) sa uvećanim ponderima za M2 (zbog evrizacije) i u režimu varijabilnog deviznog kursa (ARA IV) sa uvećanim ponderima za M2 i izvoz u kojem su devizne rezerve za 14%, odnosno 19% veće od optimalnih (2022). U modelu fiksnog deviznog kursa, sa originalnim ponderima (ARA I), devizne rezerve su za oko 50% više u odnosu OR. Kada bi CBBH prešla na režim varijabilnog deviznog kursa, sa od strane MMF-a predloženim ponderima, OR bi bile najniže, a višak deviznih rezervi najviši (8,5 milijardi KM, ili 113% u odnosu na devizne rezerve sa kraja 2022. god.).

Ovi nalazi u kombinaciji sa nerealizovanim gubicima na portfoliju obveznica nastalim zbog rasta kamatnih stopa (2022) i troškovima negativne kamatne stope na depozite kod ino banaka i aktivu CBBH (2016 - 2021) postojeći, visok, nivo deviznih rezervi dovode u pitanje sa aspekta ekonomičnosti i rentabilnosti. Pored toga u istraživanju je dat vrlo visok ponder ostalim obavezama i time akcijskom kapitalu u vlasništvu nerezidenata, koji uopšte nije mobilan u BH, i kao takav ne predstavlja izraženu prijetnju za devizne rezerve, jer je promet na bh. berzama u poređenju sa tržišnom kapitalizacijom vrlo nizak (10%) i u najvećem djelu se odvija na tržištu dužničkih hartija od vrijednosti.

Nivo deviznih rezervi može biti relaksiran i zbog činjenice da je finansijski sistem u BH izraženo bankocentričan, što ostavlja malo investicionih alternativa bankarskim depozitima. Visok nivo neto strane aktive bh. komercijalnih banaka (oko 9% GDP) dodatno štiti devizne rezerve i predstavlja ekonomsko opravdanje za njihovo smanjenje.

Prema rezultatima istraživanja, a na osnovu svih navedenih razloga, postojeći zakonski, obavezni, minimalni odnos neto devizne aktive i monetarne pasive koje je postavljen na jedan (racio pokrića) predstavlja prepreku dostizanju OR. Pored toga, on smanjuje i rentabilnost bh. emisione banke, ne samo zbog negativnih prinosa na devizne rezerve, nego i zbog nemogućnosti ekonomičnijeg i rentabilnijeg kreditnog angažmana CBBH na bh. tržištu u poređenju sa prinosima na stranom tržištu.

Izračunati interval viška deviznih rezervi od 1,9 mlrd. KM do 8,5 mlrd. KM (2022) zajedno sa višim očekivanim prinosima na domaćem tržištu nego na stranom, i opcijom vođenja monetarne politike značajno većeg stepena diskrecije u poređenju sa postojećem, koja ne podrazumijeva samo kreditiranje rezidenata, već i varijabilni devizni kurs konvertibilne marke, stvara mogućnost, ali i potrebu, promjene bh. monetarnog režima. Ako su principi ekonomičnosti i rentabilnosti ključni ekonomski principi, podređenost deviznih rezervi ovim principima zahtjeva radikalnu ekonomsku transformaciju bh. monetarnog režima, koja bi trebala započeti promjenom vrijednosti koeficijenta pokrića i njegovim značajnim spuštanjem ispod jedan, a kasnije i prelaskom na varijabilni devizni kurs.

Buduća istraživanja OR s obzirom na hroničan bh. spoljnotrgovački deficit, a u vezi činjenice da smo izolovali i vrlo jaku vezu između uvoza i deviznih rezervi, bi kao jednu od determinanti OR trebala uzeti u obzir tražnju za deviznim rezervama po osnovu uvoza. Nova istraživanja na ovu temu bi mogla ići u pravcu komparativne analiza pokrića monetarne pasive sa neto deviznim rezervama u BH i njenom neposrednom okruženju, kao i u zemljama čiji su ekonomski sistemi uzor za BH. Takođe, zanimljiva bi bila i istraživanja koja dovode u vezu koncept optimalnih deviznih rezervi sa troškovima držanja deviznih rezervi.

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DETERMINANTS OF FOREIGN EXCHANGE RESERVES AND THE OPTIMAL LEVEL OF FOREIGN EXCHANGE RESERVES IN BOSNIA AND HERZEGOVINA

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Summary: The research answered the question of what affects BH foreign exchange reserves and what is the lower limit of the optimal level of foreign exchange reserves of the Central Bank of Bosnia and Herzegovina (CBBH). We defined excess foreign exchange reserves as the difference between the balance of foreign exchange reserves and the lower limit of the optimal level of foreign exchange reserves. In most of the analyzed period, foreign exchange reserves are significantly above the lower limit of the optimal foreign exchange reserves. In 2022, the banking sector had the largest excess of foreign exchange reserves in the scenario of a floating exchange rate, without considering the degree of euroization. The excess is the lowest in the fixed exchange rate regime, in which, through the money supply, we allowed a high impact of euroization on optimal foreign exchange reserves. Even under this most conservative scenario, the excess foreign exchange reserves amount to 1.9 billion KM or about 4% of nominal GDP in 2022. Changes in BH monetary regime, enabling the CBBH to lend to residents and a possible transition to a floating exchange rate, are possible while maintaining a satisfactory level of foreign currency liquidity of the CBBH.

