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DETERMINANTE TRŽIŠTA NEKRETNINA U REPUBLICI SRBIJI: PREGLED I NALAZI

Prof. dr Almir Alihodžić

redovni profesor, Ekonomski fakultet Univerziteta u Zenici
almir.dr2@gmail.com

Rezime: Promene vrednosti na tržištu nekretnina utiču, kako na kvalitet kreditnih portfolija banaka, tako i na finansijsku stabilnost i realnu ekonomiju. Republika Srbija je jedna od zemalja koja se suočava sa uzlaznim trendom potražnje za stanovanjem. Ovaj rad istražuje uticaj makroekonomskih i bankarskih varijabli na indeks cena nekretnina u Srbiji za period od 2014. do 2023. godine na kvartalnom nivou. Takođe, u ovom istraživanju se primenjuje panel regresiona i korelaciona analiza. Odabrane nezavisne (eksplanatorne) varijable su bruto domaći proizvod, indeks potrošačkih cena, kamatna stopa na bankarske kredite, odnos kursa domaće valute prema evru i štednja stanovništva. Rezultati istraživanja su pokazali da je najsignifikantniji uticaj na indeks cena nekretnina imala nezavisna varijabla indeks potrošačkih cena. S druge strane, najznačajniji negativni uticaj na zavisnu varijablu (indeks cena nekretnina) su imale sledeće nezavisne varijable: kamatna stopa na bankarske kredite i devizni kurs domaće valute u odnosu na evro.

Ključne reči: Indeks cena nekretnina, makroekonomske varijable, bankarske varijable, Shapiro Wilk test, Breusch – Pagan test, regresiona analiza, Hausman test.

JEL klasifikacija: R30, E31, G51

Uvodna razmatranja

Smeštaj i stanovanje se smatraju osnovnim ljudskim potrebama. Da bi se to postiglo građanska je obaveza svake zajednice da pomogne ljudima u upravljanju adekvatnim smeštajem. Na taj način, Vlada pokušava da obezbedi pristup prilagođen potrošačima kako bi uspeła da realizuje svoje odluke na stambenom tržištu. Da bi se privreda razvijala u pravom smeru, važno je uspostaviti ravnotežu između potražnje i dostupnosti stanovanja (Rozin, 2020).

Dakle, stanovanje je glavna komponenta bogatstva domaćinstava i jedan od glavnih pokretača privatne potrošnje (Mian i ostali, 2013). Štaviše, stambena tržišta su veoma relevantna za finansijsku stabilnost, pošto su mehurići cena stanova istorijski bili dramatično štetni događaji. S tim u vezi je procena trendova i rizika na stambenim tržištima ključna za centralne banke (Jorda i ostali, 2015). Odabir prave kombinacije politika zavisi od dostupnosti detaljnih i pravovremenih informacija o potražnji i ponudi stambenih objekata. Na primjer, kreatori politike mogu želeći da odaberu različite politike u zavisnosti od toga da li je prekomeran rast cena stanova posledica bujanja na strani potražnje ili niske ponude.

Razvoj stambenog tržišta određuju mnogi usko povezani ekonomski, pravni, finansijski, institucionalni i politički faktori. Oni se mogu kvantifikovati prvenstveno međunarodnim terminima, gde makroekonomski faktori kao što su bruto domaći proizvod (BDP), inflacija, stope prinosa, te dostupnost hipotekarnih kredita igraju značajnu ulogu. Postoji nekoliko faktora koji utiču na potražnju, generalno bez obzira na lokalne varijacije. To mogu biti različiti uzroci i administrativno-politički, pravni i ekonomski mehanizmi, kao što su stambena politika državnih organa, postojeći sistem kredita i mogućnosti njihovog dobijanja, stopa inflacije i drugi (Hott i ostali, 2008).

Cijene stanova su u korelaciji sa kretanjima poslovnog ciklusa i u širokom spektru stvarnih varijabli, kao što su investicije i potrošnja. U vezi sa ovim atributima, sektor nekretnina u mnogim zemljama je postao jedan od ključnih sektora privrednog rasta i razvoja. U poslednjoj deceniji, posebno u većini industrijskih zemalja cene stanova su dramatično porasle zbog niskih dugoročnih kamatnih stopa, ekonomskog rasta i velike likvidnosti (Ahearne i ostali, 2005).

Vitalna pitanja stanovanja i razvoja privrede su dobila veliku pažnju u poslednje dve decenije. Globalna finansijska kriza iz 2008. godine pokazala je značajnu povezanost između stanovanja i privrede. To je takođe bila verovatno jedna od najgorih finansijskih kriza u SAD-u koja je formirala super stambeni balon na globalnom tržištu nekretnina. Nakon kolapsa tržišta nekretnina u SAD-u ili krize subprimarnog tržišta iz 2008.-2009. god., došlo je do oživljavanja fokusa na tržištu nekretnina. Tržište nekretnina ima dvostruku ulogu i to kao potrošačko dobro i kao investicija, što je prepoznato u literaturi (Leung, 2004). Pandemija COVID-19 je dodatno promenila i stvorila određene sopstvene trendove cena nekretnina.

Proteklih godina u Republici Srbiji povećan je promet na tržištu nekretnina, što je bilo u skladu sa kretanjima na ovom segmentu tržišta, kao i u drugim zemljama. Dakle, promet je bio veći u 2022. godini za 22% u odnosu na 2021. godinu. Na data tržišna kretanja uticalo je više faktora kao što su: povećana tražnja za nekretninama koja je pre svega bila refleksija pozitivnih kretanja na tržištu rada, povoljni uslovi kreditiranja, niske kamatne stope, potraga za alternativnim investicijama, povećan rad od kuće usled pandemije i drugi faktori (Narodna banka Srbije, 2022).

Osnovni cilj ovog istraživanja je da utvrdi u kojoj meri i kojim intenzitetom odabrane makroekonomske i bankarske varijable utiču na kretanje indeksa cena nekretnina u Republici Srbiji. Nulta hipoteza podržava model slučajnih efekata. S druge strane, alternativna hipoteza podržava model fiksnih efekata. U radu će se testirati sledeće hipoteze:

H0: Nulta hipoteza: Model slučajnih efekata je odgovarajući

H1: Alternativna hipoteza: Model fiksnih efekata je odgovarajući

Hipoteze u ovom istraživanju će se testirati uz pomoć Hausmanovog testa.

Rad je strukturiran iz šest delova. Prvi deo odnosi se na uvodna razmatranja sa akcentom na važnost tržišta nekretnina, cilj istraživanja i postavljene hipoteze. Drugi deo opisuje pregled dosadašnjih istraživanja u kontekstu uticaja različitih demografskih, socijalnih, makroekonomskih i bankarskih indikatora na kretanje indeksa cena nekretnina i drugih relevantnih indikatora na tržištu nekretnina. Treći deo ukratko analizira stanje na tržištu nekretnina u Srbiji kroz prizmu odabranih indikatora na tržištu nekretnina. Četvrti deo opisuje izabranu metodologiju istraživanja sa fokusom na model fiksnih efekata i model slučajnih efekata. Peti deo odnosi se na podatke potrebne za analizu. Šesti deo predstavlja dobijene rezultate istraživanja, kao i određena zapažanja i preporuke.

Pregled relevantne literature

Raznovrsnost cena i aktivnosti stambenog tržišta na regionalnom nivou proističe pre svega iz raznovrsnosti socioekonomskih faktora i društvenih procesa. Posebna pažnja u mnogim radovima je posvećena demografskim faktorima koji uključuju godine starosti, pol, bračni status, i koji utiču na stambene potrebe. Demografska situacija se može promeniti kao rezultat migracije, kako između država, regiona, tako i pojedinačnih gradova (Annas i ostali, 1984).

Mnogi autori su proučavali odnos između demografije i tržišta nekretnina. Povećanje broja novorođenčadi ima mali kratkoročni efekat na stambeno tržište, ali povećava potražnju za novim kućama dvadeset godina kasnije. Smanjenje broja rođenih ili povećanje prosečne starosti stanovništva snažno utiče na tražnju i na cene stanova (Mankiw i Weil, 1989).

Značajan udeo rashoda za stanovanje u budžetima domaćinstava ima za posledicu tesnu korelaciju između rasta prihoda u datoj oblasti i rasta cena stanova (Reichert, 1990). Rezultati empirijskog istraživanja prema Galinu (2006) ukazuju na to da zbog niske fleksibilnosti prihoda stambenog tržišta dati odnos može biti diskutabilan u mnogim slučajevima.

Prihodi stanovništva su usko povezani sa tržištem rada, te su pored prihoda i mogućnosti zapošljavanja važan potencijal regije, što rezultira povećanjem lokalnih cena stanovanja. Takođe, postoje i očekivanja da će povećanje procenta nezaposlenih u ovoj oblasti uticati na smanjenje cene stanova (Berg, 2002).

Ekonomski faktori uključuju ne samo prihode stanovništva i tržište rada već i stanje lokalne privrede. Ovo se može odraziti na indikator poput lokalnog BDP-a, iako empirijska istraživanja sprovedena na kanadskom tržištu pokazuju da odnosi koji su sasvim logični i očigledni, nisu uvek potvrđeni u praksi. Isto tako značajni su i pokazatelji koji proizilaze direktno sa tržišta nekretnina, a odnose se na ravnotežu ili neravnotežu između ponude i potražnje (Allen i ostali, 2009).

Nivo razvijenosti stambenog tržišta odražava ekonomsko stanje domaćinstava, koje zavisi pre svega od stabilnosti prihoda. Dakle, na efektivnu tražnju, te kao rezultat toga i na cenu stanova u velikoj meri utiču finansijski resursi domaćinstava, kao što su štednja i raspoloživi prihod (Lin i ostali, 2014).

Makroekonomski faktori su od kapitalnog značaja u razumevanju kretanja cena na tržištu nekretnina. Prema Irandoustu (2019) cene stambenih nekretnina određene su zakonom ponude i potražnje, što dalje znači da svaki faktor koji utiče na navedeni zakon ima uticaj i na određivanje cena mesta stanovanja. S tim u vezi, makroekonomski faktori mogu imati odlučujući uticaj u kontekstu utvrđivanja precenjenosti ili podcenjenosti vrednosti stambenih nekretnina.

Kau i Keenan (1980) sprovedli su odgovarajuću studiju o odnosu kamatnih stopa i cena stanova. Došli su do zaključka da povećane kamatne stope uglavnom utiču na smanjenje potražnje na tržištu nekretnina, te konsekvantno deluju na smanjenje cene stanova. Suprotno od Kau i Keenan, Geoffrei (2002) i Ahearne i ostali (2005) veruju da će sa porastom kamatnih stopa troškovi investiranja u razvoj nekretnina rasti, a profiti opadati, što bi indirektno dovelo do smanjenja ponude nekretnina, i konačno do rasta cena nekretnina.

Takođe, Pillaiyan (2015) je pronašla inverznu vezu između kamatne stope i cene stanova u Maleziji i tvrdila je da je niska kamatna stopa podstakla balon u cenama nekretnina. Isto tako, navela je da svako povećanje kamatnih stopa na kratak rok dovodi do odgovarajuće promene u ceni stanova.

Lin i ostali (2014) koristili su dvadeset lokalnih indikatora, uključujući starost stanovništva, procenat brakova, obrazovanje, nezaposlenost, bezbednost, kvalitet vazduha itd. Rezultati istraživanja su pokazali da se tržišna vrednost merena brojem transakcija pokazala kao destimulirajuća mera prosečne cene stanova.

Belke i Keil (2018) sažimaju četiri pristupa varijablama koje utiču na cene stambenih nekretnina. Naime, prvo, pristup cenama imovine koji povezuje cene nekretnina sa budućim diskontovanim prihodima. Drugo, fokusira se na pristupačnost i održivost cena stanova ili drugih privatnih domaćinstava. Dato se analizira putem odnosa prihoda, zatim odnosa kredita i vrednosti indeksa, zatim odnos stvarnih mesečnih troškova hipoteke i prihoda. Treće, postoji hedonistički metod određivanja cena. To zapravo znači da hedonističko modeliranje cena uzima u obzir specifične karakteristike pojedinačnih objekata ili naselja, od kojih svaki doprinosi ukupnoj vrednosti nekretnine. Četvrto, postoje ekonometrijski modeli koji direktno procenjuju efekat cena nekretnina. Takvi modeli su zasnovani na nekom obliku nacionalnog, regionalnog ili lokalnog indeksa cena nekretnina kombinovanog u vremenske serije ili panel forme.

