

PROCENJIVANJE PDV EFIKASNOSTI U ZEMLJAMA BENELUKSA

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Apstrakt

Relevantnost poreza na dodatu vrednost ogleda se u generisanju značajne količine prihoda i suzbijanju poreske evazije. Svrha istraživanja je usmerena ka procenjivanju prikupljenih prihoda i merenju efikasnosti naplate PDV prihoda u zemljama Beneluksa (Belgija, Holandija i Luksemburg) za vremenski period 2011-2020. godine. Empirijski rezultati istraživanja ukazuju da je prosečna PDV efikasnost iznosila 59.84% u posmatranim zemljama. pri čemu je najveći stepen efikasnosti zabeležen u Luksemburgu, a najmanja vrednost u Belgiji. Panel regresioni rezultati pokazuju da ekonomski rast, finalna potrošnja, državni rashodi i PDV prihodi pozitivno utiču na PDV efikasnost u posmatranim zemljama. Istovremeno, varijable poput nezaposlenosti i inflacije, kao i standardna PDV stopa imaju negativan efekat na efikasnost PDV prihoda. Dobijeni empirijski nalazi mogu biti od pomoći kreatorima ekonomske politike u analiziranim zemljama prilikom profilisanja i prilagođavanja poreske politike sa stanovišta poreza na dodatu vrednost.

Ključne reči: *porez na dodatu vrednost, efikasnost, panel analiza, zemlje Beneluksa.*

JEL: *H20, H21, H26*

Uvod

Države širom sveta imaju poteškoća sa prikupljanjem zahtevanog nivoa poreskih prihoda za finansiranje planiranih aktivnosti (Mu et al., 2022). Potencijalni problem prikupljanja prihoda naročito dolazi u kriznim momentima, kada usporava ekonomska aktivnost i dovodi do negativnih tendencija u kretanju fundamentalnih makroekonomskih indikatora. Pitanje efikasnosti prikupljanja i

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naplate prihoda je važno za sve fiskalne vlasti, pri čemu je neophodno utvrditi glavne generatore poreskih prihoda u državnim budžetima. Radi obezbeđivanja javnih usluga i pokrivanja javnih potreba, kreatori fiskalnih vlasti moraju stvoriti odgovarajući poreski sistem koji će generisati potreban nivo prihoda na poreskoj, ali i neporeskoj osnovi. Adekvatno upravljanje prihodnom stranom budžeta je preduslov za optimalno planiranje i izvršenje projektovanih rashoda.

Prikupljanje poreza predstavlja značajan instrument u osiguranje ekonomske stabilnosti i razvoja (Majerová, 2016), kao i najvažnija stavka državnih budžetskih prihoda (Kubjatkova et al., 2021). Sredstva od poreza se mogu koristiti za usmeravanje privrede ka realizaciji specifičnih ciljeva (Kowal, Przekota, 2021). U skladu sa tim, poreski prihodi treba da omogućće sredstva za odgovarajuću infrastrukturu, zdravstvo, obrazovanje, kulturu, zaposlenost, raspodelu društvenog dohotka i javnu bezbednost. (Dobrovič et al., 2021). Slično, Barbu et al. (2022) identifikuje poreske prihode kao glavni izvor finansiranja državnih buxeta za ulaganja u javnu infrastrukturu. Kako bi se poboljšalo prikupljanje poreskih prihoda, pored odgovarajućeg institucionalnog i zakonodavnog okvira, neophodno je unaprediti kapacitete poreske administracije, kao i efikasnost njihovih aktivnosti (Ramírez-Álvarez, Carrillo-Maldonado, 2020). Takođe, pitanje prikupljanja poreza je esencijalno za fiskalne vlasti i ono je uslovljeno strukturom poreskog sistema određene zemlje. Naime, struktura poreskih sistema zemalja u razvoju i nerazvijenih zemalja je prvenstveno opredeljena ka posrednim porezima, odnosno porezima na potrošnju. S druge strane, poreski sistemi razvijenih zemalja imaju daleko veće učešće neposrednih poreza zbog znatno više dohodne osnovice koja podleže oporezivanju. Pored ozbiljnih ograničenja zaduživanja i prepreka za povećanjem resursa putem podizanja fiskalnog pritiska, ogroman rast obima javne potrošnje u većini razvijenih zemalja ukazuje da kreatori ekonomskih politika moraju unaprediti efikasnost javnog sektora (Cordero et al., 2021). Ovo pitanje je značajno za upravljanje poreskim prihodima i njihovo efikasno alociranje u produktivne svrhe.

Oporezivanje potrošnje u većini zemalja širom sveta je bazirano na porezu na dodatu vrednost i porezu na promet (Sokolovska, Sokolovskyi, 2015). Iz tog razloga, porez na dodatu vrednost dobija sve više na značaju u empirijskim merenjima i analizama efekata na određene makroekonomske indikatora. Tóth et al. (2021) navodi da uloga poreza na potrošnju predstavlja jedno od najvažnijih pitanja u okviru debata oko optimalne poreske strukture sa aspekta efikasnosti i pravičnosti. Acosta-Ormaechea et al. (2019) ističe da kreatori ekonomske politike neretko favorizuju poreze na potrošnju za podsticanje ekonomskog rasta u odnosu na neposredne poreze na primeru 70 ekonomija.

Struktura rada obuhvata četiri segmenta. Posle uvodnog razmatranja, sledi pregled teorijskih i empirijskih nalaza koji su povezani sa porezom na dodatu vrednost sa stanovišta naplate i efikasnosti prikupljenih prihoda. Treći segment rada

podrazumeva metodološki okvir koji obuhvata uzorak, odabir posmatranih varijabli, definisanje hipoteza, primena panel testova radi selektovanja odgovarajućeg empirijskog modela. Četvrti segment rada uključuje merenje i ocenjivanje efekata odabranih varijabli na PDV efikasnost u zemljama Beneluksa. Poslednji segment rada podrazumeva zaključna razmatranja i preporuke za kreatore ekonomske politike zemalja Beneluksa.

Teorijski okvir istraživanja

Suočavajući se sa izazovima prikupljanja sredstava i pokrivanja narastajućih potreba, mnoge zemlje uvode različite poreske oblike, uključujući i porez na dodatu vrednost (Aizenman, Jinjark, 2008). Porez na dodatu vrednost je postao najčešći porez na potrošnju širom sveta (Giesecke, Tran, 2012), pri čemu Keen (2013) ističe da je ovaj poreski oblik implementiran u više od 150 zemalja širom sveta. Porez na dodatu vrednost, kao zamena za porez na promet, ističe se kao efikasan poreski oblik, odnosno, instrument koji generiše i povećava poreske prihode (Hoseini, Briand, 2020). Prema evidenciji OECD-a, na kraju 2018. godine, taj broj je povećan na 168 zemalja koje su implementirale PDV u poreske sisteme (OECD, 2018). Teorija predviđa porez na dodatu vrednost kao efikasan poreski oblik, što predstavlja jedan od priamrnih razloga za rapidno implementiranje ovog poreskog oblika širom sveta (Adhikari, 2020). O značaju poreza na dodatu vrednost sa aspekta generisanja prihoda govore Feltenstein et al. (2022) i Morrow et al. (2022), koji naglašavaju da porez na dodatu vrednost predstavlja glavni izvor poreskih prihoda. Takođe, Lin (2008) ističe da ovaj poreski oblik generiše značajno više prihoda u odnosu na ostale poreske oblike, odnosno predstavlja najstabilniji i najproduktivniji oblik od svih komponenti poreskog sistema (Abshari et al., 2021). Shodno tome, porez na dodatu vrednost bi trebalo da bude poreski oblik kojim se postiže veća ekonomska efikasnost u odnosu na alternativne posredne poreze (Mascagni et al., 2021). Istovremeno, ovaj poreski oblik nije pogodan kao instrument raspodele dohotka (Shiraishi, 2022). U zemljama bez velikih administrativnih ograničenja, ovaj poreksi oblik prvenstveno treba da služi za efikasno i predvidivo prikupljanje prihoda (Cnossen, 2012).