Keywords: policy of foreign exchange reserves, monetary policy, currency board, floating exchange rate.

JEL classification: E52, F31

Introduction

After it was proven that the Central Bank of Bosnia and Herzegovina (CBBH), although it operates on the principles of a currency board, nevertheless runs a discretionary monetary policy (Jović, 2020), whereby the business cycle in Bosnia and Herzegovina (BH) differs from the business cycle in the area of the reserve currency - eurozone (Jović, 2021), we continue research on the necessity of transforming the BH monetary regime.

Foreign exchange reserves, serving as a cover for the import of goods and settlement of foreign debt liabilities, perform the function of a guardian of foreign currency liquidity of the economic system. The need to determine the optimal level of foreign exchange reserves arises from the fact that, in addition to the benefits of holding foreign exchange reserves, there are also costs. The subject of this research are foreign exchange reserves in BH, and our goal is to determine their optimal level or the level towards which they should converge, considering the characteristics of the BH economic system.

We assume, according to our working hypothesis, that the foreign exchange reserves of the Central Bank of Bosnia and Herzegovina (CBBH) are above the optimal level required from the aspect of foreign exchange liabilities of Bosnia and Herzegovina's non-banking and banking sectors. From the view of the currency board, this hypothesis casts doubt on the need for full coverage of monetary liabilities with net foreign exchange assets, i.e., maintaining the coverage ratio of monetary liabilities above one.

In the first part of the paper, we present the development of necessary or optimal foreign exchange reserves through a short review of theoretical positions on the subject and empirical research on this problem. The method of proving the research hypothesis and the database used is explained in the research methodology, which is followed by the presentation of the research results and the polemics on the topic of the obtained results. The main methodological research tools are the multiple regression model and methods for determining adequate reserves (IMF, 2015). In the final parts of the research, we again consider the obtained conclusions and draw recommendations for economic decision-makers and future research on this topic.

Literary Review

Traditional ways of measuring the appropriate level of foreign exchange reserves and hence their determinants follow a very simple, linear, and logical rule. The requirement for quarterly coverage of imports with foreign exchange reserves (Krušković, 2014) is among the first rules of its kind (IMF, 2011), as well as the requirement that foreign exchange reserves be equal to the short-term part of external debt. These proposals were created in the milieu of direct or indirect representatives of capital exporting countries who were primarily interested in ensuring, through the size of foreign exchange reserves, that the debtor country has sufficient foreign exchange resources to pay their claims. The variables that determine the coverage of imports with foreign exchange reserves are the growth rate of real GDP, exchange rate, opportunity costs of holding foreign exchange reserves, and the dummy variable, which separates the period before and after the Asian crisis (Hakim, 2013).

Since the early 90s, foreign exchange reserves have rapidly grown (Rodrik, 2006), and their participation has increased to 30% of GDP and eight months of imports. We found the most comprehensive overview of the determinants of foreign exchange reserves and their evolution in a study by the Bank for International Settlements (Cantu & Yavuz, 2019). Until the 2000s, prudence related to the current account deficit, the size of the financial sector, and financial openness were the primary determinants of foreign reserves. The size of the current account deficit and the size of the financial sector are directly correlated with the size of foreign exchange reserves. Financial openness is a statistically significant factor of foreign exchange reserves, except in the case of developed European countries and oil-exporting countries, where an inverse but statistically insignificant relationship was established.

Later, the main motives for holding foreign exchange reserves are transferred to the variables concerning the exchange rate, its stability, and the degree of its overvaluation. The policy of the monetary anchor, which is most often conducted within the framework of an overvalued exchange rate, requires a higher level of foreign exchange reserves to defend the target exchange rate. The third group of variables affecting foreign exchange reserves concerns the size of the economic system. As expected, a larger population leads to more significant foreign exchange reserves, although this connection is not strong in Asian countries and in general in the period before the global financial crisis (2007-2009). The main determinants of the world's second-largest economy (China) are import changes and short-term debt (Misztal, 2021). The research found that the level of Chinese foreign exchange reserves is above the optimal level measured by the methodology developed by the IMF. In the last quarter of a century, this international institution has several times developed and improved the methodology for determining optimal foreign exchange reserves. At the very beginning (IMF, 2001), the prevailing views were that the old rules of thumb (such as three months' coverage of imports with foreign exchange reserves) must be discarded in favor of short-term external debt, expected capital outflows, exchange rate regimes and differences in interest rates. That proposal is based on dividing indicators of the optimal level of foreign exchange reserves into foreign debt, trade, money, and macro indicators (Krušković, 2014, p. 73). Later recommendations (IMF, 2011) (IMF, 2013) (IMF, 2015) went in the direction of testing and determining the variables and their influence (weight) on the level of foreign exchange reserves. As the most reliable determinants of the optimal level of foreign exchange reserves, short-term external debt, other liabilities to non-residents, broad money (M2), and exports are isolated (more on this in the methodological basis of the work). Research that dealt with the foreign exchange reserves of Bosnia and Herzegovina, i.e., are scarce. One of them (Šoja & Galijašević, 2017) investigated the optimal level of foreign exchange reserves (2005 - 2015) and their resistance to extreme internal and external shocks. It was concluded that the level of foreign exchange reserves is above the optimal level but that in case of an extreme shock, the foreign exchange reserves would not be enough.