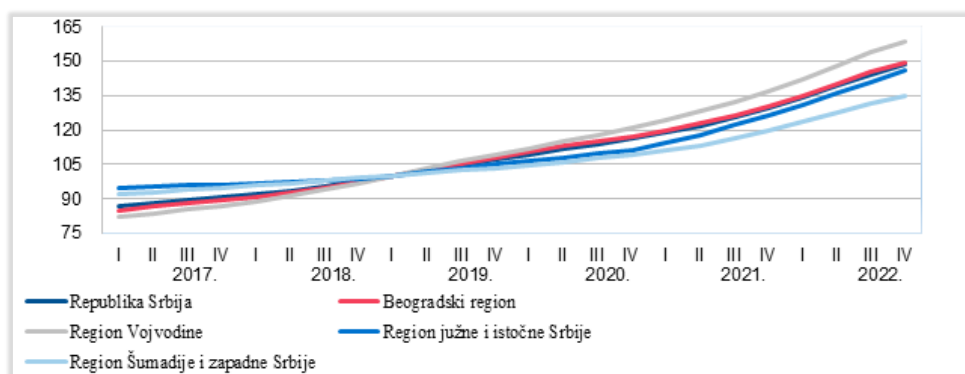
Trofimov (2018) u svom istraživanju pokazuje da dugotrajnim visokim ekonomskim rastom stambena gradnja može postati prekomerno stimulativna, gde dolazi do suviše gradnje gde se konsekvantno stvara veća ponuda stambenih nekretnina nego što je potražnja za istim. Dato rezultira padom cena nekretnina.

Tripathi (2019) u svom opsežnom istraživanju među različitim zemljama koristi random efekt model i sugerise da bi Vlada trebalo da prilagodi monetarnu politiku kao što su inflacija i ponuda novca, kako bi se obuzdale stvarne cene nekretnina. Takođe, Khoo i ostali (2019) proučavali su cene nekretnina u Maleziji, te na isti način preporučili da Vlada treba da pojača promociju stambenih cena kako bi se izbegla ubrzana inflacija. Stabilnost cena pomaže da se finansijsko-ekonomska aktivnost održi na zadovoljavajućem nivou. Dakle, politika stabilnosti cena je dragoceno sredstvo za snižavanje i stabilizaciju inflacije.

Analiza odabranih indikatora na tržištu nekretnina Republike Srbije

Indeks cena stanova razvijen je u skladu s međunarodnim smernicama, kao i na osnovu modela za masovnu procenu stanova, koji pored cena iz kupoprodajnih ugovora uzima u obzir i različite kvalitativne karakteristike nepokretnosti iz relevantnih izvora. Kretanje vrednosti indeksa daje uvid na kontinuirani trend rasta cena stanova tokom posmatranog perioda (Narodna banka Srbije, 2022). Grafikon u nastavku teksta ilustruje trend kretanja indeksa cena stanova na tržištu nekretnina u Republici Srbiji za period: 2017. – 2022. godine.

Grafikon 1 - Trend kretanja indeksa cena stanova u Republici Srbiji za period: 2017 – 2022. godine

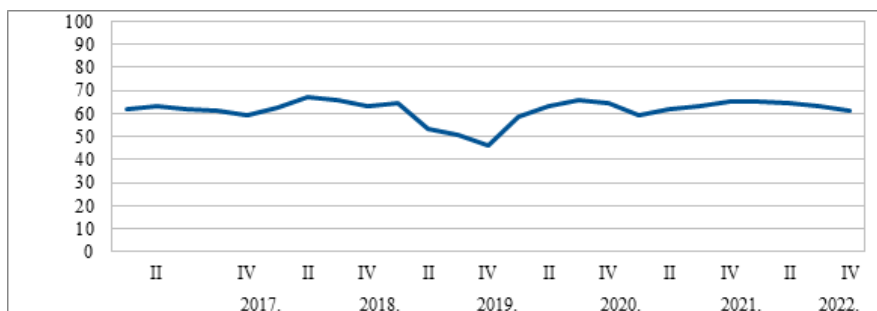


Izvor: www.nbs.rs (Preuzeto:16.01.2024.)

Indeks cene stanova na tržištu nekretnina u Republici Srbiji na kraju četvrtog kvartala 2022. godine iznosio je 148,79, što je više za oko 64% u odnosu na četvrti kvartal 2017. godine. Sa stanovišta regiona najviše su povećane cene stanova u regionu Vojvodine za oko 16,02% i grada Beograda za oko 14,91%. Kako se najveći broj procenjenih stambenih nepokretnosti odnosi na beogradski region, da se zaključiti da je prosečna procenjena vrednost po kvadratnom metru stambenih nepokretnosti u Republici Srbiji u najvećoj meri determinisana kretanjem vrednosti procena stambenih nepokretnosti u beogradskom regionu (Narodna banka Srbije, 2022).

LTV ratio (engl. Loan-to-Value) predstavlja pokazatelj odnosa vrednosti hipotekarnog kredita i vrednosti nepokretnosti koja služi za obezbeđenje datog kredita.

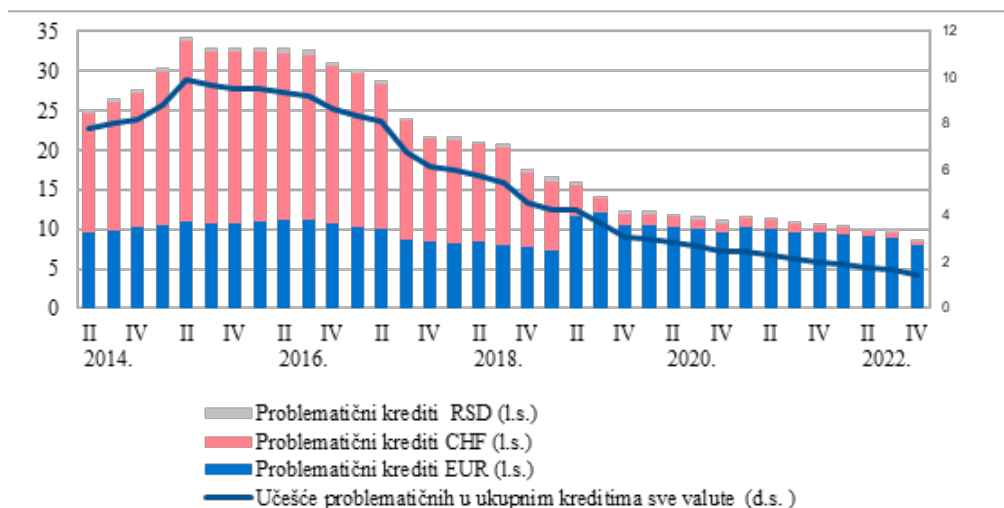
Grafikon 2 - Vrednost stambenih kredita za koje je hipotekovan stan u odnosu na procenjenu vrednost stanova - LTV ratio za period: 2017 – 2022. godine



Izvor: www.nbs.rs (Preuzeto:16.01.2024.)

Iz prethodnog grafikona se da primetiti da je vrednost LTV racija u poslednjem kvartalu 2022. godine iznosila 61,1%, što predstavlja relativno povećanje u odnosu na četvrti kvartal 2017. godine za oko 2,55%. Prosečna vrednost LTV racija je znatno ispod propisanog nivoa od 80%. U cilju obezbeđenja uslova za kvalitetniju procenu vrednosti nekretnina, što posledično utiče na smanjenje rizika nastanka novih problematičnih kredita, te razvoju tržišta problematičnih kredita Narodna banka Srbije od 2015. godine vodi bazu podataka o procenama vrednosti nekretnina koje su predmet hipoteke i o kreditima obezbeđenim hipotekom (Narodna banka Srbije, 2022).

Grafikon 3 - Problematicni krediti stambene izgradnje na tržištu nekretnina Republike Srbije za period: 2014 - 2022. godine



Izvor: www.nbs.rs (Preuzeto: 16.01.2024.)

Nepokretnosti su kao predmet obezbeđenja kredita vrlo zastupljene u bankarskom sektoru Republike Srbije. S tim u vezi je adekvatna procena vrednosti nekretnina od esencijalnog značaja jer su banke direktno izložene riziku promene tržišnih cena nepokretnosti. Iz prethodnog grafikona je vidljivo značajno smanjenje problematičnih kredita u 2022. godini koje je iznosilo oko 3.3% u odnosu na 2014. godinu gde je učešće iznosilo preko 20%. Razlozi različitih vremenskih razdoblja analize odabranih indikatora na tržištu nekretnina Republike Srbije i ekonometrijske analize su pre svega nedostatak domaće statistike posmatranih podataka.

Metodologija istraživanja

Ekonometrijsko modeliranje cene nekretnina korišćenjem socioekonomskih i ekoloških faktora ima relativno dugu tradiciju i često se opisuje u literaturi. Obimni pregled statističkih modela koji opisuju odnose između cene stanova i faktora koji na njih utiču na nacionalnom, regionalnom i lokalnom nivou predstavili su Gasparenje i ostali (2014) gde su naveli prednosti i nedostatke modela, kao i njihove strukturne elemente. Često se postavlja pitanje: zašto se koristi panel regresiona analiza i podaci u različitim studijama? Prednosti korišćenja panel analize i podataka su mnogobrojne. Hsiao (1985), Klevmarket (1989) i Solon (1989) naveli su nekoliko prednosti korišćenja panel podataka.

Štaviše, panel podaci daju više informativnih podataka, veću varijabilnost, manje kolinearnosti među varijablama i više stepena slobode, a samim tim i veću efikasnost.

Postoje tri tipa panel analitičkih modela koji se koriste, i to: (1) objedinjeni regresioni model, (2) model fiksnog efekta i (3) model slučajnog efekta. Objedinjeni regresioni model je jedan tip modela koji ima konstantne koeficijente koji se odnose i na preseke i na nagibe. Za ovaj model istraživači mogu da objedine sve podatke i pokrenu običan model regresije najmanjih kvadrata. Model fiksnog efekta su razlike između jedinica poprečnog preseka koje se mogu obuhvatiti razlikama u konstantnom terminu, a termin preseka regresionog modela varira u svim jedinicama poprečnog preseka. U modelu slučajnog efekta, pojedinačni efekti su nasumično raspoređeni po jedinicama poprečnog preseka i da bi se uhvatili pojedinačni efekti, regresioni model je specificiran sa terminom preseka koji predstavlja ukupni konstantni termin (Seddigi i Lawler, 2000).

Osnovni cilj ovog istraživanja je merenje ključnih makroekonomskih i bankarskih indikatora na promene cena nekretnina. Procene potencijalnih odrednica odnose se na postojeću literaturu. Ekonometrijski model predstavljen je na sledeći način:

$$\% \Delta HPI = \beta_0 + \beta_1 * (\% \Delta GDP) + \beta_2 * (\% \Delta CPI) + \beta_3 * (\% \Delta BCIR) + \beta_4 * (\% \Delta EXR) + \beta_5 * (\% \Delta HS) \quad (1)$$

Ekonometrijski model je model višestruke regresije, uključujući dve ili više objašnjavajućih (eksplanatornih) varijabli. Da bi se uzela u obzir razlika između posmatranih podataka i očekivane vrednosti dodaje se termin slučajne greške $\varepsilon_i = \% \Delta \text{ cena nekretnina} - E(\% \Delta \text{ Cena nekretnina})$, gde se jednačina novog ekonometrijskog modela može zapisati na sledeći način:

$$\% \Delta HPI = \beta_0 + \beta_1 * (\% \Delta GDP) + \beta_2 * (\% \Delta CPI) + \beta_3 * (\% \Delta BCIR) + \beta_4 * (\% \Delta EXR) + \beta_5 * (\% \Delta HS) + \varepsilon_i \quad (2)$$

Osnovna pretpostavka je da posmatrane vrednosti ekonometrijskog modela zadovoljavaju odnos populacije i da se pridržavaju strogih pravila egzogenosti, uslovno nekorelisanih grešaka i normalnosti grešaka. Osim toga, bitno je napomenuti da ne postoji apsolutno tačna linearna veza između eksplanatornih varijabli. Ukoliko je p – vrednost statistički značajna treba koristiti model fiksnog efekta. Posmatrano sa druge strane, ukoliko p – vrednost nije statistički značajna treba koristiti model slučajnog efekta. Test značajnosti je izveden za sve varijable korišćenjem t -testa pri nivou značajnosti od 95% (Chmelarova, 2007).