Efikasan poreski sistem često karakteriše visok stepen naplate poreza uz prihvatljive troškove naplate (Babici et al., 2019). Posmatrajući strukturu PDV sistema, Kalyva et al. (2016) naglašava jednostavan sistem oporezivanja sa ograničenom upotrebom sniženih stopa. Uvođenje poreza na dodatu vrednost podrazumeva odgovarajući ekonomski kapacitet u pogledu apsorbovanja potencijalnih cenovnih oscilacija. Benkovskis i Fadejeva (2014) navode da su stope poreza na dodatu vrednost važne za potrošnju, ali i nivo cena, kao i da kretanje, odnosno promena PDV stopa može imati suštinske implikacije na stopu inflacije. U skladu sa tim, Milenković et al. (2020) potvrđuju statistički značajan uticaj poreza na dodatu vrednost na stopu inflaciji u Republici Srbiji. Campos-

Vázquez i Medina-Cortina (2019) navode da je manji stepen disperzija cena prisutan na tržištima sa izraženom konkurencijom. Pored mogućeg cenovne oscilacije na opštem nivou, porez na dodatu vrednost je zahvalan poreski oblik sa stanovišta prikupljanja prihoda i jačanja poreske discipline. Chan et al. (2017) navodi da sistem poreza na dodatu vrednost ima pozitivne efekte na disciplinu izvršne vlasti u pogledu prikupljanja i upravljanja poreskim prihodima. Jačanje poreske discipline predstavlja esencijalan zadatak za fiskalne vlasti širom sveta, imajući u vidu postojanje problema poreske evazije (Martinez et al., 2022). U istraživanju autora Baum et al. (2017) potvrđena je statistički značajna veza između prikupljanja prihoda i kapaciteta poreske administracije. Prema autorima Capasso et al. (2021) važno je obezbediti snažne fiskalne institucije koje su od suštinskog značaja radi osiguranja pozitivnog stava javnosti prema plaćanju poreza. Takođe, autori Lin i Jia (2019), kao i Ndubula i Matiku (2021) u svojim studijama ukazuju da su edukacija o porezu i poreske stope usko vezane za performanse prikupljenih prihoda.

Postoji određeni broj teorijskih i empirijskih istraživanja koja su bila fokusirana na efikasnost poreza na dodatu vrednost (Zídková, 2014; Tagkalakis, 2014; Baum et al., 2017; Bostan et al., 2017; Hodžić, Celebi, 2017; Đorđević et al., 2019; Hodroyiannis and Papaoikonomou, 2020; Kowal, Przekota, 2021). Autori Đorđević et al. (2021) ističu da je najveća efikasnost naplate PDV moguća ako su mere fiskalne politike korelisane sa ekonomskim i strukturnim politikama ostvarujući snažan sinergetski efekat. Zídková (2014) potvrđuje pozitivan odnos između finalne potrošnje i ukupnog PDV jaza u dvadeset četiri EU zemlje, dok Tagkalakis (2014) ističe da poboljšanje ekonomskih uslova unapređuje efikasnost PDV-a. S druge strane, empirijska analiza Bostan et al. (2017) prikazuje iznenađujuće rezultate koji potvrđuju da ne postoji statistički značajna razlika između PDV stope i PDV prihoda, kao i negativan uticaj PDV stope na fiskalnu efikasnost Rumunije za vremenski period 2006-2014. godine. Acosta-Ormaechea i Morozumi (2021) naglašavaju da povećanje PDV-a pozitivno utiče na dugoročni rast, samo u slučaju da je poboljšana naplata prikupljenih prihoda, ali ne i standardna PDV stopa. Takođe, Hodroyiannis and Papaoikonomou (2020) su utvrdili da povećanje PDV prihoda i njihove efikasnosti može biti realizovana putem veće upotrebe plaćanja kartica u zemljama unutar Evrozone za vremenski period 2006-2016. godine.

Budući da je cilj istraživanja usmeren ka utvrđivanju PDV efikasnosti u zemljama Benelusa, dobijeni empirijski rezultati mogu biti lukrativni za fiskalne vlasti posmatranih zemalja prilikom kreiranja i profilisanja poreskih politika. Doprinos ovog istraživanja podrazumeva da kreatori ekonomske vlasti mogu uvažiti i primeniti empirijske nalaze kao vodič prilikom formulisanja politike i sistema poreza na dodatu vrednost. Na taj način, optimalni empirijski model PDV efikasnosti doprineće maksimalnom prikupljanju prihoda uz minimalne štetne implikacije na ekonomiju.

Metodološki okvir istraživanja

Procenjivanje poreske efikasnosti je oduvek bila u fokusu istraživanja javnih finansija, kako na nacionalnom, tako i međunarodnom nivou (Mukherjee, 2020). Metodologija ispitivanja PDV efikasnosti zahteva prikupljanje podataka o prihodima od PDV-a u odnosu na bruto domaći proizvod (BDP), standardnu stopu PDV-a, finalnu potrošnju i indeks potrošačkih cena (CPI). Poslednjih godina istraživanja o PDV efikasnost u Evropskoj uniji je povezana sa modelom koji je razvio Keen (2013). To utvrđuje efikasnost povezujući stvarne prihode od PDV-a sa teoretskim prihodima od PDV-a. Na osnovu koncepta Tanzi and Davoodi (2000), PDF efikasnost se može izračunati putem tradicionalnog pristupa merenja:

$$\text{VAT efficiency} = \frac{\text{VAT revenue}}{\frac{\text{GDP}}{\text{SVAR}}} \quad (1)$$

Istovremeno, koeficijent PDV efikasnosti, koji se neretko u literaturi označava oznakom C, može se izračunati i prema sledećoj matematičkoj formuli:

$$\text{C-efficiency} = \frac{V}{PV} \quad (2)$$

$$PV = \text{svr} \times (\text{FC} - V) \quad (3)$$

V – realizovani PDV prihodi, PV – teorijski (pretpostavljeni) PDV prihodi, SVAR – standardna PDV stopa, FC – finalna potrošnja.

Pokazatelj C-efikasnost PDV-a pokazuje koji procenat finančne potrošnje je prikupljen za svaki procentni poen standardne stope poreza na dodatu vrednost (Cnossen, 2015).

Optimalni koeficijent PDV efikasnosti od 100 procenata treba razmatrati totalno efikasnim u slučaju kada je poreska osnovica obuhvaćena proporcionalnom poreskom stopom. U slučaju postojanja snižene PDV stope na određena dobra i usluge, vrednost datog pokazatelja biće ispod 100 procenata (Hodžić, Celebi, 2017). Nakon izračunavanja ovih indikatora/koeficijenata, moguće je utvrditi i PDV jaz, kao razliku između ostvarivog prihoda od PDV-a (teorijskog) i realnog prihoda od PDV-a da bi se identifikovalo njegovo povećanje odnosno smanjenje u vremenu, kroz stopu PDV jaza. Na osnovu metodološkog okvira istraživanja baziranog na istraživačkim konceptima Keen (2013) i Popa i Botos (2021), razvijene su sledeće hipoteze:

H₀: Makroekonomski faktori značajno utiču na PDV efikasnost u zemljama Beneluksa.

H₁: Stopa ekonomskog rasta pozitivno utiče na PDV efikasnost u zemljama Beneluksa.

H₂: Stopa finalne potrošnje pozitivno utiče na PDV efikasnost u zemljama Beneluksa.

H3: Stopa nezaposlenosti negativno utiče na PDV efikasnost u zemljama Beneluksa.

H4: Stopa inflacije negativno utiče na PDV efikasnost u zemljama Beneluksa.