Methodology and Data

The IMF has repeatedly proposed and analyzed ways of calculating the required level of foreign exchange reserves determined based on the determinants of foreign exchange reserves. In one of the previous studies of this kind (IMF, 2015) for the key variables, short-term external debt, other liabilities (external debt with a maturity of more than one year and share capital owned by non-residents), M2 and exports were proposed final weightings depending on whether the economic system is in the regime of fixed or floating exchange rate and whether capital movement control is implemented.

The weights for these variables are general and do not have to correspond to each country individually, so it was necessary to check the usability of the proposed variables for determining the required level of foreign exchange reserves in the case of Bosnia and Herzegovina. The connection between BH foreign exchange reserves on the one hand, and the proposed variables on the other hand, including other portfolio liabilities and other investments, we assessed and tested using a multiple linear regression model with annual and quarterly frequency variables, as well as using the Granger test, in which null hypothesis presented as the assertion that there is no causality between the variables. Quantitative and qualitative methods proved the connection between foreign exchange reserves and short-term debt. In the assessment of foreign exchange reserves, the IMF offered four variables as the main determinants of foreign exchange reserves, which may or may not correspond to the demand for foreign exchange reserves in each country and especially do not have to correspond to the optimal level of foreign exchange reserves in BH, which functions as a currency board without the function of an institution of final resort (lender of last resort). In the first IMF survey in 2011, the weights for short-term debt, M2 other portfolio investments, and exports for countries with capital controls were 30%, 15%, 10%, and 10%, and for the floating exchange rate, the weights for the same variables were set at 30%, 15%, 5%, and 5%. In the previous IMF research, it was suggested that other portfolio liabilities be replaced with other liabilities, and it also pointed out the great impact of dollarization on the outbreak of banking crises and the need to correct weights in highly dollarized or highly euroized economies. Starting from the initially recommended model for countries with a fixed exchange rate and without control of capital movements, we determined the optimal foreign exchange reserves (OR) in three more ways.

In order to evaluate the level towards which the foreign exchange reserves of Bosnia and Herzegovina should converge, we constructed four models (Table 1). The first model (ARA I) is based on the recommendation of the IMF (IMF, 2015, p. 19) for countries with a fixed exchange rate and without control of capital movements; the lower limit of optimal foreign exchange reserves is determined as the sum of the weighted amount of (foreign) short-term debt, other liabilities, broad money (M2) and exports, with recommended weights of 30%, 20%, 10%, and 10% respectively. The second model (ARA II) formed, also based on the IMF, 2015, keeps the weights for short-term debt (30%) and other liabilities (15%), while the weighting for M2 is doubled (20%) due to the high degree of euroization of BH banking liabilities and the weighting for export (10%) remain the same. Recognizing the high degree of euroization of the banking sector of BH, in which euro deposits of households make up 48% of total deposits of households, as well as the fact that the CBBH does not have a contracted credit line with the ECB, we increased the weighting for M2 by double. We left the other weights at the same level and thus formed the second model, which also refers to the fixed exchange rate regime without controlling capital movements. These two models imply the retention of the existing monetary regime (fixed exchange rate, absence of LOLR, and automatic purchase and sale of the convertible mark), while the other two models imply the transition to a floating exchange rate and the appearance of the CBBH as a creditor of BH residents. The third (ARA III) and fourth (ARA IV) model determine the optimal level of foreign exchange reserves if the CBBH switches to a floating exchange rate regime without controlling capital movements. In ARA III, the proposals of the IMF (IMF, 2015, p. 19) were introduced, according to which the weights in the floating exchange rate regime for short-term liabilities, other liabilities, M2, and exports are 30%, 15%, 5%, and 5%, respectively. In the last model, ARA IV, which is also based on a floating exchange rate, we kept the weights for short-term debt and other liabilities (30% and 15%).

Due to high euroization and dependence on imports (and a high and chronic foreign trade deficit), which is an approximation of export, we have quadrupled the weighting for M2 and set it to 20% (following the example of ARA II) and doubled the weighting for exports compared to ARA III (10%). We did not change the weights for short-term debt and other liabilities because the floating exchange rate enables flexible management of public debt, and we assumed that through lending in local currency by the CBBH, an additional part of foreign exchange reserves can be used to pay off external debt.

Table 1 - Models for Estimating the Lower Bound of the Optimal Level of Foreign Exchange Reserves

	Weights				Exchange rate
	Kratkoročni dug	Ostale obaveze	M2	Izvoz	
ARA I	30%	20%	10%	10%	Fixed
ARA II	30%	20%	20%	10%	Fixed
ARA III	30%	15%	5%	5%	Variable
ARA IV	30%	15%	20%	10%	Variable

Source: IMF and Author. The weights that have changed concerning the initial proposal of the IMF are shaded.