Podaci

Ovo istraživanje se fokusira na sledećim varijablama: zavisna varijabla će biti indeks cena nekretnina u Republici Srbiji (HPI), dok će se bruto domaći proizvod (GDP), indeks potrošačkih cena (CPI), kamatna stopa na bankarske kredite (BCIR), devizni kurs dinara prema evru (EXR) i štednja sektora stanovništva (HS) posmatrati kao nezavisne varijable. Izbor posmatranih varijabli za analizu je značajan rast cena i atraktivnost sektora nekretnina u Republici Srbiji, kao i pretpostavljena kauzalnost nezavisnih varijabli kao značajnih prediktora. Istraživanje obuhvata period od prvog kvartala 2014, do četvrtog kvartala 2023. godine. Analiza će se bazirati na kvartalnim podacima jer su podaci na godišnjem nivou nepouzdan uzorak za ekonometrijsku evaluaciju. Podaci su prikupljeni sa službenih stranica Narodne banke Republike Srbije, Republičkog zavoda za statistiku Srbije i Svetske banke. Merenje i očekivani efekat zavisne i nezavisnih varijabli dati su u tabeli 1.

Tabela 1 - Kratki opis zavisne i nezavisnih varijabli u modelu

Varijabla	Skraćenica	Očekivani efekat
Indeks cena nekretnina	HPI	
Bruto domaći proizvod	GDP	(+)
Indeks potrošačkih cena	CPI	(+)
Kamatna stopa na bankarske kredite	BCIR	(-)
Devizni kurs dinara prema evru	EXR	(-)
Štednja sektora stanovništva	HS	(+)

Izvor: Proračun autora

Indeks cena nekretnina (HPI) - meri promene cena stambenih nekretnina kao procentualne promene od nekog određenog početka datuma koji ima HPI od 100. Dakle, indeks cena nekretnina je indeksni broj za merenje nivoa kretanja cena stambene imovine (stanova, privatnih kuća, kuća u nizu, itd.) koju domaćinstva povremeno kupuju.

Bruto domaći proizvod (GDP) - je ukupna novčana ili tržišna vrednost svih gotovih dobara ili usluga proizvedenih unutar granica zemlje u određenom vremenskom periodu. Kao široka mera ukupne domaće proizvodnje, funkcioniše kao sveobuhvatan pokazatelj ekonomskog zdravlja posmatrane zemlje. GDP igra značajnu ulogu u formiranju cena stambenih nekretnina. Prema Razali i Tanu (2016) preferirani ekonomski rast podiže cene stambenih nekretnina.

Indeks potrošačkih cena (CPI) - je indeks cena, odnosno cena prosečne ponderisane tržišne korpe potrošačkih dobara i usluga koje kupuju domaćinstva. Promene u izmerenom CPI prate promene cena tokom vremena (<https://en.wikipedia.org>). Dakle, indeks potrošačkih cena je najčešće razmatrana mera inflacije. Generalno, povećanje CPI može izazvati povećanje cena građevinskog materijala, troškova rada i drugih operativnih troškova koji se odnose na izgradnju i održavanje stanova. U ovom istraživanju se pretpostavlja pozitivna korelacija između indeksa cena nekretnina i indeksa potrošačkih cena.

Kamatna stopa na bankarske kredite (BCIR) - kamata je novčana naknada za korišćenje pozajmljenog novca. Dakle, kamata je iznos novca koji zajmodavac ili finansijska institucija dobija za pozajmljivanje novca (<https://www.investopedia.com>). Kada kamatne stope rastu, paralelno rastu i troškovi zaduživanja, a potencijalni kupci se obeshrabruju. Kao rezultat toga, potražnja za stambenim nekretninama opada. Prema Andrews (2010) između cena nekretnina i kamatnih stopa postoji negativna korelacija, koja takođe zavisi i od stepena konkurencije u bankarskom sektoru. U ovom radu se pretpostavlja negativna korelacija između indeksa cena nekretnina i kamatnih stopa na bankarske kredite.

Devizni kurs dinara prema evru (EXR) - devizni kurs je kurs po kome će se jedna valuta zameniti za drugu valutu i utiče na trgovinu i kretanje novca između zemalja. Na kurseve utiču i vrednost domaće valute i vrednost strane valute (<https://www.investopedia.com>). Devizni kursevi mogu uticati na međunarodne tokove kapitala koji ulazi na tržište nekretnina. Ako kurs domaće valute opadne, cene imovine domaćeg tržišta nekretnina, kao što su stambeni objekti postaću jeftiniji za strane investitore, a uslovi poput ovog mogu povećati priliv kapitala u sektor nekretnina i podići cene nekretnina. U studiji se pretpostavlja negativna korelacija između indeksa cena nekretnina i deviznog kursa dinara prema evru.

Štednja sektora stanovništva (HS) - osnovni izvor bankarskog potencijala čine depoziti. Depozitni izvori čine preko tri četvrtine od ukupnih izvora bankarskih sredstava (Plakalović i Alihodžić, 2015). Ukupna štednja sektora stanovništva u bankama u Republici Srbiji nastavila je trend rasta jačajući depozitnu bazu bankarskog sektora (Narodna banka Srbije, 2022. god.).

Rezultati i diskusija

Rezultati deskriptivne statistike, korelacije, multikolinearnosti, normalne distribucije, homoskedastičnosti i heteroskedastičnosti, kao i regresije predstavljeni su u tabelama 2-9. Ukupan broj opservacija iznosi 40, što predstavlja relativno reprezentativan uzorak, kako sa stajališta dostupnih podataka na tržištu nekretnina u Republici Srbiji, tako i u kontekstu vremenskog okvira.

Tabela 2 - Deskriptivna statistika između zavisne i nezavisnih varijabli u modelu na tržištu nekretnina Republike Srbije za period: 2014: Q1 – 2023:Q4

Indikatori	HPI	GDP	CPI	BCIR	EXR	HS
Srednja vrednost	1,3777E2	2,245	112,210	6,431	1,1880E2	1,4467E0
Std. devijacija	35,184	3,392	14,235	2,704	2,180	1,13225582E0
Varijansa	1,238E3	11,506	202,65	7,313	4,755	1,282
Mera asimetrije	0,586	0,552	1,346	1,078	1,116	-0,740
Spljoštenost	-0,857	3,143	0,759	0,595	0,327	0,939
Min	94,91	-6,3	97,8	3,31	115,38	1,8027E0
Max	203,37	13,8	146,1	14,13	123,97	3,49667E0

Izvor: Kalkulacija autora na osnovu podataka Narodne banke Srbije, Republičkog zavoda za statistiku i podataka Svetske banke

Prethodna tabela ilustruje rezultate deskriptivne statistike između zavisne varijable, tj. indeksa cena nekretnina i nezavisnih varijabli: bruto domaćeg proizvoda, indeksa potrošačkih cena, kamatne stope na bankarske kredite, deviznog kursa dinara prema evru i štednje sektora stanovništva. U kontekstu kretanja prve mere rizika, odnosno standardne devijacije najjaču volatilnost su zabeležile sledeće varijable: stopa štednje sektora stanovništva, indeks cena nekretnina (35,18%) i indeks potrošačkih cena (14,23%). Takođe, i srednja vrednost je pratila paralelni trend, kao i standardna devijacija. I pored pojačane neizvesnosti na globalnom nivou, zatim tenzija izazvanim geopolitičkim faktorima i krizom u Ukrajini, ukupna štednja sektora stanovništva nastavila je trend rasta jačajući time depozitnu osnovu bankarskog sektora Republike Srbije, koja čini osnovni izvor finansiranja kreditne aktivnosti. Primera radi, devizna štednja na kraju 2022. godine dostigla je iznos od oko 12,8 mlrd evra, što je u apsolutnom iznosu više za oko 0,5 mlrd evra u odnosu na 2021. godinu. Isto tako, štednja sektora stanovništva u bankama u Republici Srbiji je u četvrtom kvartalu 2023. godine veća za oko 65% u odnosu na četvrti kvartal 2014. godine. Analiza isplativosti štednje koju sprovodi Narodna banka Srbije pokazuje da je u proteklih deset godina dinarska štednja bila isplativija od štednje u evrima, kako na kratki, tako i na dugi rok, zahvaljujući pre svega sledećim faktorima: zdrave i očuvane finansijske stabilnosti, relativno viših kamatnih stopa na štednju u dinarima nego na štednju u eurima, povoljnijeg poreskog tretmana štednje u domaćoj valuti, i drugih faktora (Narodna banka Srbije, 2022). Takođe, jedan od esencijalnih faktora rasta štednje sektora stanovništva u bankama u Republici Srbiji je i nepostojanje alternativnih i povoljnijih vidova štednje i investiranja. S tim u vezi, indeks cena nekretnina pokazao je veliku kolebljivost i oscilaciju, tako da je na kraju četvrtog kvartala 2014. godine sa 96,47 indeksnih poena povećan na 203,37 na kraju četvrtog kvartala 2023. godine, što je povećanje za oko 110,81%.

Tabela 3 -Korelaciona analiza (Pearson koeficijent korelacije) između zavisne varijable i nezavisnih varijabla na tržištu nekretnina Republike Srbije za period: 2014: Q1 – 2023:Q4

		HPI	GDP	CPI	BCIR	EXR	HS
HPI	Pearson Correlation	1,000	0,206	0,958	-0,432	-0,517	0,124
	Sig. (2-tailed)	-	0,202	0,000	0,004	0,001	0,447
	N	40	40	40	40	40	40
GDP	Pearson Correlation	0,206	1,000	0,107	-0,471	-0,084	-0,150
	Sig. (2-tailed)	0,202	-	0,511	0,002	0,605	0,357
	N	40	40	40	40	40	40
CPI	Pearson Correlation	0,958	0,107	1,000	-0,217	-0,466	0,036
	Sig. (2-tailed)	0,000	0,511	-	0,179	0,002	0,824
	N	40	40	40	40	40	40
BCIR	Pearson Correlation	-0,432	-0,471	-0,217	1,000	0,064	-0,214
	Sig. (2-tailed)	0,004	0,002	0,179	-	0,697	0,185
	N	40	40	40	40	40	40
EXR	Pearson Correlation	-0,517	-0,084	-0,466	0,064	1,000	-0,151
	Sig. (2-tailed)	0,001	0,605	0,002	0,697	-	0,351
	N	40	40	40	40	40	40
HS	Pearson Correlation	0,124	-0,150	0,036	-0,214	-0,151	1,000
	Sig. (2-tailed)	0,447	0,357	0,824	0,185	0,351	-
	N						

Izvor: Kalkulacija autora na osnovu podataka Narodne banke Srbije, Republičkog zavoda za statistiku i podataka Svetske banke

Rezultati istraživanja Kostasa i Haibina (2004) pokazuju da postoji pozitivan uticaj inflacije na cene stambenih nekretnina. Dati zaključak objašnjavaju troškovima gradnje stanova. U periodu kada nastupi inflacija, cene materijala za gradnju se povećavaju, što konsekvntno poskupljuje radove. U cilju ostvarivanja željenog profita izvođači radova ili investitori tada povećavaju prodajne cene. Efekat troškova gradnje može biti prikriven, s obzirom da izvođači radova mogu čekati povoljan trenutak, te ne prodavati novogradnju po njenom završetku, ukoliko potražnja u datom momentu nije zadovoljavajuća. S tim u vezi, delovanje inflacije na cene stambenih nekretnina može doći do izražaja u budućnosti. Iz tabele 3 se da primetiti da je najjača pozitivna korelacija sa zavisnom promenljivom, odnosno indeksom cena nekretnina ostvarila varijabla indeksa potrošačkih cena (0,958) pri signifikantnošću ($p < 0,05$). Prema Cohen-u (1988) ukoliko se korelacija kreće između 0,50 i 1,0 onda je reč o jakoj korelaciji.

Mnoga istraživanja pokazuju negativnu kauzalnost između kamatnih stopa i cena stambenih nekretnina. Trofimov (2018) ističe razloge jeftinog zaduživanja u kontekstu hipoteka manjih vrednosti, kao i jeftinih zajmova. Jeftini zajmovi utiču na to da domaćinstva povećavaju potražnju za nekretninama. Ravnotežu na tržište nekretnina donose investitori u stambene projekte, gde niske kamatne stope predstavljaju povoljno poslovno okruženje za izgradnju i finansiranje novih stambenih jedinica. U ovom istraživanju je dobijena negativna kauzalnost između kamatnih stopa na kredite i indeksa cena nekretnina (-0,432) pri značajnosti manjoj od 5%.