H5: Državni rashodi pozitivno utiču na PDV efikasnost u zemljama Beneluksa.

H6: Veće standardne PDV stope dovode do manje PDV efikasnosti u zemljama Beneluksa.

H7: Veći PDV prihodi doprinose većoj PDV efikasnosti u zemljama Beneluksa.

Empirijski okvir merenja i ocenjivanja PDV efikasnosti u zemljama Beneluksa je izvršen na osnovu istraživačkog koncepta autora Keen (2013) i Popa i Botos (2021), koji posmatra PDV prihode, standardnu PDV stopu, kao i finalnu potrošnju kao ključni pokazatelj prilikom merenja efekta indirektnog oporezivanja, tj. poreza na potrošnju. U radu je predstavljen regresioni model koji podrazumeva zavisnu varijablu EF i uticaj nezavisnih varijabli poput BDP, FP, NEZ, INF, DR, PDV stopa i PDV prihodi (Tabela 1).

Tabela 1. Odabir eksplanatornih varijabli

Varijable	Simbol	Kalkulacija	Očekivani efekat
Bruto domaći proizvod	BDP	godišnja stopa	+
Finalna potrošnja	FP	% učešće u BDP	+
Nezaposlenost	NEZ	godišnja stopa	-
Inflacija	INF	godišnja stopa	-
Državni rashodi	DR	% učešće u BDP	+
Standardna PDV stopa	PDVs	godišnja stopa	-
PDV prihodi	PDVp	% učešće u BDP	+

Izvor: Ilustracija autora

Na osnovu panel konstrukcije Brooks (2008), regresioni model je predstavljen kao:

$$Y_{it} = \alpha + \beta x_{it} + \mu_{it} \quad (4)$$

Y_{it} – zavisna varijabla (EF)

α - konstanta

βx_{it} - koeficijenti nezavisnih varijabli (BDP, FP, NEZ, INF, DR, PDVs, PDVp)

i – 3 zemlje (Belgija, Holandija i Luksemburg)

t – 2011-2020

μ_{it} - rezidual

EF – PDV efikasnost; BDP – stopa rasta bruto domaćeg proizvoda; FP – finalna potrošnja; NEZ – stopa nezaposlenosti; INF – stopa inflacije; DR – državni rashodi; PDVs – standardna PDV stopa; PDVp – PDV prihodi.

Empirijski rezultati i diskusija

U okviru ovog segmenta rada, izvršena je kalkulacija pokazatelja PDV efikasnosti u zemljama Beneluksa za vremenski period 2011 – 2020. Dobijene vrednosti posmatranog indikatora predstavljaju preduslov za panel ocenjivanje efekata eksplanatornih varijabli.

Tabela 2. Komparativni prikaz PDV efikasnosti u zemljama Beneluksa

Godina	Belgija	Holandija	Luksemburg
2011	47.83	51.18	92.44
2012	48.14	46.79	88.95
2013	47.02	46.98	86.72
2014	46.77	47.19	83.69
2015	45.98	48.73	78.33
2016	47.02	51.81	77.14
2017	47.05	52.35	78.23
2018	46.80	52.48	76.84
2019	47.14	55.43	75.96
2020	44.79	57.41	78.95

Izvor: Kalkulacija autora

Na osnovu rezultata iz Tabele 2, može se primetiti da je prosečna PDV efikasnost najviša u Luksemburgu (81.73%) u odnosu na Belgiju (46.85%) i Holandiju (51.04%), gde su vrednosti posmatranog indikatora znatno manje. Analizirajući po godinama, PDV efikasnost je najviše porasla u 2012. godini u Holandiji (+6.32%), zatim 2020. godine u Luksemburgu (+3.94%), odnosno 2016. godine u Belgiji (+2.26%). Ukoliko se analizira relativni pad ovog indikatora, uočava se da je PDV efikasnost najviše opala u Holandiji u 2012. godini (-8.58%), zatim Luksemburgu (-6.41%), kao i 2020. godine u Belgiji (-4.98%).

Za merenje uticaja makroekonomskih faktora na elastičnost i efikasnost poreza na dodatu vrednost u zemljama Beneluksa, u okviru ovog istraživanja, korišćeni su podaci iz sekundarnih izvora podataka, koji se odnose na makroekonomske pokazatelje (bruto društveni proizvod – BDP, nezaposlenost, finalna potrošnja, inflacija, državni rashodi). Svi podaci su prikupljeni sa službenih stranica vodećih međunarodnih institucija, tako da je većina podataka u istraživanju, preuzeto sa stranica Međunarodnog monetarnog fonda (International Monetary Fund) i Svetske banke (World Bank). U istraživanju se koriste podaci za period od 2011. – 2020. godine, a odnose se na zemlje Beneluksa. Pre samog ispitivanja i ocenjivanja uticaja makroekonomskih faktora na PDV elastičnost i PDV efikasnost, potrebno je utvrditi potencijalne razlike u nivou posmatranih pokazatelja između analiziranih zemalja Beneluksa (Belgija, Holandija i Luksemburg) za vremenski period 2011.-2020. godine.

Tabela 3. Procenjivanje razlika u nivou PDV efikasnosti

EF	W = Wilks' lambda		L = Lawley-Hotelling trace		
	P = Pillai's trace		R = Roy's largest root		
Source	Statistic	F(df1)	F(df2)	F	Prob>F
W	0.1792	2.0	27.0	61.82	0.0000
P	0.8208	2.0	27.0	61.82	0.0000
L	4.5789	2.0	27.0	61.82	0.0000
R	4.5789	2.0	27.0	61.82	0.0000
Residual					27
Total					29

Izvor: Kalkulacija autora

Tabela 3 prikazuje rezultate multivarijane analize za zemlje Beneluksa u pogledu procene nivoa razlika vrednosti PDV elastičnosti i PDV efikasnosti za vremenski period 2011. - 2020. godine. Na osnovu dobijenih vrednosti Pillai's Trace = 0.000 za odabranu varijablu PDV efikasnost, može se zaključiti da postoji statistički značajna razlika u nivou PDV efikasnosti u navedenim zemljama za analizirani vremenski period.

Nakon utvrđivanja razlika u nivou PDV efikasnosti u zemljama Beneluksa, sledi ispitivanje i ocenjivanje uticaja odabranih makroekonomskih faktora na PDV efikasnost panel nivou za vremenski period 2011.-2020. godine. Panel procena je izvršena na osnovu modela slučajnih efekata i modela fiksnih efekata. Istovremeno, prikazana je panel uzročnost, odnosno kauzalnost između makroekonomskih faktora i PDV efikasnosti. Kao uslov odgovorajućeg regresionog modela, potrebno je sprovesti testiranje stacionarnosti, kao i utvrditi da li postoji problem multikolinearnosti, odnosno naglašene korelisanosti između odabranih nezavisnih varijabli.

U Tabeli 4 prikazani su različiti panel testovi stacionarnosti (LLC test, BTtest and H-T test) na primeru tri panela (Belgija, Holandija i Luksemburg) koji su primenjeni radi ispitivanja i identifikovanja trenda stacionarnosti uključenih varijabli. Rezultati ukazuju na stacionarnost prvog reda kod većine varijabli na nivou značajnosti 0.05. Sledi ispitivanje međusobne korelisanosti eksplanatornih varijabli primenom VIF testa.