Abbreviations used in the text are A - annual level, ARA - assessment of the adequate level of foreign exchange reserves (assessing reserve adequacy), BH - Bosnia and Herzegovina, Bosnian, Centralna banka BH - CBBH, C – constant in regression model, D - first difference, DIR - a difference in foreign and BH interest rate, E - export, FTP – BH - BH foreign trade partners, GDP - gross domestic product, I-import, LOLR - lender of last resort, M2 – broad money (money outside banks, demand, and time deposits), OI - other portfolio investments, OL - other liabilities, OR - optimal foreign exchange reserves, PI - portfolio investments, Q - quarterly level, REER - real effective exchange rate, R - foreign exchange reserves, RM - regression model, VOL - volatility (standard deviation).

Results and Discussion

The assumption about the influence of BH short-term foreign debt on foreign exchange reserves and their optimal level we do not derive using a model but from expert proposals, which are part of the practice of the IMF in the optimization of foreign exchange reserves. The Italian Minister of Finance, Guidotti, suggested that foreign exchange reserves should correspond to one-year foreign debt liabilities, i.e., the short-term part of external debt. Later, this proposal was supplemented and elaborated by former Federal Reserve Governor, Alan Greenspan, so this approach to determining optimal reserves was called the Greenspan-Guidotti rule (IMF, 2011, p. 13).

Because of how the BH currency board works, the connection between foreign exchange reserves and money supply is extreme, almost perfect, at the level and in the first difference (Tables 2 and 3). Given that CBBH issues money, convertible marks, only through the purchase of foreign currency from banks primary money (monetary base) increases only through the growth of foreign exchange reserves. The growth of domestic currency liquidity increases banks' credit potential, and any change in loans, through credit-deposit multiplication, leads to changes in the money supply, from which the connection between foreign exchange reserves and monetary aggregate M2 is derived.

The impact also goes in the opposite direction because the growth of primary deposits (cash deposits) and secondary deposits (created by granting loans) directly increases the demand for foreign currencies of non-banking sectors and, indirectly, the demand for foreign exchange reserves.

Table 2 - Elasticity of Foreign Exchange Reserves (R/GDP) to Broad Money (M2/GDP) in the Level, 2000-2022 (RM 1)

	Coefficient	Standard error	T-statistics	Probability
C (Konstanta)	0.12	0.016	0.74	0.46
M2/GDP	0.467	0.026	17.45	0.00

Source: Author

Two-way causality is also shown by the Granger causality test, which cannot be rejected for the null hypothesis that foreign exchange reserves do not affect M2, and that the broad money does not affect foreign exchange reserves. The probabilities for the obtained value of the F statistic (3 and 2) are 0.08 and 0.17 for the assumption that foreign exchange reserves do not affect the money supply i.e., that the money supply does not affect foreign exchange reserves. Given that the value of the Durbin-Watson statistic is significantly below two (0.91), which indicates positive autocorrelation and potentially spurious regression, even though the relationship is established following the way the currency board works, we also developed equations with stationary variables, by determining the first difference in level. The equation with variables without unit root I (1) does not show the existence of autocorrelation (the value of the Durbin-Watson statistic is close to two), and the regressor with the money supply is significant at the level below 1%. In both cases, the Granger test gives the probability for the obtained F statistic (0.28 i 0.15), which again confirms the two-way causality between the variables. According to the model in the first difference, an increase in money supply by 1% to GDP increases foreign exchange reserves by 0.76% to GDP.

Table 3 - Foreign Exchange Reserves vs. M2 (first difference) 2000 - 2022 (RM 2)

	Coefficient	Standard error	T-statistics	Probability
C	-0.0057	0.0027	-2.091945	0.0494
D_M2/GDP	0.7646	0.0498	15.33440	0.0000

Source: Author

We have also isolated the statistically significant and high influence of broad money on foreign exchange reserves on data with quarterly frequency (Table 4). An increase in M2 by 1% of GDP leads to an increase in foreign exchange reserves of 0.49% of GDP. The impact of variability (volatility) in the REER and GDP of the most important trade partners and interest differentials on foreign exchange reserves is also statistically significant and of the expected sign, but it is of extremely low intensity. Between portfolio investments (PI/GDP) and foreign exchange reserves, no statistically strong relationship has been established, and the interdependence between imports and foreign exchange reserves is not only highly significant (at the level of 1%) but also extremely intense, even more significant than the influence of M2 on foreign exchange reserves. The positive correlation between imports and foreign exchange reserves is only partially illogical because a high ratio of imports and foreign exchange reserves reflects the openness of the economy (Beaufort & Kapteyen, 2001) and therefore, even a positive impact of import growth on foreign exchange reserves can be expected (Cooper, 1968). However, in classical models, a negative relationship is always identified (Heller, 1966).

Table 4 - Influence of Selected Variables and M2 on Foreign Exchange Reserves of the CBBH, 2005 – 2022

	RM 3	RM 4
C	-0.56 (-4.44) ***	-0.64 (-4.9)***
I/ GDP (-1)	0.78 (3.96) ***	0.934 (4.5)***
M2/GDP	0.49 (22.81) ***	0.49 (23.5)***
PI/GDP	1.38 (1.55)	
REER_volatility	0.05 (3.32)***	0.05 (3.25)***
STP_GDP_volatility	0.02 (4.42) ***	0.018 (3.86)***
DIR	-0.08 (-4.16) ***	-0.075 (-4.27)***
Dummy variable for crisis (-1)		0.07 (2.39)**
R2	0.97	0.93

Source: Author.