Jedna od bitnih pretpostavki primene metoda najmanjih kvadrata je da regresori nisu međusobno perfektno linearno zavisni, jer u slučaju da postoji perfektna korelacija među njima, ocene regresionih koeficijenata postaju nedeterminisane. Multikolinearnost prema tome, podrazumeva linearnu zavisnost među regresorima modela, i najbolje se objašnjava kao nedostatak nezavisnih varijacija u eksplanatornim varijablama da bi se sa preciznošću razdvojili njihovi zasebni uticaji na zavisnu varijablu (Jovičić i Mitrović-Dragutinović, 2018). Dakle, multikolinearnost postoji kada su nezavisne promenljive jako korelisane. U ovom istraživanju ćemo izračunati faktor porasta varijanse (engl. variance inflation factor – VIF), da bi testirali da li postoji ili ne postoji multikolinearnost između nezavisnih varijabli.

Svaka varijabla koja ima VIF koeficijent veći od 3 smatra se multikolnearnom i isključuje se iz modela. Takođe, u slučaju multikolinearnosti, koeficijenti varijabli su nestabilni i standardne greške su previsoke. Tabela u nastavku teksta prikazuje rezultate testiranja multikolinearnosti putem VIF koeficijenta.

Tabela 4 - Multikolnearna analiza preko faktora porasta varijanse za sve posmatrane nezavisne varijable

Variable	VIF	1/VIF
GDP	1,42	0,702497
CPI	1,35	0,739360
BCIR	1,51	0,661561
EXR	1,34	0,748452
HS	1,19	0,841246
Prosečna vrednost VIF	1,36	

Izvor: Kalkulacija autora

Kao što se može primetiti u prethodnoj tabeli, svaka pojedinačna nezavisna varijabla ima vrednost VIF koeficijenta manju od 3, što navodi na zaključak da ne postoji multikolinearnost između varijabli, pa postavljeni model vredi. U tabeli 3 je evidentno da nezavisne varijable između sebe imaju koeficijent korelacije ispod $r = 0,90$, što takođe navodi na zaključak da ne postoji multikolinearnost (Pallant, 2011).

Takođe, u ovom istraživanju ćemo pokazati da li su reziduali normalno distribuirani ili nisu putem Shapiro – Wilk W testa. Postaviće se dve hipoteze, i to:

Ho – Reziduali imaju normalnu distribuciju, i

H1 – Reziduali nemaju normalnu distribuciju.

Rezultati Shapiro- Wilk W testa su predstavljeni u sledećoj tabeli:

Tabela 5 - Rezultati Shapiro Wilk W testa za testiranje normalne distribucije reziduala

Varijabla	Obs	W	V	z	Prob>z
U	40	0,96975	1,196	0,376	0,35341

Izvor: Kalkulacija autora

Iz prethodne tabele, a prema rezultatima Shapiro Wilk testa se vidi da je verovatnoća veća od 5% što navodi na zaključak da se prihvata nulta hipoteza i da reziduali imaju normalnu distribuciju i odbacuje se alternativna hipoteza.

U statistici, niz slučajnih promenljivih je homoskedastičan ako sve njegove slučajne promenljive imaju istu konačnu varijansu, gde je ovo svojstvo poznato kao homogenost varijanse. Komplementarni pojam se naziva heteroskedastičnost poznat takođe kao heterogenost varijanse. Takođe, u ovom istraživanju ćemo ispitati homoskedastičnost i heteroskedastičnost reziduala uz pomoć Breusch – Paganovog testa, postavljanjem sledećih hipoteza:

H_0 – Reziduali su homoskedastični (imaju konstantnu varijansu), i

H_1 – Reziduali su heteroskedastični.

Rezultati Breusch – Pagan testa su predstavljeni u sledećoj tabeli:

Tabela 6 - Rezultati Breusch -Pagan testa za testiranje homoskedastičnosti i heteroskedastičnosti reziduala

chi 2(1)	0,86
Prob >chi2	0,3547

Izvor: Kalkulacija autora

Iz tabele 6, a prema rezultatima Breusch-Pagan testa se vidi da je verovatnoća veća od 5% i iznosi 35,47%, što navodi na zaključak da se prihvata nulta hipoteza i da reziduali imaju konstantnu varijansu, što je poželjno za model i odbacuje se alternativna hipoteza.

U tabeli 7 prikazani su rezultati regresije fiksnih efekata (FE) između odabranih varijabli u modelu. Ukupan broj opservacija je 40 što čini model relativno reprezentativnim. Empirijska vrednost F – testa za 8 stepeni slobode u numeraciji i 32 stepeni slobode u apoenu iznosila je 290,09. Nezavisne varijable koje su pokazale najznačajniju korelaciju sa zavisnom promenljivom, odnosno indeksom cena nekretnina u modelu, i čija je p – vrednost manja od 5% su sledeće: indeks potrošačkih cena (0,000), kamatna stopa na bankarske kredite (0,000) i devizni kurs dinara prema evru (0,003).

Tabela 7 - Regresioni model fiksnih efekata između zavisne (HPI) i nezavisnih varijabli na tržištu nekretnina Republike Srbije za period: 2014:Q1-2023:Q4

Nasumični efekti GLS regresije					Broj opservacija = 40	
R ² : unutar = 0,9791					Broj grupa = 4	
Između = 0,9454						
Ukupno: 0,9788					Opservacija po grupi min = 10	
Prosečno:10,0						
Maksimalno: 10						
F(8, 32) = 290,09						
Prob>F = 0,000						
HPI (zavisna)	Koef.	St. greška	t	P> t	[95% Interval poverenja]	
GDP	0,0035	0,3209	0,01	0,991	-0,6510	0,6581
CPI	2,1268	0,0746	28,48	0,000	1,9745	2,2791
BCIR	-3,0291	0,4151	-7,30	0,000	-3,8756	-2,1825

EXR	-1,5857	0,4851	-3,27	0,003	-2,5752	-0,5963
HS	0,8152	0,8807	0,93	0,362	-0,9810	2,6115
_cons	105,798	62,919	1,68	0,103	-22,525	234,123
Sigma_u	0,8695					
Sigma_e	5,6841					
Rho	0,02286					

Izvor: Proračun autora

Takođe, iz prethodne tabele se može primetiti da postoji inverzna veza između kamatne stope na bankarske kredite i indeksa cena nekretnina (-3.0291). Dakle, to znači da ako se BCIR smanji za 1% onda će HPI porasti za oko 3.029 pod pretpostavkom da se druge varijable smatraju nepromenjenim. Prema oceni banaka rast cena stambenih nepokretnosti i kamatnih stopa predstavljali su faktore smanjenja tražnje sektora stanovništva za kreditima na kraju 2022. godine. Standardi za odobravanje kredita na strani ponude pooštreni su od drugog tromesečja 2022. godine, na šta su najviše uticali povećani troškovi izvora finansiranja, manja konkurencija u bankarskom sektoru, te neizvesnost u kontekstu opšte ekonomske situacije, što se reflektovalo na smanjenu spremnost za preuzimanje rizika (Narodna banka Srbije, 2022). Isto tako negativna kauzalnost je zabeležena i između deviznog kursa dinara prema evru i indeksa cena nekretnina (-1.586). Prema Asalu (2018) devizni kurs je bitan indikator u određivanju cena stambenih nekretnina. Naime, slab devizni kurs u odnosu na strane zemlje može pozitivno uticati na cene nekretnina. Strani investitori ili sektor domaćinstva će imati veću želju za kupovinom domaće nekretnine u drugoj zemlji kada domaća valuta deprecira u odnosu na stranu valutu. U tom slučaju, domaće stambene nekretnine postaju jeftinije za strane investitore čija će povećana potražnja za nekretninama u inostranstvu povećati cene na tržištu nekretnina.

Vrednosti F statistike i Wald chi 2 testa su signifikantne na nivou značajnosti manjem od 5% za posmatrane skupove varijabli i podataka, što ukazuje na činjenicu da predloženi model dobro odgovara podacima. Isto tako rezultati analize pokazuju da oko 97.88% promena u indeksu cena nekretnina u Republici Srbiji je objašnjeno određenim nezavisnim varijablama koje se koriste u ovom modelu (Tabela 8).

Tabela 8 - Regresija slučajnih efekata (GLS) između zavisne (HPI) i nezavisnih varijabli na tržištu nekretnina Republike Srbije za period: 2014-2023. god.

Fiksni efekti unutar regresije					Broj opservacija = 40	
R ² : unutar = 0,9791					Broj grupa = 4	
Između = 0,9454						
Ukupno: 0,9788					Opservacija po grupi min = 10	
Prosečno:10,0						
Maksimalno: 10						
Wald chi 2 (5) =1.569,14						
Prob>F = 0,000						
HPI (zavisna)	Koef.	St. greška	t	P> t	[95% Interval poverenja]	
GDP	0,0075	0,3090	0,02	0,980	-0,5982	0,6134
CPI	2,1294	0,0717	29,66	0,000	1,9887	2,2701

BCIR	-3,0213	0,3995	-7,56	0,000	-3,8043	-2,2383
EXR	-1,5495	0,4658	-3,33	0,001	-2,4625	-0,6365
HS	0,8842	0,8461	1,04	0,296	-0,7742	2,5426
_cons	101,037	60,393	1,67	0,094	-17,330	219,40
Sigma_u	0					
Sigma_e	5,684					
Rho	0					

Izvor: Proračun autora

Na osnovu rezultata GLS regresionog modela na zavisnu varijablu, odnosno indeks cena nekretnina (HPI) najjači pozitivan uticaj imala je CPI nezavisna varijabla, što je naznačeno vrednošću koeficijenta od 2,1294 i vrednošću verovatnoće od 0,000. Dakle, to znači da ako se CPI poveća za 1% onda će HPI porasti za 2,1294 pod pretpostavkom da se druge varijable smatraju nepromenjenim. Rezultati ovog istraživanja su podržani studijama koje su sprovedli Zamillaili i Qoyum (2021), Panagiotidis i Printzis (2016), Fanama i Pratikto (2019), Fauzia (2019) i Mohan i ostali (2019) koji pokazuju da inflacija značajno pozitivno utiče na cene nekretnina. Teorijski, odnos između CPI i indeksa cena nekretnina objašnjava da povećanje CPI može izazvati povećanje cena građevinskog materijala, troškova rada i drugih operativnih troškova koji se odnose na izgradnju i održavanje nekretnina. Konsekventno, ovo može dovesti do rasta cena nekretnina.

S druge strane, iz tabele 8 se može primetiti da je najjača negativna veza zabeležena između kamatne stope na bankarske kredite i indeksa cena nekretnina (-3,0213) pri signifikantnošću manjom od 5%, što se može zaključiti da sa smanjivanjem kamatnih stopa na kredite raste potražnja za kreditima, kao i potražnja za nekretninama. Balqis i Purwono (2021) napominju da se kamatne stope uvek pomno prate, kako ne bi imale veliki uticaj kada rastu jer će usporiti realni sektor. Međutim treba napomenuti da se kamatne stope razlikuju od banke do banke uprkos pragu koji je postavila Narodna banka. To znači da će niža kamatna stopa povećati kupovnu moć pojedinca pri kupovini stana jer je kamata koja se plaća niža. S tim u vezi, to će delovati da se poveća potražnja za stambenim kreditima, kao i cena stanova. Tokom poslednjih godina povećan je promet na tržištu nekretnina, kako u Republici Srbiji, tako i u drugim zemljama okruženja. Dakle, poslednjih godina cene na tržištu nekretnina rasle su skoro kao na svetskom nivou, na čiji rast je uticalo mnoštvo faktora kao što su: povoljna kretanja na tržištu rada, niske kamatne stope, potraga za alternativnim investicijama, povećani rad od kuće usled pandemije COVID-19 i drugi faktori (Narodna banka Srbije, 2022).