Tabela 4. Testovi stacionarnosti

Paneli sadrže jedinične korene								
Paneli su stacionarni								
Variables	LLC test	P-value	Breitung test	P-value	Harris-Tzavalis test	P-value	Hadri LM test	P-value
EF	-1.38	0.643	-1.41	0.205	0.79	0.645	5.98	0.000
Δ EF	-5.42	0.041	-5.63	0.000	-0.18	0.001	-0.47	0.681
BDP	-2.60	0.000	-1.81	0.036	0.19	0.000	0.18	0.426
Δ BDP	-1.16	0.000	-1.66	0.048	-0.18	0.000	0.65	0.257
FP	-2.53	0.019	-1.09	0.862	0.83	0.735	6.18	0.000
Δ FP	-4.89	0.038	-1.28	0.098	-0.28	0.002	-0.41	0.656
NEZ	-6.31	0.000	-0.97	0.117	0.88	0.537	4.39	0.000
Δ NEZ	-5.87	0.000	-1.31	0.096	-0.61	0.003	2.14	0.016
INF	-5.35	0.000	3.09	0.992	0.92	0.689	7.98	0.000
Δ INF	-7.56	0.000	-0.68	0.248	-0.34	0.001	-0.46	0.679
DR	-4.07	0.000	-1.34	0.091	0.47	0.051	1.17	0.120
Δ DR	-6.32	0.000	-1.51	0.066	-0.27	0.001	1.16	0.122
PDVs	-5.39	0.048	0.5	0.000	0.46	0.047	4.31	0.000
Δ PDVs	-2.47	0.905	-0.48	0.314	-0.07	0.000	0.45	0.325
PDVp	-0.82	0.721	-1.13	0.872	0.71	0.435	5.07	0.000
Δ PDVp	-4.71	0.006	-1.77	0.038	-0.05	0.000	-0.82	0.793

Izvor: Kalkulacija autora

Rezultati VIF testa (Tabela 5) prikazuju prosečnu vrednost od 2.39, što dovodi do zaključka da ne postoji problem multikolinearnosti između odabranih eksplanatornih varijabli (vrednost manja od 4). Imajući u vidu da su ispunjeni svi preduslovi za kreiranje odgovarajućeg panel regresionog modela, sledi komparativni prikaz modela slučajnih efekata i modela fiksnih efekata.

Tabela 5. VIF test - test multikolinearnosti

Varijable	VIF
BDP	1.81
FP	2.68
NEZ	2.95
INF	2.52
DR	3.68
PDVs	1.77
PDVp	1.32
Mean VIF	2.39

Izvor: Kalkulacija autora

Na osnovu rezultata modela slučajnih efekata (Tabela 6), može se uočiti statistički značajan uticaj eksplanatornih varijabli, odnosno BDP-a, finalne potrošnje, nezaposlenosti, inflacije, državnih rashoda, PDV stope i PDV prihoda, na PDV efikasnost u zemljama Beneluksa za vremenski period 2011. - 2020. godine. Analizirajući karakter i intenzitet uticaja, primetno je da varijable BDP, FP, DR i PDV prihodi pozitivno i statistički značajno utiču na PDV efikasnost u posmatranim zemljama, što podrazumeva da njihov rast doprinosi povećanju efikasnosti naplate PDV-a. S druge strane, varijable NEZ, INF i PDV stopa imaju

negativan i statistički značajan uticaj na PDV efikasnost, što implicira da njihovo povećanje rezultira padom efikasnosti naplate PDV-a. Visoka vrednost koeficijenta determinacije R-squared (0.876) ukazuje da je model adekvatno dizajniran, kao i Prob F (0.000) na validnost postavljenog empirijskog modela.

Tabela 6. Model slučajnih efekata

Varijable	Model slučajnih efekata (RE)	Efekat + 1%	Efekat + 10%
Δ BDP	0.172 (0.000)	+0.17%	1.72%
Δ FP	0.895 (0.007)	+0.89%	+8.95%
Δ NEZ	-0.212 (0.000)	-0.21%	-2.12%
Δ INF	-0.159 (0.032)	-0.16%	-1.59%
Δ DR	0.124 (0.000)	+0.12%	+1.24%
Δ PDVs	-0.583 (0.000)	-0.58%	-5.83%
Δ PDVp	0.518 (0.000)	+0.52%	+5.18%
R-squared			0.876
Model validity			0.000

Izvor: Kalkulacija autora

Na osnovu rezultata modela fiksnih efekata (Tabela 7), može se konstatovati statistički značajan uticaj eksplanatornih varijabli, odnosno BDP-a, finalne potrošnje, nezaposlenosti, inflacije, državnih rashoda, PDV stope i PDV prihoda, na PDV efikasnost u zemljama Beneluksa za vremenski period 2011. - 2020. godine. Analizirajući karakter i intenzitet uticaja, primetno je da varijable BDP, FP, DR i PDV prihodi pozitivno i statistički značajno utiču na PDV efikasnost u posmatranim zemljama, što podrazumeva da njihov rast doprinosi povećanju efikasnosti naplate PDV-a. S druge strane, varijable NEZ, INF i PDV stopa imaju negativan i statistički značajan uticaj na PDV efikasnost, što implicira da njihovo povećanje rezultira padom efikasnosti naplate PDV-a. Visoka vrednost koeficijenta determinacije R-squared (0.924) ukazuje da je model postavljen na odgovarajući način, kao i Prob F (0.000) na validnost definisanog empirijskog modela.

Tabela 7. Model fiksnih efekata

Varijable	Model fiksnih efekata (FE)	Efekat + 1%	Efekat + 10%
ΔBDP	0.204 (0.000)	+0.20%	2.04%
ΔFP	0.958 (0.002)	+0.96%	+9.58%
ΔNEZ	-0.216 (0.000)	-0.22%	-2.16%
ΔINF	-0.147 (0.000)	-0.15%	-1.47%
ΔDR	0.159 (0.004)	+0.16%	+1.59%
ΔPDVs	-0.597 (0.000)	-0.60%	-5.97%
ΔPDVp	0.592 (0.000)	+0.59%	+5.92%
R-squared	0.924		
Model validity	0.000		

Izvor: Kalkulacija autora

Rezultati Hausman testa (Tabela 8) pokazuju da je model fiksnih efekata adekvatan prilikom procenjivanja uticaja makroekonomskih faktora na PDV efikasnost u zemljama Beneluksa. To podrazumeva da odabrani model uključuje eksplanatorne varijable koje objašnjavaju 92.4% varijacija PDV efikasnosti u posmatranim zemljama, što ukazuje na visoku pouzdanost i verodostojnost dobijenih empirijskih nalaza.

Tabela 8. Odabir modela – Hausman test

Specifikacija modela	Rezultat	Zaključak
Model slučajnih efekata vs Model fiksnih efekata	$\text{Chi2}(7) = (b-B)'[(Vb-VB)^{-1}](b-B) =$ $\text{Prob}>\text{chi2} = 0.0000$	Model fiksnih efekata je odgovarajući

Izvor: Kalkulacija autora

Kako bi se utvrdila potencijalna uzročnost između makroekonomskih faktora i indikatora PDV efikasnosti, sprovedeno je merenje kauzalnosti između odabranih varijabli za vremenski period 2011-2020. godine. Rezultati testa kauzalnosti (Tabela 9) ukazuju na dvosmernu uzročnost između bruto domaćeg proizvoda (BDP), finalne potrošnje (FP), državnih rashoda (DR), PDV stope, PDV prihoda i PDV efikasnosti (EF). S druge strane, potvrđena je jednosmerna kauzalnost nezaposlenosti (NEZ), inflacije (INF) i PDF efikasnosti EF). Kod identifikovanih jednosmernih uzročnosti, potrebno je naglasiti da promena na strani makroekonomskih faktora poput nezaposlenosti i inflacije dovodi do promene PDV efikasnosti u zemljama Beneluksa.