Note: Foreign exchange reserves are presented as the ratio of foreign exchange reserves to GDP. In parentheses are the t statistics. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

In ARA models, according to the IMF methodology, there is no import variable, and a part of import is always used to produce export products so that export can be a good approximation of import demand for foreign exchange reserves. Developed regression models, with exports, or the variability of exports as independent variables in the equation of foreign exchange reserves, confirm the correctness of this economic reasoning (Table 5). The variables related to export in all equations have the expected positive sign, i.e., the negative sign if it is about the variability of exports and are statistically significant at the level below 1%. The impact of exports on foreign exchange reserves is high regardless of whether this variable is introduced into the model with or without a time lag. An increase in exports and M2 lead to a relative increase in foreign exchange reserves to GDP, all else equal (RM 4, RM 5, and RM 6). In the equations with exports, all other variables are statistically significant except for portfolio investments, so we replaced them with other investments from the balance of payments.

Table 5 - Influence of Selected Variables and Exports on Foreign Exchange Reserves of the CBBH, 2005 – 2022

	RM 5	RM 6	RM 7
C	-0.21 (-2.70) ***	-0.26 (-3.27)***	-0.29 (-3.54)***
E/GDP	0.56 (2.20)**	0.75 (2.83)***	0.89 (3.25)***
M2/GDP	0.44 (15.48) ***	0.43 (15.10) ***	0.43 (15.02)

M2/GDP	0.44 (15.48) ***	0.43 (15.10) ***	0.43 (15.02)
REER_VOL	0.06 (3.86) ***	0.76 (0.82) ***	0.07 (4.41)***
PI/GDP		0.07 (4.28)	
STP_VOL_A	0.02 (3.43) ***	0.02 (3.84) ***	0.02 (3.50)***
DIR	-0.07 (-3.37) ***	-0.06 (-3.35) ***	-0.06 (-3.36)***
Dummy variable for crisis (-1)			0.05 (1.15)
R^2	0.91		

Source: Ibid

Other portfolio investments (OI) have been proposed (IMF, 2015) as an essential variable for the demand and level of foreign exchange reserves (Table 6). As expected, their impact on foreign exchange reserves is positive and statistically significant (RM 8 and RM 9). Growth of the first difference in other investments to GDP for one ppt increases foreign exchange reserves (difference in the quotient of foreign exchange reserves and GDP) by 0.47 ppt.

Table 6 - Impact of Selected Variables and Other Portfolio Investments on Foreign Currency Reserves of the CBBH, 2016 – 2022

	RM 8	RM 9
C	-0.34 (-2.10)**	-0.12 (-1.39)*
E/GDP	0.48 (2.13) **	0.22 (1.40)
D_M2/GDP	0.48 (17.17)***	0.45 (16.26)***
D_OI/GDP	0.47 (5.14) ***	0.42 (4.41)***
D_REER_VOL	0.03 (1.79)*	
STP_VOL_A	0.01 (2.33) **	0.004 (1.9)*
DIR	-0.04 (-1.69) *	-0.04 (-1.97)**
I_VOL_Q	0.01 (1.68)*	
R^2	0.94	0.93

Source: Ibid

In IMF 2015, it was recommended that other liabilities to non-residents should be used instead of other portfolio investments in determining the optimal level of foreign exchange reserves. The Granger test, as in the case of the relationship between foreign exchange reserves and money supply, does not provide the power to reject the null hypothesis of no mutual influence between foreign exchange reserves and other liabilities at the 5% significance level, except in one case.

For variables at the level (R - foreign exchange reserves, OL - other liabilities) for the null hypothesis, that foreign exchange reserves do not affect other liabilities, the F test statistic is 0.21, the probability is 0.81, which demonstrates a two-way relationship between the variables (Table 7). As expected, with a high degree of reliability (F statistic 2.54 and probability 12%), it is impossible to reject the null hypothesis that other liabilities do not affect the level of foreign exchange reserves. The relative level of foreign exchange reserves (R/GDP) affects other liabilities (OL/GDP), but with variables defined in this way, as we have previously stated, the influence of other liabilities on foreign exchange reserves is absent. The possible reason is that other liabilities, in addition to medium-term and long-term debt to non-residents, also include shares of non-residents in BH joint stock companies. That capital, as a quasi-obligation towards non-residents, in BH due to the low liquidity of the financial markets is not mobile at all. Therefore, the low mobility of share capital in this type of specification of the Granger test could explain the absence of influence of other liabilities towards non-residents on foreign exchange reserves. On the other hand, the variables in the first difference confirm again the two-way causality between foreign exchange reserves because, with a high degree of reliability, it is not possible to reject the null hypothesis according to which other liabilities do not affect foreign exchange reserves (Table 8). For these reasons, even though share capital in BH has a low level of mobility and the financial market is shallow, we have kept other liabilities towards non-residents in the models for evaluating the optimal level of foreign exchange reserves.