Takođe, devizni kurs dinara prema evru je nezavisna varijabla koja ima značajan negativan uticaj na indeks cena nekretnina o čemu svedoči vrednost verovatnoće od 0,001, što je manje od 5% i vrednost koeficijenta od -1,5495. To znači da ako se devizni kurs dinara prema evru poveća za 1% indeks cena nekretnina će se konsekventno smanjiti za oko -1,5495 pod pretpostavkom da se ostale varijable smatraju nepromenjenim. Tokom 2022. godine dinar je ojačao prema evru za oko 0,2%. U istom periodu usled slabljenja evra prema dinaru na međunarodnom finansijskom tržištu dinar je oslabio prema dolaru za oko 5,7% (Narodna banka Srbije, 2022). Teorijski, ako se kurs domaće valute smanji, cene imovine domaćeg tržišta nekretnina, kao što su stambeni objekti, postaće jeftinije za strane investitore, te uslovi poput ovog mogu povećati priliv kapitala u sektor nekretnina i podići cene stambenih objekata. Osim toga, devizni kurs može uticati i na cenu proizvodnje građevinskog materijala jer sa povećanjem kursa domaće valute može doći do povećanja cena uvezenog građevinskog materijala, te će na kraju rasti i cene nekretnina. Magdalena (2015) navodi da je kurs važan u kupovini nekretnina jer kada valuta oslabi iznos glavnog duga plus kamate postaju sve viši za plaćanje. Tako da se cena kapitala povećava zbog kursa i u krajnjoj instanci povećava se cena nekretnine. Prema Sumer i Ozorhanu (2020) devizni kursevi mogu uticati na percepciju investitora o razmatranju stanovanja kao investicione opcije. Dakle, kada domaći kurs oslabi, više se mora trošiti na posedovanje imovine i dugoročno je radije kombinovati razne druge investicione instrumente.

Tabela 9 - Rezultati Hausman-ovog testa između nezavisnih varijabli za period: 2014.-2023. god.

Varijable	(b) Model fiksnih efekata	(B) Model slučajnih efekata	(b-B) Razlika	Sqrt (diag(V_b-V_B)) S.E.
GDP	0,0035446	0,0075657	-0,0040211	0,0864171
CPI	2,12682	2,129453	-0,002633	0,0205701
BCIR	-3,029115	-3,021348	-0,0077671	0,1126068
EXR	-1,585774	-1,54952	-0,0362541	0,1355381
HS	0,8152433	0,8842281	-0,0689848	0,2444094

Izvor: Proračun autora

$$\begin{aligned} \text{chi2}(5) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= \mathbf{0,12} \\ \text{Prob}>\text{chi2} &= \mathbf{0,9998} \end{aligned}$$

S obzirom da je chi kvadratna vrednost jednaka nuli, kao i to da je p – vrednost pojedinih nezavisnih varijabli jednaka nuli ili nešto veća od nule, ali manja od 5% (za varijable kao što su: indeks potrošačkih cena, kamatne stope na bankarske kredite i devizni kurs domaće valute u odnosu na evro) onda se može zaključiti da su pojedine nezavisne varijable imale uticaj na zavisnu varijablu. Takođe, prema rezultatima Hausman testa verovatnoća je veća od 5% i iznosi 0,9998 što navodi na zaključak da se prihvata nulta hipoteza, odnosno GLS regresija slučajnih efekata i odbacuje alternativna hipoteza, tj. model fiksnih efekata.

Zaključna razmatranja

Tržište stambenih nekretnina je od vitalne važnosti za stanovnike bilo koje zemlje, kao i za Vladu i pripadajuća državna upravljačka tela. Nekretnine kao oblik imovine imaju mnogo karakteristika koje ih razlikuju od drugih oblika imovine na tržištima. Ponuda nekretnina je lokalna, gde da bi se nekretnina uopšte ponudila na tržište treba znatno više vremena nego kod drugih proizvoda, s obzirom na vremenski rok faze planiranja i izgradnje nekretnina. Recimo, cene najma mogu ostati na istom nivou duži vremenski period nezavisno od situacije na tržištu iz razloga dugoročnog ugovora o najmu. Određena ograničenja tržišta stambenih nekretnina odnose se na transparentnost, gde se većina transakcija vrši bilateralnim pregovorima. Takođe, likvidnost ovog tržišta je ograničena zbog visokih transakcionih troškova, gde se kupci uglavnom oslanjaju na kredite banaka. S tim u vezi, navedene karakteristike uzrokuju kretanje cena stambenih nekretnina po drugačijim obrascima od drugih oblika imovine.

U toku proteklih nekoliko godina povećan je promet na tržištu nekretnina, kako u Republici Srbiji, tako i u drugim zemljama regiona. Dakle, cene nekretnina su rasle skoro na svetskom nivou, na šta su uticali brojni faktori poput povoljnijih kretanja na tržištu rada, niskih kamatnih stopa, potraga za alternativnim vidovima investicija i drugi faktori.

Rad obuhvata teorijski i empirijski deo istraživanja koji se sproveden uz pomoć korelacione i regresione analize. Osnovni cilj ovog rada je bio da se istraži uticaj određenih makroekonomskih i bankarskih indikatora na cene nekretnina u Republici Srbiji za period od prvog kvartala 2014., do četvrtog kvartala 2023. godine.

Dakle, u ovom istraživanju su korišćeni efekti nezavisnih varijabli i njihov uticaj na zavisnu varijablu korišćenjem objedinjenog OLS regresionog modela (FE) i regresionog modela slučajnih efekata (GLS) uz pomoć Hausmanovog testa. Primena modela višestruke linearne regresije ukazuje na to da je indeks cena nekretnina u poslednjih 10 godina u pozitivnoj korelaciji i sa visokom značajnošću sa indeksom potrošačkih cena, a u negativnoj korelaciji sa kamatnom stopom na bankarske kredite i deviznim kursom dinara prema evru. Za razliku od prethodnih rezultata istraživanja, rast bruto domaćeg proizvoda, kao i rast štednje sektora stanovništva ne izgledaju statistički značajni. Stoga se predlaže Vladi da održava stabilnost indeksa potrošačkih cena kako bi se održala stabilnost cena nekretnina. U kontekstu testiranja postavljenih hipoteza rezultati istraživanja putem Hausmanovog testa su pokazali da je verovatnoća veća od 5%, što upućuje na zaključak da se prihvata nulta hipoteza, odnosno GLS regresija slučajnih efekata i odbacuje alternativna hipoteza, odnosno model fiksnih efekata. Pitanje o važnosti tržišta nekretnina ponovo je aktuelno iz razloga opravdane percepcije mladih ljudi i domaćinstava gde je skoro pa nemoguće kupiti vlastitu nekretninu.

Ograničena relevantna literatura na ovu temu takođe ograničava razvoj daljih istraživanja faktora koji utiču na cene nekretnina. S tim u vezi, potrebna su dalja istraživanja koja bi uključivala duži vremenski period i veći broj zemalja, kako bi se dopunilo i razvilo razumevanje determinanti cena nekretnina. Isto tako nova istraživanja autora u datoj problematici mogu se proširiti uključivanjem većeg broja nezavisnih varijabli. Ovo istraživanje takođe može biti od pomoći da se procene buduće promene indeksa cena nekretnina, koje su pre svega uslovljene promenama posmatranih makroekonomskih i bankarskih varijabli.

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DETERMINANTS OF THE REAL ESTATE MARKET IN THE REPUBLIC OF SERBIA: OVERVIEW AND FINDINGS

Prof. Almir Alihodžić. PhD

Tenured professor, Faculty of Economics, University of Zenica
almir.dr2@gmail.com

Summary: *Value changes in the real estate market affect both the quality of bank loan portfolios and financial stability and the real economy. The Republic of Serbia is one of the countries facing an upward trend in demand for housing. This paper investigates the impact of macroeconomic and banking variables on the real estate price index in Serbia for the period from 2014 to 2023 on a quarterly basis. Also, panel regression and correlation analysis are applied in this research. The selected independent (explanatory) variables are the gross domestic product, the consumer price index, the interest rate on bank loans, the exchange rate of the domestic currency against the euro and household saving. The research results showed that the independent variable consumer price index had the most significant impact on the housing price index. On the other hand, the following independent variables had the most significant negative impact on the dependent variable (housing price index): interest rate on bank loans and the domestic currency against the euro.*

Keywords: Real estate price index, macroeconomic variables, banking variables, Shapiro Wilk test, Breusch-Pagan test, regression analysis, Hausman test.

JEL classification: R30, E31, G51

Introductory Considerations

Accommodation and housing are considered basic human needs. To achieve this, it is the civic duty of every community to help people manage adequate housing. In this way, the Government is trying to provide a consumer-friendly approach to succeed in implementing its decisions on the housing market. For the economy to develop in the right direction, it is important to establish a balance between housing demand and availability (Rozin, 2020).

Therefore, housing is the main component of household wealth and one of the main drivers of private consumption (Mian et al., 2013). Furthermore, housing markets are highly relevant to financial stability, as housing price bubbles have historically been dramatically damaging events. In this regard, the assessment of trends and risks in housing markets is crucial for central banks (Jorda et al., 2015). Choosing the right mix of policies depends on the availability of detailed and timely information on housing supply and demand. For example, policymakers may want to choose different policies depending on whether excessive house price growth is due to a demand-side boom or a low supply.

The development of the housing market is determined by many closely related economic, legal, financial, institutional, and political factors. They can be quantified primarily in international terms, where macroeconomic factors such as gross domestic product (GDP), inflation, rates of return, and the availability of mortgage loans play a significant role. Several factors affect demand, generally regardless of local variations. These can be various causes and administrative-political, legal, and economic mechanisms, such as the housing policy of state authorities, the existing system of loans and the possibilities of obtaining them, the inflation rate, and others (Hott et al., 2008).

Housing prices are correlated with business cycle movements and a wide range of real variables, such as investment and consumption. In connection with these attributes, the real estate sector in many countries has become one of the key sectors of economic growth and development. In the last decade, especially in most industrialized countries, housing prices have risen dramatically due to low long-term interest rates, economic growth, and high liquidity (Ahearne et al., 2005).

The vital issues of housing and economic development have received much attention in the last two decades. The global financial crisis of 2008 showed a significant connection between housing and the economy. It was also probably one of the worst financial crises in the US that formed a super housing bubble in the global real estate market.

After the collapse of the US real estate market or the subprime market crisis of 2008-2009, there was a resurgence of focus on the real estate market. The real estate market has a dual role as a consumer good and as an investment, which is recognized in the literature (Leung, 2004). The COVID-19 pandemic has further changed and created certain real estate price trends of its own.

In recent years, the turnover in the real estate market has increased in the Republic of Serbia, which was in line with trends in this segment of the market, as well as in other countries. Therefore, turnover was higher in 2022 by 22% compared to 2021. The given market trends were influenced by several factors such as increased demand for real estate, which was primarily a reflection of positive trends in the labor market, favorable credit conditions, low-interest rates, the search for alternative investments, increased work from home due to the pandemic and other factors (National Bank of Serbia, 2022).

The main goal of this research is to determine to what extent and with what intensity the selected macroeconomic and banking variables influence the movement of the housing price index in the Republic of Serbia. The null hypothesis supports the random effects model. On the other hand, the alternative hypothesis supports the fixed effects model. The paper will test the following hypotheses:

H0: Null hypothesis: The random effects model is appropriate.

H1: Alternative hypothesis: The fixed effects model is appropriate.

The hypotheses in this research will be tested using the Hausman test.

The paper is structured in six parts. The first part refers to the introductory considerations with emphasis on the importance of the real estate market, the research objective, and the set hypotheses. The second part describes an overview of previous research in terms of the influence of various demographic, social, macroeconomic, and banking indicators on the movement of the real estate price index and other relevant indicators on the real estate market. The third part briefly analyzes the state of the real estate market in Serbia through the prism of selected indicators on the real estate market. The fourth part describes the chosen research methodology with a focus on the fixed effects model and the random effects model. The fifth part refers to the data needed for the analysis. The sixth part presents the obtained research results, as well as certain observations and recommendations.

Review of Relevant Literature

The variety of prices and activities of the housing market at the regional level stems primarily from the variety of socio-economic factors and social processes. Special attention in many papers is devoted to demographic factors that include age, gender, marital status, and which affect housing needs. The demographic situation can change as a result of migration between countries, regions, and individual cities (Annas et al., 1984).

Many authors have studied the relationship between demographics and the real estate market. An increase in the number of babies has little short-term effect on the housing market but increases the demand for new houses twenty years later. A decrease in the number of births or an increase in the average age of the population strongly affects the demand and the prices of apartments (Mankiw & Weil, 1989).