Tabela 9. Merenje uzročnosti makroekonomskih faktora i PDV efikasnosti

Smer	F-statistic	Prob.	Uzročnost
BDP → EF	3.587	0.034	dvosmerna uzročnost
EF → BDP	3.794	0.019	
FP → EF	4.637	0.008	dvosmerna uzročnost
EF → FP	4.716	0.012	
NEZ → EF	2.656	0.328	jednosmerna uzročnost
EF → NEZ	4.131	0.047	
INF → EF	4.140	0.039	jednosmerna uzročnost
EF → INF	1.568	0.575	
DR → EF	3.696	0.042	dvosmerna uzročnost
EF → DR	4.217	0.036	
PDVs → EF	7.306	0.000	dvosmerna uzročnost
EF → PDVs	7.748	0.004	
PDVp → EF	7.223	0.000	dvosmerna uzročnost
EF → PDVp	7.101	0.000	

Izvor: Kalkulacija autora

Zaključak

Rad podrazumeva empirijsku analizu merenja i ocenjivanja uticaja odabranih makroekonomskih faktora na PDV efikasnost u zemljama Beneluksa (Belgija, Holandija i Luksemburg) za vremenski period 2011-2020. godine. Stope poreza na dodatu vrednost u zemljama Beneluksa kretale su se od 17% u Belgiji, do 21% koliko je iznosio porez na dodatu vrednost u Holandiji i Luksemburgu. Prosečna PDV efikanost posmatranih zemalja je iznosila 59.84%, pri čemu je daleko najveća prosečna vrednost indikatora zabeležena u Luksemburgu (81.73%). S druge strane, Belgija i Holandija su ostvarile prosečne vrednosti od 46.85% i 51.04% tokom analiziranog vremenskog perioda. Rezultati multivarijacione analize ukazuju na statistički značajne razlike u nivou PDV efikasnosti u zemljama Beneluksa tokom posmatranog vremenskog perioda. Panel regresiona analiza je izvršena na osnovu modela slučajnih efekata i modela fiksnih efekata, pri čemu su rezultati Hausman testa su potvrdili da je model fiksnih efekata adekvatan. Empirijski nalazi ukazuju na statistički značajan uticaj svih varijabli, što dovodi do zaključka da se može prihvatiti hipoteza H_0 . Imajući u vidu pozitivan uticaj bruto domaćeg proizvoda, finalne potrošnje, državnih rashoda i PDV prihoda na PDV efikasnost, može se konstatovati prihvatanje hipoteza H_1 , H_2 , H_5 i H_7 . Konkretno, rast BDP-a, FP, DR i PDV prihoda za 1% doprinosi povećanju PDV efikasnosti za 0.20%, 0.96%, 0.16% i 0.59%. S druge strane, nezaposlenost, inflacija i PDV stopa imaju negativan uticaj na PDV efikasnost u posmatranim zemljama, što omogućava prihvatanje hipoteza H_3 , H_4 i H_6 . Naime, rast NEZ, INF i PDV stope za 1% rezultira smanjenju PDV efikasnosti za 0.22%, 0.15% i 0.60%. Doprinos ovog rada se ogleda u proširivanju postojećeg teorijskog okvira usmerenog ka poreskoj efikasnosti, kao i pružanju novih empirijskih saznanja vezanih za efikasnost naplate prihoda od poreza na dodatu vrednost u zemljama Beneluksa. Dobijeni empirijski rezultati ukazuju da se zemlje

Beneluksa moraju fokusirati na veće stope BDP rasta i finalne potrošnje uz veće učešće državnih rashoda, kako bi se ostvarile pozitivne implikacije na PDV efikasnost. Istovremeno, niža stopa inflacije i stopa nezaposlenosti imaće pozitivne efekte na PDV efikasnost. Na kraju, smanjenje standardne PDV stope može generisati više PDV prihoda, što će se nesumnjivo povoljno odraziti na PDV efikasnost u posmatranim zemljama. Rezultati kauzalnosti ukazuju na dvosmernu uzročnost između bruto domaćeg proizvoda (BDP), finalne potrošnje (FP), državnih rashoda (DR), PDV stope, PDV prihoda i PDV efikasnosti (EF). S druge strane, potvrđena je jednosmerna kauzalnost nezaposlenosti (NEZ), inflacije (INF) i PDF efikasnosti (EF). Doprinos ovog rada se ogleda u pružanju empirijskih smernica kreatorima ekonomskih politika prilikom profilisanja PDV politike u kontekstu prilagođavanja makroekonomskom okviru zemalja Beneluksa. Istovremeno, dobijeni empirijski nalazi mogu biti od pomoći i zemljama širom sveta, naročito zemljama u kojima PDV ima značajno učešće u prikupljenim poreskim prihodima.

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EVALUATION OF VAT EFFICIENCY IN BENELUX COUNTRIES

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Abstract

The relevance of value added tax is reflected in the generation of a significant amount of revenue and the suppression of tax evasion. The purpose of the research is aimed at assessing collected revenues and measuring the efficiency of VAT revenue collection in the Benelux countries (Belgium, the Netherlands and Luxembourg) for the period 2011-2020. years. Empirical research results indicate that the average VAT efficiency was 59.84% in the observed countries. where the highest degree of efficiency was recorded in Luxembourg, and the lowest value in Belgium. Panel regression results show that economic growth, final consumption, government expenditures and VAT revenues have a positive effect on VAT efficiency in the observed countries. At the same time, variables such as unemployment and inflation, as well as the standard VAT rate, have a negative effect on the efficiency of VAT revenue. The obtained empirical findings can be of help to economic policy makers in the analyzed countries when profiling and adjusting tax policy from the point of view of value added tax.

Key words: *value added tax, efficiency, panel analysis, Benelux countries.*

JEL: *H20, H21, H26*

Introduction

States around the world have difficulties in raising the required level of tax revenue to finance planned activities (Mu et al., 2022). The potential problem of revenue collection especially occurs in moments of crisis, when economic activity slows down and leads to negative tendencies in the movement of fundamental macroeconomic indicators. The issue of the efficiency of revenue collection and collection is important for all fiscal authorities, where it is necessary to determine the main generators of tax revenue in state budgets. In order to provide public services and cover public needs, the creators of fiscal authorities must create an appropriate tax system that will generate the required level of income on a tax, but

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also non-tax basis. Adequate management of the revenue side of the budget is a prerequisite for optimal planning and execution of projected expenditures.

Tax collection represents an important instrument in ensuring economic stability and development (Majerová, 2016), as well as the most important item of state budget revenues (Kubjatková et al., 2021). Tax funds can be used to direct the economy towards the realization of specific goals (Kowal, Przekota, 2021). Accordingly, tax revenues should provide funds for appropriate infrastructure, health, education, culture, employment, social income distribution and public safety. (Dobrović et al., 2021). Similarly, Barbu et al. (2022) identifies tax revenues as the main source of financing state budgets for investments in public infrastructure. In order to improve the collection of tax revenues, in addition to the appropriate institutional and legislative framework, it is necessary to improve the capacities of the tax administration, as well as the efficiency of their activities (Ramírez-Álvarez, Carrillo-Maldonado, 2020). Also, the issue of tax collection is essential for fiscal authorities and it is conditioned by the structure of the tax system of a particular country. Namely, the structure of the tax systems of developing and underdeveloped countries is primarily focused on indirect taxes, ie taxes on consumption. On the other hand, the tax systems of developed countries have a much higher share of direct taxes due to a significantly larger income base that is subject to taxation. In addition to serious borrowing constraints and obstacles to increasing resources through raising fiscal pressure, the huge growth in the volume of public spending in most developed countries indicates that economic policy makers must improve the efficiency of the public sector (Cordero et al., 2021). This issue is significant for the management of tax revenues and their efficient allocation for productive purposes.

Taxation of consumption in most countries around the world is based on value added tax and sales tax (Sokolovska, Sokolovskyi, 2015). For this reason, value added tax is gaining more and more importance in empirical measurements and analyzes of effects on certain macroeconomic indicators. Tóth et al. (2021) states that the role of consumption tax is one of the most important issues in the debates about the optimal tax structure from the perspective of efficiency and fairness. Acosta-Ormaechea et al. (2019) points out that economic policy makers often favor consumption taxes to stimulate economic growth over direct taxes on the example of 70 economies.