Table 7 - Interdependence Between Foreign Exchange Reserves (R) and Other Liabilities to Non-Residents (in level), Granger Test

Null hypothesis	Number of observation	F statistics	Probability
R does not Granger Cause OL	17	0.21409	0.8103
OL does not Granger Cause R		2.54967	0.1195
R/GDP does not Granger Cause OL/GDP		2.38698	0.1341
OL/GDP does not Granger Cause R/GDP	17	5.64964	0.0187

Source: Ibid

Table 8 - Interdependence Between Foreign Exchange Reserves (R) and Other Liabilities Towards Non-Residents (in the first difference), Granger Test

Null hypothesis		F statistics	Probability
D_R does not Granger Cause D_OL		1.2002	0.3377
D_OL does not Granger Cause D_R	16	1.1856	0.3418
D_R/GDP does not Granger Cause D_OL/GDP		1.73106	0.222
D_OL/GDP does not Granger Cause D_R/GDP	16	1.64836	0.2365

Source: Ibid

Optimal foreign exchange reserves (OR) obtained based on four ARA models have the same dynamics, but also a significant difference due to different weights for four key variables (Table 9). On average, in 2016 – 2022, the OR varies in the interval of 7.6 billion KM up to 14.1 billion KM with significant deviations between models. The highest level of OR (14.1 billion KM) is provided by the ARA II model, which assumes the operation of the CBBH in the regime of a fixed exchange rate and a higher level of euroization of BH banks liabilities, which is presented through twice the weighting for broad money compared to the initial assumption of the IMF (ARA I). The flexible monetary policy presented not only through a floating exchange rate but also the possibility of lending money to BH residents by the CBBH (this activity is prohibited in the current model of the currency board) lowers the OR to the lowest level, which at the end of 2022 is 7.6 billion KM (ARA III). Between these two extremes are the OR in the fixed exchange rate regime and the initially proposed weightings for M2 and exports of 10% (ARA I). The extreme variant of the floating exchange rate (ARA IV) with significantly increased weightings for both M2 (quadrupled) and exports (doubled weighting) approaches the level of OR to the model with a fixed exchange rate in which emphasis is placed on euroization (ARA II). In all models during 2013 and 2017, OR recorded excessive growth due to the increase in M2. The most significant contribution to the growth of OR in 2020, in addition to M2, is provided by other liabilities, and in 2021, OR is under the influence of export growth.

Table 9 - Optimal Foreign Exchange Reserves of the CBBH (in billions of KM)

	2016	2017	2018	2019	2020	2021	2022
ARA I	7.4	7.6	8.3	8.6	8.4	9.8	10.8
ARA II	9.4	9.8	10.7	11.2	11.2	13.0	14.1
ARA III	5.2	5.3	5.9	6.1	5.9	6.8	7.6
ARA IV	8.8	9.2	10.2	10.7	10.7	12.4	13.5
Average	7.7	8.0	8.8	9.1	9.1	10.5	11.5

Source: Author

The obtained results are, of course, reflected in the excess of foreign exchange reserves that the CBBH keeps above the optimal level of foreign exchange reserves. On average, since 2016 until 2022, excess fell in the interval of 1.8 billion KM up to 5.8 billion KM (Table 10). The highest excess of foreign exchange reserves has a monetary regime with a floating exchange rate that ignores the high degree of euroization of the BH banking sector (ARA III). The floating exchange rate and the relatively low weighting for M2 (ARA III) set the excess foreign exchange reserves at twice as high as the optimal foreign exchange reserves (Table 11). Even in the case of the existing fixed exchange rate regime, without emphasizing the high euroization of BH of banking liabilities (ARA I), it assumes that the foreign currency reserves of the CBBH are for 5.3 billion, or by almost 50%, more than the optimal foreign exchange reserves (2022). IMF models in which we put a much greater emphasis on euroization than the initial proposal of the IMF (ARA II), or in which, in addition to euroization, we took into account the chronic foreign trade of Bosnia and Herzegovina imbalances (ARA IV) gave a significantly smaller excess of reserves but still indicate an excessively high level of foreign exchange reserves. The foreign exchange reserves excess of 1.9 billion KM (ARA III) is 4% of the nominal GDP of BH in 2022, and 17% of the short-term external debt can be repaid with it. The findings of the research are in line with the only previous one of this kind (Šoja & Galijašević, 2017), which, using different methodologies, also concluded that the level of foreign exchange reserves of the CBBH is above the optimal level (except in circumstances of extreme shock).