A significant share of housing expenditures in household budgets results in a close correlation between income growth in a given area and housing price growth (Reichert, 1990). The results of empirical research according to Galin (2006) indicate that due to the low flexibility of the income of the housing market, the given relationship can be debatable in many cases.

Incomes of the population are closely related to the labor market, and in addition to income and employment opportunities, they are an important potential of the region, which increases local housing prices. Also, there are expectations that the increase in the percentage of unemployed in this area will affect the decrease in the price of apartments (Berg, 2002).

Economic factors include not only the income of the population and the labor market, but also the state of the local economy. This can be reflected in an indicator such as the local GDP, although empirical research conducted on the Canadian market shows that relationships that are quite logical and obvious are not always confirmed in practice. Equally important are the indicators that derive directly from the real estate market, and refer to the balance or imbalance between supply and demand (Allen et al, 2009).

The level of development of the housing market reflects the economic condition of households, which depends primarily on the stability of income. Therefore, the effective demand, and as a result the price of apartments, is largely influenced by the financial resources of households such as savings and disposable income (Lin et al, 2014).

Macroeconomic factors are of capital importance in understanding price movements in the real estate market. According to Irandoust (2019), the prices of residential real estate are determined by the law of supply and demand, which further means that every factor that affects the said law also has an impact on the price determination of the place of residence. In this regard, macroeconomic factors can have a decisive influence in terms of determining the overvaluation or undervaluation of the value of residential real estate.

Kau and Keenan (1980) conducted a related study on the relationship between interest rates and housing prices. They concluded that increased interest rates mainly affect the decrease in demand in the real estate market and consequently decrease the price of apartments. Contrary to Cow and Keenan, Geoffrey (2002) and Ahearne et al. (2005) believe that as interest rates rise, the costs of investing in real estate development will increase and profits will decrease, which would indirectly lead to a decrease in the supply of real estate, and ultimately to an increase in real estate prices.

Also, Pillaiyan (2015) found an inverse relationship between interest rate and housing prices in Malaysia and argued that low interest rates fueled the property price bubble. Likewise, she stated that any increase in interest rates in the short term leads to a corresponding change in the price of apartments.

Lin et al. (2014) used twenty local indicators, including population age, marriage rate, education, unemployment, safety, air quality, etc. The research results showed that the market value measured by the number of transactions proved to be a disincentive measure of the average price of apartments.

Belke and Keil (2018) summarize four approaches to the variables that affect residential real estate prices. Namely, first, the asset pricing approach that links real estate prices to future discounted income. Second, it focuses on the affordability and sustainability of the prices of apartments or other private households. This is analyzed through the income ratio, then the loan-to-value index ratio, then the actual monthly mortgage cost-to-income ratio. Third, there is the hedonic pricing method. This means that hedonic pricing modeling takes into account the specific characteristics of individual buildings or neighborhoods, each of which contributes to the overall value of the property. Fourth, some econometric models directly estimate the effect of real estate prices. Such models are based on some form of national, regional, or local house price index combined in time series or panel form.

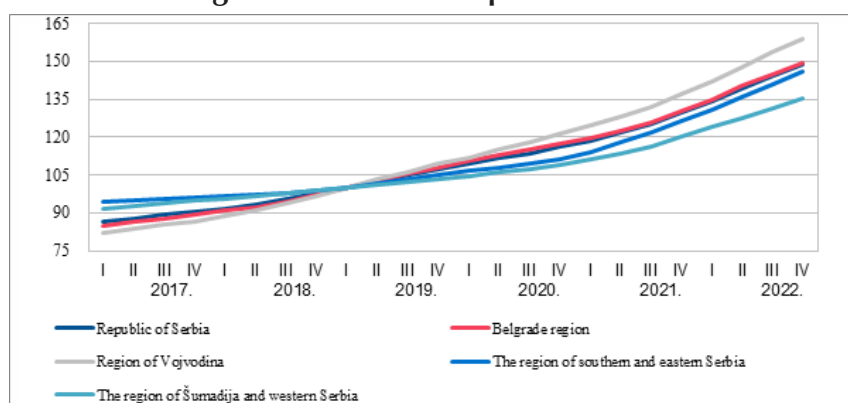
In his research, Trofimov (2018) shows that with long-term high economic growth, residential construction can become excessively stimulating, where there is excessive construction, which consequently creates a supply of residential real estate greater than the demand. This results in a drop in real estate prices.

Tripathi (2019) in his extensive cross-country research uses a random effect model and suggests that the government should adjust monetary policies such as inflation and money supply to curb real estate prices. Also, Khoo et al. (2019) studied real estate prices in Malaysia, and in the same way, recommended that the Government should strengthen the promotion of housing prices to avoid accelerated inflation. Price stability helps to maintain financial and economic activity at a satisfactory level. Therefore, the policy of price stability is a valuable tool for lowering and stabilizing inflation.

Analysis of Selected Indicators on the Real Estate Market of the Republic of Serbia

The apartment price index was developed by international guidelines as well as based on a model for the mass assessment of apartments, which, in addition to prices from sales contracts, also takes into account various qualitative characteristics of real estate from relevant sources. The movement of the index value provides insight into the continuous trend of rising apartment prices during the observed period (National Bank of Serbia, 2022). The graph below illustrates the trend of the housing price index on the real estate market in the Republic of Serbia for the period: 2017 - 2022.

Graph 1 - Trend of the Housing Price Index in the Republic of Serbia for the Period: 2017 – 2022

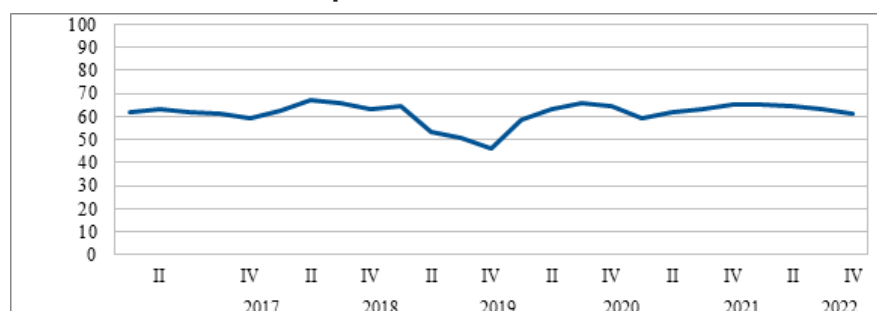


Source: www.nbs.rs (Accessed on: January 16, 2024)

The price index of apartments on the real estate market in the Republic of Serbia at the end of the fourth quarter of 2022 was 148.79, which is about 64% higher than in the fourth quarter of 2017. From the point of view of the region, the prices of apartments increased the most in the region of Vojvodina by about 16.02% and in the city of Belgrade by about 14.91%. As the largest number of assessed residential properties refers to the Belgrade region, it can be concluded that the average estimated value per square meter of residential properties in the Republic of Serbia is to the greatest extent determined by the movement of the assessed value of residential properties in the Belgrade region (National Bank of Serbia, 2022).

Loan-to-value is an indicator of the relationship between the value of the mortgage loan and the value of the real estate used to secure the given loan.

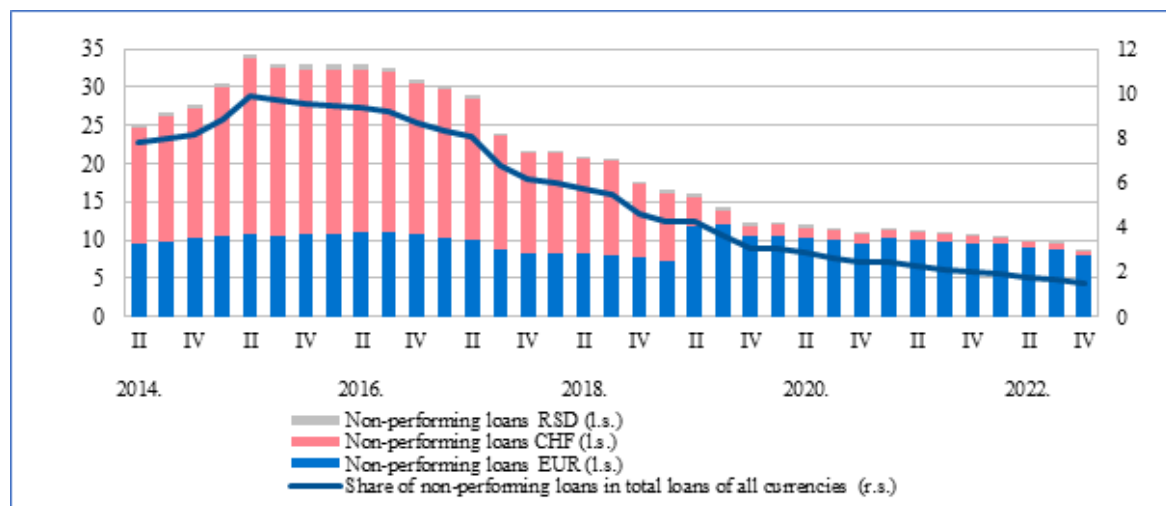
Graph 2 - The Value of Housing Loans for which the Apartment is Mortgaged in Relation to the Estimated Value of the Apartments - LTV Ratio for the Period: 2017 – 2022



Source: www.nbs.rs (Accessed on: January 16, 2024)

From the previous graph, it should be noted that the value of the LTV ratio in the last quarter of 2022 was 61.1%, which represents a relative increase compared to the fourth quarter of 2017 by about 2.55%. The average value of the LTV ratio is well below the prescribed level of 80%. To ensure the conditions for a better assessment of the value of real estate, which consequently affects the reduction of the risk of new non-performing loans, and the development of the market of non-performing loans, the National Bank of Serbia has been maintaining a database of real estate valuations that are the subject of mortgages and loans secured by mortgages since 2015 (National Bank of Serbia, 2022).

Graph 3 - Non-Performing Residential Construction Loans on the Real Estate Market of the Republic of Serbia for the Period: 2014 - 2022



Source: www.nbs.rs (Accessed on: January 16, 2024)

Real estate is very common in the banking sector of the Republic of Serbia as a loan collateral. In this regard, an adequate assessment of the value of real estate is of essential importance because banks are directly exposed to the risk of changes in the market prices of real estate. The previous graph shows a significant decrease in non-performing loans in 2022, which amounted to about 3.3% compared to 2014, where the share was over 20%. The reasons for the different time periods of the analysis of the selected indicators on the real estate market of the Republic of Serbia and the econometric analysis are primarily the lack of domestic statistics of the observed data.

Research Methodology

Econometric modeling of real estate prices using socioeconomic and environmental factors has a relatively long tradition and is often described in literature. An extensive review of statistical models describing the relationships between housing prices and the factors affecting them at the national, regional, and local levels was presented by Gasparenie et al. (2014) where they listed the advantages and disadvantages of the models as well as their structural elements. A question is often asked: why use panel regression analysis and data in different studies? The advantages of using panel analysis and data are numerous. Hsiao (1985), Clevermarket (1989), and Solon (1989) have listed several advantages of using panel data. Furthermore, panel data provide more informative data, greater variability, less collinearity among variables, and more degrees of freedom, and thus greater efficiency.

There are three types of panel analytical models used, namely: (1) pooled regression model, (2) fixed effect model, and (3) random effect model. A pooled regression model is one type of model that has constant coefficients related to both intercepts and slopes. For this model, researchers can pool all the data and run an ordinary least squares regression model. The fixed effect model is the differences between the cross-sectional units that can be captured by the differences in the constant term, and the intercept term of the regression model varies across the cross-sectional units. In a random effect model, the individual effects are randomly distributed across the cross-sectional units and to capture the individual effects, a regression model is specified with the intercept term representing the overall constant term (Seddigi and Lawler, 2000).