The structure of the work includes four segments. After the introductory discussion, there follows an overview of theoretical and empirical findings related to value added tax from the point of view of collection and efficiency of collected revenues. The third segment of the work includes a methodological framework that includes the sample, selection of observed variables, definition of hypotheses, application of panel tests in order to select the appropriate empirical model. The fourth segment of the work involves measuring and evaluating the effects of

selected variables on VAT efficiency in the Benelux countries. The last segment of the work involves concluding considerations and recommendations for economic policy makers of the Benelux countries.

Theoretical framework of research

Facing the challenges of raising funds and covering the growing needs, many countries are introducing various tax forms, including value added tax (Aizenman, Jinjarak, 2008). Value added tax has become the most common consumption tax worldwide (Giesecke, Tran, 2012), with Keen (2013) pointing out that this tax form has been implemented in more than 150 countries worldwide. Value added tax, as a replacement for sales tax, stands out as an effective tax form, that is, an instrument that generates and increases tax revenues (Hosseini, Briand, 2020). According to OECD records, at the end of 2018, that number increased to 168 countries that implemented VAT in their tax systems (OECD, 2018). The theory predicts value added tax as an efficient tax form, which is one of the primary reasons for the rapid implementation of this tax form worldwide (Adhikari, 2020). The importance of value added tax from the aspect of revenue generation is discussed by Feltenstein et al. (2022) and Morrow et al. (2022), who emphasize that value added tax represents the main source of tax revenues. Also, Lin (2008) points out that this form of taxation generates significantly more revenue compared to other forms of taxation, that is, it represents the most stable and productive form of all components of the tax system (Abshari et al., 2021). Accordingly, value added tax should be a tax form that achieves greater economic efficiency compared to alternative indirect taxes (Mascagni et al., 2021). At the same time, this tax form is not suitable as an instrument of income distribution (Shiraishi, 2022). In countries without major administrative restrictions, this tax form should primarily serve for efficient and predictable revenue collection (Cnossen, 2012).

An efficient tax system is often characterized by a high level of tax collection with acceptable collection costs (Babici et al., 2019). Looking at the structure of the VAT system, Kalyva et al. (2016) emphasizes a simple taxation system with limited use of reduced rates. The introduction of value added tax implies an appropriate economic capacity in terms of absorbing potential price fluctuations. Benkovskis and Fadejeva (2014) state that value added tax rates are important for consumption, but also the price level, as well as that the movement or change of VAT rates can have essential implications for the inflation rate. Accordingly, Milenković et al. (2020) confirm the statistically significant influence of value added tax on the inflation rate in the Republic of Serbia. Campos-Vázquez and Medina-Cortina (2019) state that a lower degree of price dispersion is present in markets with pronounced competition. In addition to the possible price oscillation at the general level, the value added tax is a grateful tax form from the point of view of revenue collection and strengthening of tax discipline. Chan et al. (2017)

states that the value added tax system has positive effects on the discipline of the executive in terms of tax revenue collection and management. Strengthening tax discipline is an essential task for fiscal authorities worldwide, given the existence of the problem of tax evasion (Martinez et al., 2022). In the research of Baum et al. (2017) confirmed a statistically significant relationship between revenue collection and tax administration capacity. According to the authors Capasso et al. (2021) it is important to ensure strong fiscal institutions which are essential to ensure a positive public attitude towards paying taxes. Also, authors Lin and Jia (2019), as well as Ndubula and Matiku (2021) indicate in their studies that tax education and tax rates are closely related to the performance of collected revenues.

There is a certain number of theoretical and empirical research that focused on the effectiveness of value added tax (Zídková, 2014; Tagkalakis, 2014; Baum et al., 2017; Bostan et al., 2017; Hodžić, Celebi, 2017; Đorđević et al., 2019; Hodroyiannis and Papaoikonomou, 2020; Kowal, Przekota, 2021). Authors Đorđević et al. (2021) point out that the highest efficiency of VAT collection is possible if fiscal policy measures are correlated with economic and structural policies, achieving a strong synergistic effect. Zídková (2014) confirms a positive relationship between final consumption and the total VAT gap in twenty-four EU countries, while Tagkalakis (2014) points out that improving economic conditions improves VAT efficiency. On the other hand, the empirical analysis of Bostan et al. (2017) shows surprising results confirming that there is no statistically significant difference between the VAT rate and VAT revenue, as well as the negative impact of the VAT rate on the fiscal efficiency of Romania for the time period 2006-2014. years. Acosta-Ormaechea and Morozumi (2021) emphasize that an increase in VAT has a positive effect on long-term growth, only if the collection of collected revenues is improved, but not the standard VAT rate. Also, Hodroyiannis and Papaoikonomou (2020) found that the increase in VAT revenues and their efficiency can be realized through greater use of card payments in countries within the Eurozone for the time period 2006-2016. years.

Since the goal of the research is aimed at determining the VAT efficiency in the Benelux countries, the obtained empirical results can be lucrative for the fiscal authorities of the observed countries when creating and profiling tax policies. The contribution of this research implies that the creators of the economic authorities can appreciate and apply the empirical findings as a guide when formulating the policy and the value added tax system. In this way, the optimal empirical model of VAT efficiency will contribute to maximum revenue collection with minimal harmful implications for the economy.

Methodological research framework

Assessing tax efficiency has always been the focus of public finance research, both at the national and international level (Mukherjee, 2020). The VAT efficiency testing methodology requires the collection of data on VAT revenues in relation to gross domestic product (GDP), standard VAT rate, final consumption and consumer price index (CPI). In recent years, research on VAT efficiency in the European Union has been linked to the model developed by Keen (2013). It determines efficiency by relating actual VAT revenues to theoretical VAT revenues. Based on the concept of Tanzi and Davoodi (2000), PDF efficiency can be calculated through a traditional measurement approach:

$$\text{VAT efficiency} = \frac{\text{VAT revenue}}{\frac{\text{GDP}}{\text{SVAR}}} \quad (1)$$

At the same time, the VAT efficiency coefficient, which is often denoted in the literature with the symbol C, can also be calculated according to the following mathematical formula:

$$\text{C-efficiency} = \frac{V}{PV} \quad (2)$$

$$PV = \text{purpose} \times (\text{FC} - V) \quad (3)$$

V - realized VAT revenues, PV - theoretical (assumed) VAT revenues, SVAR - standard VAT rate, FC - final consumption.

The indicator C-efficiency of VAT shows what percentage of financial spending is collected for each percentage point of the standard rate of value added tax (Cnossen, 2015).

The optimal VAT efficiency coefficient of 100 percent should be considered totally efficient in the case where the tax base is covered by a proportional tax rate. In the case of a reduced VAT rate on certain goods and services, the value of this indicator will be below 100 percent (Hodžić, Celebi, 2017). After calculating these indicators/coefficients, it is possible to determine the VAT gap, as the difference between the achievable VAT income (theoretical) and the real VAT income in order to identify its increase or decrease over time, through the VAT gap rate. Based on the methodological research framework based on the research concepts of Keen (2013) and Popa and Botos (2021), the following hypotheses were developed:

H₀: Macroeconomic factors significantly affect VAT efficiency in the Benelux countries.

H₁: Economic growth rate has a positive effect on VAT efficiency in the Benelux countries.

H₂: The rate of final consumption has a positive effect on VAT efficiency in the Benelux countries.

H₃: The unemployment rate has a negative effect on VAT efficiency in the Benelux countries.

H₄: Inflation rate negatively affects VAT efficiency in the Benelux countries.

H₅: Government expenditures have a positive effect on VAT efficiency in the Benelux countries.

H₆: Higher standard VAT rates lead to less VAT efficiency in the Benelux countries.

H₇: Higher VAT revenues contribute to higher VAT efficiency in the Benelux countries.