Table 10 - Excess of Foreign Exchange Reserves of the CBBH Compared to Optimal Foreign Exchange Reserves (in billions of KM)

	2016	2017	2018	2019	2020	2021	2022
ARA I	2.2	3.0	3.3	4.0	5.4	6.5	5.3
ARA II	0.2	0.8	0.9	1.4	2.6	3.4	1.9
ARA III	4.3	5.3	5.8	6.5	7.9	9.5	8.5
ARA IV	0.7	1.3	1.4	1.9	3.2	3.9	2.5
Average	1.8	2.6	2.8	3.5	4.8	5.8	4.6

Source: Author

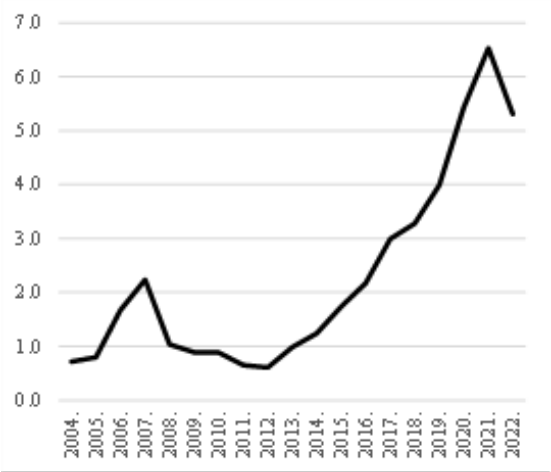
Table 11 - Excess of Foreign Exchange Reserves of the CBBH Compared to Optimal Foreign Exchange Reserves, in %

	2016	2017	2018	2019	2020	2021	2022
ARA I	30	40	39	46	64	66	49
ARA II	2	8	8	12	23	26	14
ARA III	83	99	98	108	134	140	113
ARA IV	8	14	14	18	30	32	19
Average	31	40	40	46	63	66	49

Source: Author

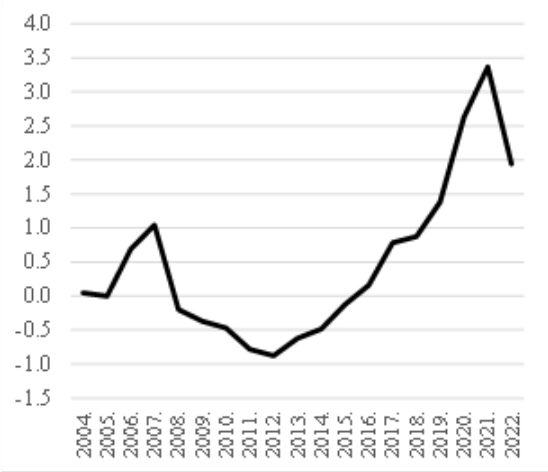
The analysis over a more extended period since 2004 (Graphs 1 - 4) shows that the excess of foreign exchange reserves reached a minimum in 2012 and that in that year, in two of the four ways of modeling foreign exchange reserves, foreign exchange reserves were below the optimal foreign exchange reserves (ARA II and ARA IV). From that year, the trend of growth of excess reserves begins without stopping until 2021. The fall in the excess of foreign exchange reserves in 2022 was caused by the fall in the market value of foreign exchange reserves due to the rise in interest rates on the one hand. On the other hand, the excess of foreign exchange reserves is affected by the growth of OR, which is entirely under the influence of the development of short-term foreign debt. On average, in 2022, the excess of foreign exchange reserves was reduced by a fifth in one year.

Graph 1 - Excess Foreign Exchange Reserves of the CBBH According to the ARA I Model with a Fixed Exchange Rate (in billions of KM)



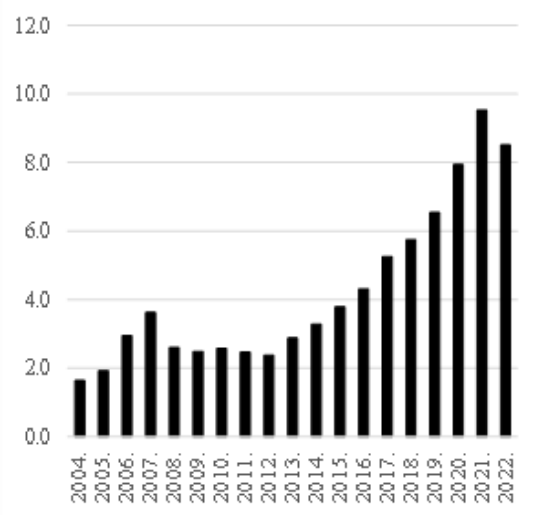
Source: Ibid

Graph 2 - Excess Foreign Exchange Reserves of the CBBH According to the ARA II Model with a Fixed Exchange Rate (in billions of KM)



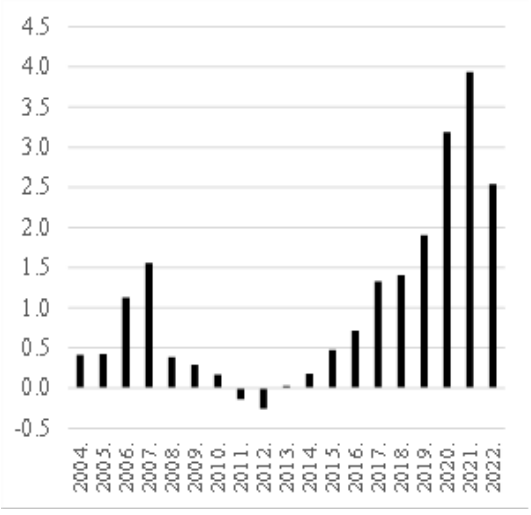
Source: Ibid

Graph 3 - Excess Foreign Exchange Reserves of the CBBH According to the ARA III Model with a Floating Exchange Rate (in billions of KM)



Source: Ibid

Chart 4 - Excess Foreign Exchange Reserves of the CBBH According to the ARA IV Model with a Floating Exchange Rate (in billions of KM)



Source: Ibid

Concluding Considerations

The costs of holding reserves on the one hand and the required level of foreign exchange reserves on the other are the main motives for searching for optimal foreign exchange reserves (OR). The determination of the OR ranged from simple rules such as the number of months in which imports should be financed from foreign exchange reserves to very complicated models that use an algorithm to optimize the value of foreign exchange reserves.