The main goal of this research is to measure key macroeconomic and banking indicators of real estate price changes. Estimates of potential determinants refer to existing literature. The econometric model is presented as follows:

$$\% \Delta HPI = \beta_0 + \beta_1 * (\% \Delta GDP) + \beta_2 * (\% \Delta CPI) + \beta_3 * (\% \Delta BCIR) + \beta_4 * (\% \Delta EXR) + \beta_5 * (\% \Delta HS) \quad (1)$$

An econometric model is a multiple regression model, including two or more explanatory variables. To account for the difference between the observed data and the expected value, a random error term is added $\varepsilon_i = \% \Delta$ the price of real estate - E (% Δ the price of real estate), where the equation of the new econometric model can be written as follows:

$$\% \Delta HPI = \beta_0 + \beta_1 * (\% \Delta GDP) + \beta_2 * (\% \Delta CPI) + \beta_3 * (\% \Delta BCIR) + \beta_4 * (\% \Delta EXR) + \beta_5 * (\% \Delta HS) + \varepsilon_i \quad (2)$$

The basic assumption is that the observed values of the econometric model satisfy the population ratio and adhere to the strict rules of exogeneity, conditionally uncorrelated errors, and normality of errors. In addition, it is important to note that there is no absolutely correct linear relationship between the explanatory variables. If the p-value is statistically significant, the fixed effect model should be used. On the other hand, if the p-value is not statistically significant, the random effect model should be used. The significance test was performed for all variables using the t-test at a significance level of 95% (Chmelarova, 2007).

Data

This research focuses on the following variables: the dependent variable will be the housing price index in the Republic of Serbia (HPI), while the gross domestic product (GDP), the consumer price index (CPI), the interest rate on bank loans (BCIR), the exchange rate dinars to the euro (EXR) and savings of the household sector (HS) considered as independent variables. The choice of observed variables for the analysis is the significant price growth and attractiveness of the real estate sector in the Republic of Serbia, as well as the assumed causality of independent variables as significant predictors. The research covers the period from the first quarter of 2014 to the fourth quarter of 2023. The analysis will be based on quarterly data because annual data is an unreliable sample for econometric evaluation. The data were collected from the official websites of the National Bank of Serbia, the Republic Institute for Statistics of Serbia, and the World Bank. The measurement and expected effect of the dependent and independent variables are given in Table 1.

Table 1 - Brief description of dependent and independent variables in the model

Variable	Abbreviation	Expected effect
Housing price index	HPI	
Gross domestic product	GDP	(+)
Consumer price index	CPI	(+)
Interest rate on bank loans	BCIR	(-)
Exchange rate of dinars against the euro	EXR	(-)
Household saving	HS	(+)

Source: Calculation by the author

Housing price index (HPI) - measures changes in residential real estate prices as a percentage change since some specified starting date that has an HPI of 100. Therefore, the real estate price index is an index number for measuring the level of price movements of residential property (apartments, private houses, terraced houses, etc.) that households periodically buy.

Gross domestic product (GDP) - is the total monetary or market value of all finished goods or services produced within the country's borders in a given period. As a broad measure of total domestic production, it functions as a comprehensive indicator of the economic health of the country under review (<https://www.investopedia.com>). GDP plays a significant role in the formation of residential real estate prices. According to Razali and Tan (2016), preferred economic growth raises residential real estate prices.

Consumer price index (CPI) - is the price index, that is, the price of the average weighted market basket of consumer goods and services purchased by households. Changes in the measured CPI follow price changes over time. Therefore, the consumer price index is the most frequently discussed measure of inflation. In general, an increase in the CPI can cause an increase in the prices of construction materials, labor costs, and other operating costs related to the construction and maintenance of housing. In this research, a positive correlation is assumed between the housing price index and the consumer price index.

The interest rate on bank loans (BCIR) - interest is a monetary fee for the use of borrowed money. Therefore, interest is the amount of money that a lender or financial institution receives for lending money. When interest rates rise, borrowing costs rise in parallel, and potential buyers are discouraged. As a result, demand for residential real estate is falling. According to Andrews (2010), there is a negative correlation between real estate prices and interest rates, which also depends on the degree of competition in the banking sector. In this paper, a negative correlation is assumed between the housing price index and interest rates on bank loans.

Exchange rate of dinars against the euro (EXR) - the exchange rate is the rate at which one currency will be exchanged for another currency and affects trade and the movement of money between countries. Exchange rates are affected by both the value of the domestic currency and the value of the foreign currency. Exchange rates can affect international flows of capital entering the real estate market. If the exchange rate of the domestic currency falls, the prices of domestic real estate assets such as housing will become cheaper for foreign investors, and conditions like this can increase capital inflows into the real estate sector and raise real estate prices. The study assumes a negative correlation between the housing price index and the exchange rate of the dinar against the euro.

Household saving (HS) - deposits are the main source of banking potential. Deposit sources make up over three-quarters of the total sources of bank funds (Plakalović & Alihodžić, 2015). The total savings of the household sector in banks in the Republic of Serbia continued its growth trend, strengthening the deposit base of the banking sector (National Bank of Serbia, 2022).

Results and Discussion

The results of descriptive statistics, correlation, multicollinearity, normal distribution, homoscedasticity, and heteroscedasticity as well as regression are presented in Tables 2-9. The total number of observations is 40, which represents a relatively representative sample both from the point of view of available data on the real estate market in the Republic of Serbia and in terms of the time frame.

Table 2 - Descriptive Statistics Between Dependent and Independent Variables in the Model on the Real Estate Market of the Republic of Serbia for the Period: 2014: Q1 – 2023: Q4

Indicators	HPI	GDP	CPI	BCIR	EXR	HS
Mean	1.3777E2	2.245	112.210	6.431	1.1880E2	1.4467E0
Std. Deviation	35.184	3.392	14.235	2.704	2.180	1.13225582E0
Variance	1.238E3	11.506	202.65	7.313	4.755	1.282
Skewness	0.586	0.552	1.346	1.078	1.116	-0.740
Kurtosis	-0.857	3.143	0.759	0.595	0.327	0.939
Min	94.91	-6.3	97.8	3.31	115.38	1.8027E0
Max	203.37	13.8	146.1	14.13	123.97	3.49667E0

Source: Calculation by the author based on data from the National Bank of Serbia, the Republic Institute of Statistics and data from the World Bank

The previous table illustrates the results of descriptive statistics between the dependent variable, i.e., the housing price index, and independent variables: gross domestic product, consumer price index, interest rates on bank loans, dinar exchange rate against the euro, and savings of the household sector. In terms of the movement of the first measure of risk, i.e. the standard deviation, the following variables recorded the strongest volatility: the savings rate of the household sector, the housing price index (35.18%), and the consumer price index (14.23%). Also, the mean followed a parallel trend as the standard deviation. Despite increased uncertainty at the global level, then tensions caused by geopolitical factors and the crisis in Ukraine, the total savings of the household sector continued the growth trend, thereby strengthening the deposit base of the banking sector of the Republic of Serbia, which constitutes the main source of financing credit activity. For example, foreign currency savings at the end of 2022 reached the amount of about 12.8 billion euros, which in absolute terms is more than 0.5 billion euros compared to 2021. Likewise, the savings of the household sector in banks in the Republic of Serbia in the fourth quarter of 2023 is about 65% higher than in the fourth quarter of 2014.

The analysis of the profitability of savings carried out by the National Bank of Serbia shows that over the past ten years, dinar savings have been more profitable than savings in euros both in the short and long term, thanks primarily to the following factors: healthy and preserved financial stability, relatively higher interest rates on savings in dinars than on savings in euros, more favorable tax treatment of savings in domestic currency, and other factors (National Bank of Serbia, 2022). Also, one of the essential factors in the growth of savings of the household sector in banks in the Republic of Serbia is the absence of alternative and more favorable forms of savings and investments. In this regard, the housing price index showed great volatility and oscillation, so that at the end of the fourth quarter of 2014, it increased from 96.47 index points to 203.37 at the end of the fourth quarter of 2023, which is an increase of about 110.81%.

Table 3 - Correlation Analysis (Pearson Coefficient of Correlation) Between the Dependent Variable and Independent Variables on the Real Estate Market of the Republic of Serbia for the Period: 2014:Q1 – 2023: Q4

		HPI	GDP	CPI	BCIR	EXR	HS
HPI	Pearson Correlation	1.000	0.206	0.958	-0.432	-0.517	0.124
	Sig. (2-tailed)	-	0.202	0.000	0.004	0.001	0.447
	N	40	40	40	40	40	40
GDP	Pearson Correlation	0.206	1.000	0.107	-0.471	-0.084	-0.150
	Sig. (2-tailed)	0.202	-	0.511	0.002	0.605	0.357
	N	40	40	40	40	40	40
CPI	Pearson Correlation	0.958	0.107	1.000	-0.217	-0.466	0.036
	Sig. (2-tailed)	0.000	0.511	-	0.179	0.002	0.824
	N	40	40	40	40	40	40
BCIR	Pearson Correlation	-0.432	-0.471	-0.217	1.000	0.064	-0.214
	Sig. (2-tailed)	0.004	0.002	0.179	-	0.697	0.185
	N	40	40	40	40	40	40
EXR	Pearson Correlation	-0.517	-0.084	-0.466	0.064	1.000	-0.151
	Sig. (2-tailed)	0.001	0.605	0.002	0.697	-	0.351
	N	40	40	40	40	40	40
HS	Pearson Correlation	0.124	-0.150	0.036	-0.214	-0.151	1.000
	Sig. (2-tailed)	0.447	0.357	0.824	0.185	0.351	-
	N						

Source: Calculation by the author based on data from the National Bank of Serbia, the Republic Institute of Statistics and data from the World Bank

The results of the research by Kostas and Haibin (2004) show that there is a positive impact of inflation on residential real estate prices. The given conclusion is explained by the costs of building apartments. In the period when inflation occurs, the prices of construction materials increase, which consequently makes the work more expensive. To achieve the desired profit, contractors or investors then increase the selling prices. The effect of construction costs can be hidden, given that contractors can wait for a favorable moment and not sell a new building after its completion if the demand at that moment is not satisfactory. In this regard, the effect of inflation on the prices of residential real estate may come to the fore in the future. From Table 3, it should be noted that the strongest positive correlation with the dependent variable, i.e., the housing price index, was achieved by the consumer price index (0.958) at significance ($p < 0.05$). According to Cohen (1988), if the correlation is between 0.50 and 1.0, then it is a strong correlation.

Many studies show negative causality between interest rates and housing prices. Trofimov (2018) highlights the reasons for cheap borrowing in terms of mortgages of lower value as well as cheap loans. Cheap loans influence households to increase demand for real estate. Investors in housing projects bring balance to the real estate market, where low-interest rates represent a favorable business environment for the construction and financing of new housing units. In this research, a negative causality was obtained between interest rates on loans and the housing price index (-0.432) at a significance of less than 5%.

One of the important assumptions of applying the least squares method is that the regressors are not perfectly linearly dependent on each other, because if there is a perfect correlation between them, the estimates of the regression coefficients become indeterminate. Multicollinearity, therefore, implies linear dependence among the model's regressors and is best explained as the lack of independent variation in the explanatory variables to accurately separate their separate effects on the dependent variable (Jovičić & Mitrović-Dragutinović, 2018). Therefore, multicollinearity exists when the independent variables are highly correlated. In our research, we will calculate the variance inflation factor (VIF) to test whether or not there is multicollinearity between the independent variables. Every variable that has a VIF coefficient greater than 3 is considered multicollinear and is excluded from the model. Also, in the case of multicollinearity, the variable coefficients are unstable, and the standard errors are too high. The table below shows the results of multicollinearity testing using the VIF coefficient.

Table 4 - Multicollinear analysis over the variance inflation factor for all observed independent variables

Variables	VIF	1/VIF
GDP	1.42	0.702497
CPI	1.35	0.739360
BCIR	1.51	0.661561
EXR	1.34	0.748452
HS	1.19	0.841246
Mean VIF	1.36	

Source: Calculation by the author

As can be observed in the previous table, every single independent variable has a VIF coefficient value less than 3, which leads to the conclusion that there is no multicollinearity between the variables, so the set model is valid. In Table 3, it is evident that the independent variables have a coefficient of correlation below $r=0.90$, which also leads to the conclusion that there is no multicollinearity (Pallant, 2011).

Also, in this research, we will show whether the residuals are normally distributed or not through the Shapiro-Wilk W test. Two hypotheses will be put forward, namely:

Ho – The residuals have a normal distribution, and

H1 – The residuals do not have a normal distribution.

The results of the Shapiro-Wilk W test are presented in the following table:

Table 5 - Results of the Shapiro Wilk W test for Testing the Normal Distribution of Residuals

Variable	Obs	W	V	z	Prob>z
U	40	0.96975	1.196	0.376	0.35341

Source: Calculation by the author

From the previous table and according to the results of the Shapiro Wilk test, it can be seen that the probability is greater than 5%, which leads to the conclusion that the null hypothesis is accepted and that the residuals have a normal distribution, and the alternative hypothesis is rejected.