The empirical framework for measuring and evaluating VAT efficiency in the Benelux countries is based on the research concept of the authors Keen (2013) and Popa and Botos (2021), which observes VAT revenues, the standard VAT rate, as well as final consumption as a key indicator when measuring the effect of indirect taxation., that is consumption tax. The paper presents a regression model that includes the dependent variable EF and the influence of independent variables such as GDP, FP, NEZ, INF, DR, VAT rate and VAT revenues (Table 1).

Table 1. Selection of explanatory variables

Variables	A symbol	Calculation	Expected effect
Gross domestic product	GDP	annual rate	+
Final consumption	FP	% participation in GDP	+
Unemployment	NOT Z	annual rate	-
Inflation	INF	annual rate	-
State expenditures	DR	% participation in GDP	+
Standard VAT rate	VAT	annual rate	-
VAT revenues	VAT	% participation in GDP	+

Source: Illustration by the author

Based on the panel construction of Brooks (2008), the regression model is presented as:

$$Y_{it} = \alpha + \beta x_{it} + \mu_{it} \quad (4)$$

Y_{it} – dependent variable (EF)

α - constant

βx_{it} - coefficients of independent variables (GDP, FP, NEZ, INF, DR, PDVs, PDVp)

and – 3 countries (Belgium, Netherlands and Luxembourg)

t – 2011-2020

μ_{it} - residual

EF – VAT efficiency; GDP – gross domestic product growth rate; FP – final consumption; NEZ - unemployment rate; INF – inflation rate; DR – state expenditures; VATs – standard VAT rate; VATp - VAT revenues.

Empirical results and discussion

Within this segment of the work, the calculation of the VAT efficiency indicator in the Benelux countries was performed for the period 2011 - 2020. The obtained values of the observed indicator are a prerequisite for the panel evaluation of the effects of the explanatory variables.

Table 2. Comparative overview of VAT efficiency in the Benelux countries

Year	Belgium	Netherlands	Luxembourg
in 2011	47.83	51.18	92.44
in 2012	48.14	46.79	88.95
in 2013	47.02	46.98	86.72
in 2014	46.77	47.19	83.69
in 2015	45.98	48.73	78.33
in 2016	47.02	51.81	77.14
in 2017	47.05	52.35	78.23
in 2018	46.80	52.48	76.84
in 2019	47.14	55.43	75.96
in 2020	44.79	57.41	78.95

Source: Author's calculation

Based on the results from Table 2, it can be noted that the average VAT efficiency is the highest in Luxembourg (81.73%) compared to Belgium (46.85%) and the Netherlands (51.04%), where the values of the observed indicator are significantly lower. Analyzing by year, VAT efficiency increased the most in 2012 in the Netherlands (+6.32%), then in 2020 in Luxembourg (+3.94%), and in 2016 in Belgium (+2.26%). If the relative decline of this indicator is analyzed, it can be seen that the VAT efficiency decreased the most in the Netherlands in 2012 (-8.58%), followed by Luxembourg (-6.41%), as well as in Belgium in 2020 (-4.98%).

In order to measure the impact of macroeconomic factors on the elasticity and efficiency of the value added tax in the Benelux countries, as part of this research, data from secondary data sources related to macroeconomic indicators (gross social product - GDP, unemployment, final consumption, inflation, government expenditures). All data were collected from the official pages of leading international institutions, so most of the data in the research was taken from the pages of the International Monetary Fund and the World Bank. The research uses data for the period from 2011 to 2020, and refers to the Benelux countries. Before examining and evaluating the impact of macroeconomic factors on VAT elasticity and VAT efficiency, it is necessary to determine potential differences in the level

of observed indicators between the analyzed Benelux countries (Belgium, the Netherlands and Luxembourg) for the time period 2011-2020. years.

Table 3. Assessing differences in the level of VAT efficiency

EF	W = Wilks' lambda		L = Lawley-Hotelling trace		
	P = Pillai's trace		R = Roy's largest root		
Source	Statistics	F(df1)	F(df2)	F	Prob>F
W	0.1792	2.0	27.0	61.82	0.0000
P	0.8208	2.0	27.0	61.82	0.0000
L	4.5789	2.0	27.0	61.82	0.0000
R	4.5789	2.0	27.0	61.82	0.0000
Residual					27
Total					29

Source: Author's calculation

Table 3 shows the results of the multivariate analysis for the Benelux countries regarding the assessment of the level of differences in the values of VAT elasticity and VAT efficiency for the time period 2011 - 2020. Based on the obtained values of Pillai's Trace = 0.000 for the selected variable VAT efficiency, it can be concluded that there is a statistically significant difference in the level of VAT efficiency in the mentioned countries for the analyzed time period.

After determining the differences in the level of VAT efficiency in the Benelux countries, the examination and assessment of the influence of selected macroeconomic factors on the VAT efficiency panel level for the time period 2011-2020 follows. years. The panel estimation was performed based on the random effects model and the fixed effects model. At the same time, panel causality, i.e. causality between macroeconomic factors and VAT efficiency, is presented. As a condition for an appropriate regression model, it is necessary to conduct stationarity testing, as well as to determine whether there is a problem of multicollinearity, that is, of pronounced correlation between the selected independent variables.

Table 4 shows different panel stationarity tests (LLC test, BTtest and HT test) on the example of three panels (Belgium, Netherlands and Luxembourg) which were applied to examine and identify the stationarity trend of the included variables. The results indicate first-order stationarity for most variables at the 0.05 significance level. The following is an examination of the mutual correlation of the explanatory variables using the VIF test.

Table 4. Stationarity tests

Panels contain unit roots								
The panels are stationary								
Variables	LLC test	P-values	Breitung test	P-values	Harris-Tzavalis test	P-values	Hadri LM test	P-values
EF	-1.38	0.643	-1.41	0.205	0.79	0.645	5.98	0.000
ΔEF	-5.42	0.041	-5.63	0.000	-0.18	0.001	-0.47	0.681
GDP	-2.60	0.000	-1.81	0.036	0.19	0.000	0.18	0.426
ΔGDP	-1.16	0.000	-1.66	0.048	-0.18	0.000	0.65	0.257
FP	-2.53	0.019	-1.09	0.862	0.83	0.735	6.18	0.000
ΔFP	-4.89	0.038	-1.28	0.098	-0.28	0.002	-0.41	0.656
NOT Z	-6.31	0.000	-0.97	0.117	0.88	0.537	4.39	0.000
ΔNEZ	-5.87	0.000	-1.31	0.096	-0.61	0.003	2.14	0.016
INF	-5.35	0.000	3.09	0.992	0.92	0.689	7.98	0.000
Δ INF	-7.56	0.000	-0.68	0.248	-0.34	0.001	-0.46	0.679
DR	-4.07	0.000	-1.34	0.091	0.47	0.051	1.17	0.120
ΔDR	-6.32	0.000	-1.51	0.066	-0.27	0.001	1.16	0.122
VAT	-5.39	0.048	0.5	0.000	0.46	0.047	4.31	0.000
ΔVATs	-2.47	0.905	-0.48	0.314	-0.07	0.000	0.45	0.325
VAT	-0.82	0.721	-1.13	0.872	0.71	0.435	5.07	0.000
ΔVATp	-4.71	0.006	-1.77	0.038	-0.05	0.000	-0.82	0.793

Source: Author's calculation

The results of the VIF test (Table 5) show an average value of 2.39, which leads to the conclusion that there is no problem of multicollinearity between the selected explanatory variables (value less than 4). Bearing in mind that all prerequisites for creating a suitable panel regression model have been met, the following is a comparative presentation of the random effects model and the fixed effects model.