Using a panel analysis, the IMF identified key variables that affect the level of foreign exchange reserves and, depending on the type of monetary regime and the presence or absence of capital control, and the degree of dollarization, i.e., euroization, proposed the shares (weights) of those variables in determining the OR. Given that the proposed models are general and do not take into account the specificities of individual countries, in this research, we first tested the reliability and strength of the connection of selected and other variables with foreign exchange reserves, after which we used the original (IMF's) and, based on them, modified models used to calculate the lower limit of OR for Bosnia and Herzegovina.

We determined OR in Bosnia and Herzegovina as a linear combination of short-term external debt, other liabilities, broad money (M2), and export. We increased the weights due to the high level of euroization in BH, as well as due to the inflexibility of BH monetary policy (absence of LOLR). On the other hand, in models with a floating exchange rate, the possibility of exchange rate appreciation and reduction of external debt expressed in domestic currency, i.e., shock absorption by adjusting the exchange rate, had the effect that the weights for short-term debt and other liabilities remained unchanged.

A common feature of all the selected models for calculating the lower limit of the OR in the period 2016-2022, and even those in which the weights for certain variables were increased twice, or even four times compared to the recommendation of the IMF, is the isolation of a significant excess of reserves compared to the existing the level of foreign exchange reserves of the CBBH. During these seven years, the excess of foreign exchange reserves to the lower limit of optimal foreign exchange reserves was 3.7 billion KM. On average, the central bank held 39% more foreign exchange reserves than was optimal.

The lowest excess of foreign exchange reserves is in the regime of the fixed exchange rate (ARA II) with increased weights for M2 (due to euroization) and in the regime of the floating exchange rate (ARA IV) with increased weights for M2 and exports in which foreign exchange reserves are by 14% and 19% respectively higher than optimal (2022). In the fixed exchange rate model, with the original weighting (ARA I), the foreign exchange reserves are about 50% higher than the OR. If the CBBH switched to a floating exchange rate regime, with the weightings proposed by the IMF, the OR would be the lowest, and the excess foreign exchange reserves would be the highest (8.5 billion KM, or 113% compared to the foreign exchange reserves at the end of 2022).

These findings, in combination with unrealized losses on bonds portfolio caused by the growth of interest rates (2022) and costs of negative interest rates on deposits with foreign banks and assets of the CBBH (2016 - 2021), call into question the current high level of foreign exchange reserves from the aspect of the economy and profitability.

In addition, in the research, we gave very high weighting to other liabilities and, thus, to share capital owned by non-residents, which is not mobile at all in BH, and as such, does not represent a significant threat to foreign exchange reserves because turnover in BH stock market compared to the market capitalization is very low (10%) and mostly takes place on the debt securities market.

The level of foreign exchange reserves can also be relaxed because the financial system in BH is markedly bank-centric, which leaves few investment alternatives to bank deposits. The high net foreign assets of BH commercial banks (about 9% of GDP) additionally protects foreign exchange reserves and represent an economic justification for their reduction.

According to the research results, and based on all the stated reasons, the existing legal, mandatory minimum ratio of net foreign exchange assets and monetary liabilities, set to one (backing ratio), represents an obstacle to achieving the OR. In addition, it reduces the profitability of the BH central bank, not only because of negative returns on foreign exchange reserves but also because of the impossibility of more economical and profitable credit engagement of the CBBH on the BH market compared to returns on the foreign market.

The calculated interval of excess foreign exchange reserves of 1.9 billion KM up to 8.5 billion KM (2022), together with higher expected returns on the domestic market than on the foreign market, and the option of conducting a monetary policy with a significantly higher degree of discretion compared to the existing one, which does not only include lending to residents, but also the floating exchange rate of the convertible mark, creates the possibility, but also the need, of changes BH monetary regime. If the principles of economy and profitability are key economic principles, the subordination of foreign exchange reserves to these principles requires a radical economic transformation of BH monetary regime, which should begin with a change in the value of the backing ratio and its significant drop below one, and later with the transition to a floating exchange rate.

Future research of OR considering chronic BH foreign trade deficit, and in connection with the fact that we have also isolated a very strong connection between imports and foreign exchange reserves, as one of the determinants of the OR should take into account the demand for foreign exchange reserves based on imports. New research on this topic could go in the direction of comparative analysis of coverage of monetary liabilities with net foreign exchange reserves in BH and its environment, as well as in countries whose economic systems are a desired model for BH. Also, research that links the concept of optimal foreign exchange reserves with the costs of holding foreign exchange reserves would be interesting.

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