In statistics, a sequence of random variables is homoscedastic if all of its random variables have the same finite variance, where this property is known as homogeneity of variance. A complementary term is called heteroskedasticity, also known as heterogeneity of variance. Also, in this research, we will examine the homoscedasticity and heteroscedasticity of the residuals with the help of the Breusch-Pagano test, by setting the following hypotheses:

Ho – Residuals are homoscedastic (have constant variance), and

H1 – Residuals are heteroskedastic.

The results of the Breusch-Pagan test are presented in the following table:

Table 6 - Results of the Breusch-Pagan Test for Testing the Homoscedasticity and Heteroscedasticity of the Residuals

chi 2(1)	0.86
Prob > chi2	0.3547

Source: Calculation by the author

From Table 6, and according to the results of the Breusch-Pagan test, it can be seen that the probability is greater than 5% and amounts to 35.47%, which leads to the conclusion that the null hypothesis is accepted and that the residuals have a constant variance, which is desirable for the model and the alternative hypothesis is rejected.

Table 7 shows the results of fixed effects (FE) regression between selected variables in the model. The total number of observations is 40, which makes the model relatively representative. The empirical value of the F-test for 8 degrees of freedom in numbering and 32 degrees of freedom in denomination was 290.09. The independent variables that showed the most significant correlation with the dependent variable, i.e., the housing price index in the model, and whose p-value is less than 5% are the following: consumer price index (0.000), interest rate on bank loans (0.000) and exchange rate of dinar to euro (0.003).

Table 7 - Regression model of fixed effects between dependent (HPI) and independent variables on the real estate market of the Republic of Serbia for the period: 2014:Q1-2023:Q4

Fixed effects within the regression					Number of observations = 40	
R ² : within = 0.9791					Number of groups = 4	
Between = 0.9454						
Total: 0.9788					Observations by group min = 10	
Average: 10.0						
Maksimum: 10						
F(8, 32) = 290.09						
Prob>F = 0.000						
HPI (dependent)	Coeff.	St.error	t	P> t	[95% Confidence interval]	
GDP	0.0035	0.3209	0.01	0.991	-0.6510	0.6581
CPI	2.1268	0.0746	28.48	0.000	1.9745	2.2791
BCIR	-3.0291	0.4151	-7.30	0.000	-3.8756	-2.1825

EXR	-1.5857	0.4851	-3.27	0.003	-2.5752	-0.5963
HS	0.8152	0.8807	0.93	0.362	-0.9810	2.6115
_cons	105.798	62.919	1.68	0.103	-22.525	234.123
Sigma_u	0.8695					
Sigma_e	5.6841					
Rho	0.02286					

Source: Calculation by the author

Also, from the previous table, it can be noted that there is an inverse relationship between the interest rate on bank loans and the housing price index (-3.0291). Therefore, this means that if the BCIR decreases by 1% then the HPI will increase by about 3.029 assuming other variables are considered unchanged. According to the assessment of the banks, the growth of residential real estate prices and interest rates were factors in reducing the demand of the household sector for loans at the end of 2022. The standards for approving loans on the supply side have been tightened since the second quarter of 2022, which was mostly influenced by the increased costs of financing sources, less competition in the banking sector, and uncertainty in terms of the general economic situation, which was reflected in a reduced willingness to take risks (National Bank of Serbia, 2022).

Likewise, negative causality was recorded between the dinar exchange rate against the euro and the housing price index (-1,586). According to Asal (2018), the exchange rate is an important indicator in determining the prices of residential real estate. Namely, a weak exchange rate compared to foreign countries can have a positive effect on real estate prices. Foreign investors or the household sector will have a greater desire to buy domestic real estate in another country when the domestic currency depreciates against the foreign currency. In this case, domestic residential real estate becomes cheaper for foreign investors whose increased demand for real estate abroad will increase prices in the real estate market.

The values of the F statistic and the Wald chi 2 test are significant at a significance level of less than 5% for the observed sets of variables and data, which indicates the fact that the proposed model fits the data well. Likewise, the results of the analysis show that about 97.88% of the change in the housing price index in the Republic of Serbia is explained by certain independent variables used in this model (Table 8).

Table 8 - Random effects regression (GLS) between dependent (HPI) and independent variables on the real estate market of the Republic of Serbia for the period: 2014 - 2023.

Random effects GLS regression					Number of observations = 40	
R ² : within = 0.9791					Number of groups = 4	
Between = 0.9454						
Total: 0.9788					Observations by group min = 10	
Average: 10.0						
Maximum: 10						
Wald chi 2 (5) =1.569,14						
Prob>F = 0.000						
HPI (dependent)	Coeff.	St. Error	t	P> t	[95% Confidence interval]	
GDP	0.0075	0.3090	0.02	0.980	-0.5982	0.6134
CPI	2.1294	0.0717	29.66	0.000	1.9887	2.2701

BCIR	-3.0213	0.3995	-7.56	0.000	-3.8043	-2.2383
EXR	-1.5495	0.4658	-3.33	0.001	-2.4625	-0.6365
HS	0.8842	0.8461	1.04	0.296	-0.7742	2.5426
_cons	101.037	60.393	1.67	0.094	-17.330	219.40
Sigma_u	0					
Sigma_e	5.684					
Rho	0					

Source: Calculation by the author

Based on the results of the GLS regression model on the dependent variable, namely the housing price index (HPI), the CPI independent variable had the strongest positive impact, which is indicated by the coefficient value of 2.1294 and the probability value of 0.000. Therefore, this means that if the CPI increases by 1% then the HPI will increase by 2.1294 assuming other variables are considered unchanged. The results of this research are supported by studies conducted by Zamillaili and Qoyum (2021), Panagiotidis and Printzis (2016), Fanama and Pratikto (2019), Fauzia (2019) and Mohan et al. (2019) which show that inflation has a significant positive effect on prices real estate. Theoretically, the relationship between the CPI and the real estate price index explains that an increase in the CPI can cause an increase in the prices of construction materials, labor costs, and other operating costs related to the construction and maintenance of real estate. Consequently, this can lead to an increase in real estate prices.

On the other hand, from Table 8, it can be noted that the strongest negative relationship was recorded between the interest rate on bank loans and the housing price index (-3.0213) at a significance of less than 5%, which can be concluded that with the decrease in interest rates on loans, the demand increases for loans as well as the demand for real estate. Balqis and Purwono (2021) note that interest rates are always closely monitored so that they do not have a large impact when they rise because they will slow down the real sector. However, it should be noted that interest rates differ from bank to bank despite the threshold set by the National Bank. This means that a lower interest rate will increase the purchasing power of an individual when buying an apartment because the interest paid is lower. In this regard, it will act to increase the demand for housing loans as well as housing prices. In recent years, the turnover in the real estate market has increased both in the Republic of Serbia and in other surrounding countries. Therefore, in recent years, prices on the real estate market have grown almost as much as on a global level, the growth of which was influenced by many factors such as: favorable trends in the labor market, low interest rates, the search for alternative investments, increased work from home due to the COVID-19 pandemic and other factors (National Bank of Serbia, 2022).

Also, the exchange rate of the dinar against the euro is an independent variable that has a significant negative impact on the housing price index, as evidenced by the probability value of 0.001, which is less than 5%, and the coefficient value of -1.5495. This means that if the exchange rate of the dinar against the euro increases by 1%, the housing price index will consequently decrease by about -1.5495, assuming that other variables are considered unchanged. During 2022, the dinar strengthened against the euro by about 0.2%. In the same period, due to the weakening of the euro against the dinar on the international financial market, the dinar weakened against the dollar by about 5.7% (National Bank of Serbia, 2022). In theory, if the exchange rate of the domestic currency depreciates, the prices of domestic real estate assets, such as housing, will become cheaper for foreign investors, and conditions like this can increase capital inflows into the real estate sector and raise housing prices.

In addition, the exchange rate can also affect the price of production of construction materials, because with an increase in the exchange rate of the domestic currency, there may be an increase in the prices of imported construction materials, and in the end, the prices of real estate will also increase. Magdalena (2015) states that the exchange rate is important in the purchase of real estate because when the currency weakens the amount of principal plus interest becomes higher to pay. Therefore, the cost of capital increases due to the exchange rate and ultimately the price of real estate increases. According to Sumer and Ozorhan (2020), exchange rates can influence investors perception of considering housing as an investment option. Therefore, when the domestic exchange rate weakens, more must be spent on owning property and in the long term it is better to combine various other investment instruments.

Table 9 - Results of the Hausman Test Between Independent Variables for the Period: 2014-2023

Variables	(b) Fixed effects model	(B) Random effects model	(b-B) Difference	Sqrt (diag (V_b-V_B)) S.E.
GDP	0.0035446	0.0075657	-0.0040211	0.0864171
CPI	2.12682	2.129453	-0.002633	0.0205701
BCIR	-3.029115	-3.021348	-0.0077671	0.1126068
EXR	-1.585774	-1.54952	-0.0362541	0.1355381
HS	0.8152433	0.8842281	-0.0689848	0.2444094

Source: Calculation by the author

$$\begin{aligned} \text{chi2}(5) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= 0,12 \\ \text{Prob}>\text{chi2} &= 0,9998 \end{aligned}$$

Given that the chi-square value is equal to zero, as well as the fact that the p-value of individual independent variables is equal to zero or slightly greater than zero, but less than 5% (for variables such as consumer price index, interest rates on bank loans and the exchange rate of dinars against the euro) then it can be concluded that certain independent variables had an impact on the dependent variable. Also, according to the results of the Hausman test, the probability is greater than 5% and amounts to 0.9998, which leads to the conclusion that the null hypothesis, i.e., GLS regression of random effects, is accepted and the alternative hypothesis, i.e., the fixed effects model, is rejected.

Concluding Considerations

The residential real estate market is of vital importance to the residents of any country, as well as to the Government and related state governing bodies. Real estate as a form of property has many characteristics that distinguish it from other forms of property in the markets. The offer of real estate is local, where to offer real estate to the market at all, takes significantly more time than with other products, considering the time frame of the planning and construction phases of real estate. For example, rental prices can remain at the same level for a longer period regardless of the market situation due to the long-term rental agreement. Certain limitations of the residential real estate market are related to transparency where most transactions are done through bilateral negotiations. Also, the liquidity of this market is limited due to high transaction costs, where buyers mainly rely on bank loans. In this regard, the aforementioned characteristics cause residential real estate prices to move in different patterns than other forms of property.

Over the past few years, the turnover in the real estate market has increased both in the Republic of Serbia and in other countries of the region. Therefore, real estate prices grew almost at the global level, which was influenced by numerous factors such as more favorable trends in the labor market, low interest rates, the search for alternative types of investments and other factors.

The paper includes the theoretical and empirical part of the research, which was carried out with the help of correlation and regression analysis. The main goal of this paper was to investigate the impact of certain macroeconomic and banking indicators on real estate prices in the Republic of Serbia for the period from the first quarter of 2014 to the fourth quarter of 2023. Therefore, in this research, the effects of independent variables and their influence on the dependent variable were used using the unified OLS regression model (FE) and the regression model of random effects (GLS) with the help of the Hausman test. The application of the multiple linear regression model indicates that the housing price index in the last 10 years has a positive and highly significant correlation with the consumer price index, and a negative correlation with the interest rate on bank loans and the dinar exchange rate against the euro. In contrast to previous research results, the growth of the gross domestic product as well as the growth of household savings do not seem statistically significant. Therefore, it is suggested to the Government to maintain the stability of the consumer price index in order to maintain the stability of real estate prices. In terms of testing the set hypotheses, the results of the research using the Hausman test showed that the probability is greater than 5%, which points to the conclusion that the null hypothesis, i.e., the GLS regression of random effects, is accepted and the alternative hypothesis, i.e., the fixed effects model is rejected. The question of the importance of the real estate market is relevant again due to the justified perception of young people and households where it is almost impossible to buy their real estate.

The limited relevant literature on this topic also limits the development of further research into the factors influencing real estate prices. In this regard, further research involving a longer time period and a larger number of countries is needed to complement and develop the understanding of the determinants of real estate prices. Likewise, the author's new research in a given issue can be expanded by including a larger number of independent variables. This research can also help estimate future changes in housing price indices that are primarily conditioned by changes in observed macroeconomic and banking variables.

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