Table 5. VIF test - multicollinearity test

Variables	VIF
GDP	1.81
FP	2.68
NOT Z	2.95
INF	2.52
DR	3.68
VAT	1.77
VAT	1.32
Mean VIF	2.39

Source: Author's calculation

Based on the results of the random effects model (Table 6), a statistically significant impact of the explanatory variables, i.e. GDP, final consumption, unemployment, inflation, government expenditures, VAT rate and VAT revenue, on VAT efficiency in the Benelux countries for the time period can be observed. 2011 - 2020. Analyzing the character and intensity of the impact, it is noticeable that the variables GDP, FP, DR and VAT revenues have a positive and statistically significant effect on VAT efficiency in the observed countries, which

implies that their growth contributes to increasing the efficiency of VAT collection. On the other hand, the variables NEZ, INF and VAT rate have a negative and statistically significant impact on VAT efficiency, which implies that their increase results in a decrease in VAT collection efficiency. The high value of the coefficient of determination R-squared (0.876) indicates that the model is adequately designed, as well as Prob F (0.000) on the validity of the established empirical model.

Table 6. Random effects model

Variables	Random Effects (RE) Model	Effect + 1%	Effect + 10%
Δ GDP	0.172 (0.000)	+0.17%	1.72%
Δ FP	0.895 (0.007)	+0.89%	+8.95%
ΔNEZ	-0.212 (0.000)	-0.21%	-2.12%
ΔINF	-0.159 (0.032)	-0.16%	-1.59%
ΔDR	0.124 (0.000)	+0.12%	+1.24%
Δ VATs	-0.583 (0.000)	-0.58%	-5.83%
Δ VAT	0.518 (0.000)	+0.52%	+5.18%
R-squared			0.876
Model validity			0.000

Source: Author's calculation

Based on the results of the fixed effects model (Table 7), it can be concluded that the explanatory variables, namely GDP, final consumption, unemployment, inflation, government expenditures, VAT rate and VAT revenue, have a statistically significant influence on VAT efficiency in the Benelux countries for the time period 2011 - 2020. Analyzing the character and intensity of the impact, it is noticeable that the variables GDP, FP, DR and VAT revenues have a positive and statistically significant effect on VAT efficiency in the observed countries, which implies that their growth contributes to increasing the efficiency of VAT collection. On the other hand, the variables NEZ, INF and VAT rate have a negative and statistically significant impact on VAT efficiency, which implies that their increase results in a decrease in VAT collection efficiency. The high value of the coefficient of determination R-squared (0.924) indicates that the model is set appropriately, as well as the Prob F (0.000) on the validity of the defined empirical model.

Table 7. Fixed effects model

Variables	Fixed effects (FE) model	Effect + 1%	Effect + 10%
Δ GDP	0.204 (0.000)	+0.20%	2.04%
Δ FP	0.958 (0.002)	+0.96%	+9.58%
ΔNEZ	-0.216 (0.000)	-0.22%	-2.16%
ΔINF	-0.147 (0.000)	-0.15%	-1.47%
ΔDR	0.159 (0.004)	+0.16%	+1.59%
Δ VATs	-0.597 (0.000)	-0.60%	-5.97%
Δ VAT	0.592 (0.000)	+0.59%	+5.92%
R-squared	0.924		
Model validity	0.000		

Source: Author's calculation

The results of the Hausman test (Table 8) show that the fixed effects model is adequate when assessing the impact of macroeconomic factors on VAT efficiency in the Benelux countries. This means that the selected model includes explanatory variables that explain 92.4% of the VAT efficiency variations in the observed countries, which indicates high reliability and credibility of the obtained empirical findings.

Table 8. Model selection – Hausman test

Model specification	The result	Conclusion
Random Effects Model vs Fixed Effects Model	Chi2(7) = (bB)'[(Vb-VB)^(-1)](bB) = Prob>chi2 = 0.0000	A fixed effects model is appropriate

Source: Author's calculation

In order to determine the potential causality between macroeconomic factors and VAT efficiency indicators, causality measurement was conducted between selected variables for the time period 2011-2020. years. The results of the causality test (Table 9) indicate bidirectional causality between gross domestic product (GDP), final consumption (FP), government expenditure (DR), VAT rate, VAT revenue and VAT efficiency (EF). On the other hand, unidirectional causality of unemployment (NEZ), inflation (INF) and PDF efficiency EF) was confirmed. In the case of identified unidirectional causality, it should be emphasized that a change on the side of macroeconomic factors such as unemployment and inflation leads to a change in VAT efficiency in the Benelux countries.

Table 9. Measuring the causality of macroeconomic factors and VAT efficiency

Direction	F-statistic	Prob.	Causality
GDP → EF	3,587	0.034	bidirectional causality
EF → GDP	3,794	0.019	
FP → EF	4,637	0.008	bidirectional causality
EF → FP	4,716	0.012	
NEZ → EF	2,656	0.328	unidirectional causality
EF → NEZ	4.131	0.047	
INF → EF	4,140	0.039	unidirectional causality
EF → INF	1.568	0.575	
DR → EF	3,696	0.042	bidirectional causality
EF → DR	4.217	0.036	
VAT → EF	7.306	0.000	bidirectional causality
EF → VATs	7,748	0.004	
VATp → EF	7.223	0.000	bidirectional causality
EF → VAT	7.101	0.000	

Source: Author's calculation

Conclusion

The paper includes an empirical analysis of measurement and assessment of the impact of selected macroeconomic factors on VAT efficiency in the Benelux countries (Belgium, the Netherlands and Luxembourg) for the period 2011-2020. years. Value-added tax rates in the Benelux countries ranged from 17% in Belgium to 21%, which was the value-added tax in the Netherlands and Luxembourg. The average VAT efficiency of the observed countries was 59.84%, with the highest average value of the indicator recorded in Luxembourg (81.73%). On the other hand, Belgium and the Netherlands achieved average values of 46.85% and 51.04% during the analyzed time period. The results of the multivariate analysis indicate statistically significant differences in the level of VAT efficiency in the Benelux countries during the observed time period. Panel regression analysis was performed based on the random effects model and the fixed effects model, with the results of the Hausman test confirming that the fixed effects model is adequate. Empirical findings indicate a statistically significant influence of all variables, which leads to the conclusion that the hypothesis H_0 can be accepted. Bearing in mind the positive impact of gross domestic product, final consumption, state expenditures and VAT revenue on VAT efficiency, it can be stated that hypotheses H_1 , H_2 , H_5 and H_7 are accepted. Specifically, the growth of GDP, FP, DR and VAT revenue by 1% contributes to the increase of VAT efficiency by 0.20%, 0.96%, 0.16% and 0.59%. On the other hand, unemployment, inflation and VAT rate have a negative impact on VAT efficiency in the observed countries, which allows the acceptance of hypotheses H_3 , H_4 and H_6 . Namely, the growth of NEZ, INF and VAT rates by 1% results in a decrease in VAT efficiency by 0.22%, 0.15% and 0.60%. The contribution of this paper is reflected in the expansion of the existing theoretical framework aimed at tax efficiency, as well as the provision of new empirical knowledge related to the

efficiency of value added tax revenue collection in the Benelux countries. The obtained empirical results indicate that the Benelux countries must focus on higher rates of GDP growth and final consumption with a higher participation of state expenditures, in order to achieve positive implications for VAT efficiency. At the same time, a lower inflation rate and unemployment rate will have positive effects on VAT efficiency. Finally, a reduction in the standard VAT rate can generate more VAT revenue, which will undoubtedly have a positive impact on VAT efficiency in the observed countries. Causality results indicate bidirectional causality between gross domestic product (GDP), final consumption (FP), government expenditure (DR), VAT rate, VAT revenue and VAT efficiency (EF). On the other hand, unidirectional causality of unemployment (NEZ), inflation (INF) and PDF efficiency (EF) was confirmed. The contribution of this paper is reflected in the provision of empirical guidelines to economic policy makers when profiling the VAT policy in the context of adjusting the macroeconomic framework of the Benelux countries. At the same time, the obtained empirical findings can be of help to countries around the world, especially countries where VAT has a significant share in collected tax revenues.

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