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IMPACT OF MACROECONOMIC VARIABLES ON MORTGAGE MARKET: EVIDENCE FROM SERBIA

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Abstract

The primary objective of this paper is to examine the impact of macroeconomic variables on the growth of residential mortgage loans in Serbia. The analysis is based on a regression model applied to a quarterly dataset encompassing both real and monetary sector indicators for the period Q1 2009 to Q3 2024. The empirical findings contribute to the literature in two notable ways. First, the results suggest that monetary variables generally exert a stronger influence on mortgage loan dynamics than real sector indicators. Second, among all variables analyzed, public investment emerges as the most significant driver of mortgage loan growth. This result is somewhat unexpected and warrants further investigation into the transmission mechanisms through which fiscal activity affects credit expansion.

Keywords: *mortgage market, macroeconomic variables, regression analysis, Serbia*

JEL*: E44, G21, E52*

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INTRODUCTION

The development of the mortgage market in Serbia has a long and rich history, including different political, economic and legal stages - from the early 19th century and the period of the formation of the modern Serbian state, through the period of socialist organization, all the way to modern transitional and post-socialist transformations.

The political and economic transition that began in 2000 opened the way for the structural reform of Serbia's financial system, including the re-establishment of market instruments of credit security, among which the mortgage took a central place. The financial market liberalization process was aimed at creating a regulatory and institutional framework compatible with European standards, which included the reform of the banking sector, the adoption of the Law on Mortgage in 2005, the improvement of land registers, as well as the modernization of mortgage lending practices. In this period, foreign banks entered the domestic market intensively, which additionally contributed to the development of a competitive mortgage sector, based on the principles of commercial banking. Banks began to offer a wide range of home loans, with different models of interest rates (fixed, variable, indexed), as well as the introduction of foreign exchange clauses to protect against inflationary and exchange rate risks. Of particular importance in the development of the mortgage market was the establishment of the National Housing Loan Insurance Corporation - NKOSK in 2004, whose role was to increase the availability of housing loans by providing insurance for long-term loans, thereby reducing credit risks for banks and facilitating access to financing for users. This loan insurance model has contributed to greater inclusiveness of the market, especially with regard to young people and families with average incomes.

During the first decade of the 21st century, the mortgage market in Serbia recorded continuous growth, accompanied by an increase in the volume of housing loans, which coincides with broader trends of economic recovery and growth. However, the global financial crisis of 2008 significantly slowed down this trend, leading to a tightening of credit standards, a reduction in the volume of approved loans and an increase in the share of problematic claims. Despite this, the laid regulatory foundations and institutional infrastructure enabled the Serbian mortgage market to recover relatively quickly and continue with stable growth over the next decade. In the modern context, mortgage lending is a key instrument for financing housing construction and solving the housing issue in Serbia. The dominant form remains lending by commercial banks, with the support of government measures such as subsidized loans, which further stimulates demand and market development.

The motivation for this paper lies in the need to better understand how macroeconomic fundamentals shape the dynamics of residential mortgage lending in Serbia, a small open economy with an evolving housing finance market. While housing loans are an increasingly important channel linking households, banks, and the broader economy, empirical evidence on the distinct roles of real and monetary sector variables remains scarce. By addressing this gap, the paper aims to generate

insights that can inform more coherent monetary, fiscal, and macroprudential policies to promote stable and sustainable development of the mortgage market.

The aim of this paper is to analyze impact of the macroeconomic variables on residential mortgage loans in Serbia. More specifically, the main research questions explored in this study are how macroeconomic variables from the real sector (economic activity, wages, investments) and monetary sector (inflation, interest and exchange rates) affect total outstanding residential loans. The rest of the paper is organized as follows. Literature review provides a summary of the theoretical premises and empirical findings on the subject. Methodology briefly presents the definition of variables and specifications of the model. Results section provides descriptive analysis and results of model estimation, which are further discussed in Discussion section.

LITERATURE REVIEW

The mortgage market, as a crucial segment of the financial system, is heavily influenced by macroeconomic conditions. Its size, typically measured by total outstanding mortgage debt or annual mortgage originations, fluctuates in response to changes in interest rates, inflation, employment, income levels, and broader financial market stability. Understanding these macroeconomic determinants is vital not only for policymakers aiming to foster financial stability but also for investors and financial institutions engaged in mortgage lending.

Interest rates, inflation and real economic growth (or some alternative measure of economic activity) are macroeconomic variables which direct and indirect effects on mortgage loans are most frequently explored. Long-term interest rates and central bank policy rates are among the most direct macroeconomic factors shaping the mortgage market. Since most mortgages are long-term financial contracts, their affordability and attractiveness to borrowers are highly sensitive to interest rate changes. When central banks, such as the Federal Reserve or the European Central Bank, lower policy rates to stimulate economic activity, mortgage rates typically decline in tandem. This reduction increases the demand for home loans as borrowing becomes cheaper, leading to an expansion in mortgage originations and, over time, an increase in the total outstanding mortgage volume. This was especially evident in the post-2008 monetary environments, when historically low rates facilitated a surge in mortgage activity in many advanced economies. Conversely, rising interest rates, often in response to inflationary pressures, typically depress the mortgage market by reducing affordability and dampening housing demand (Green & Wachter, 2005).

Inflation, while often treated as a risk to mortgage markets due to its influence on interest rates, plays a more complex role. Moderate inflation, when accompanied by nominal wage growth, can support mortgage market expansion by increasing household incomes and reducing the real burden of debt over time. However, high or volatile inflation can have a destabilizing effect. It may prompt central banks to raise interest rates aggressively, curbing mortgage affordability and reducing credit availability. Moreover, lenders may become more risk-averse in high-inflation and volatile inflation may lead to greater uncertainty and reduced willingness of banks to issue long-term credit, including mortgages (Miles, 2004). Therefore, a stable

macroeconomic environment with predictable inflation is generally conducive to mortgage market growth.

GDP growth is another core macroeconomic driver, as it reflects the overall expansion of economic activity, employment, and income. Robust GDP growth typically supports greater credit demand and lending capacity. Rising economic output tends to raise household incomes, enhancing both the ability and willingness of households to take on mortgage debt. Empirical evidence strongly supports a link between credit growth and contemporaneous economic activity; for instance, Hofmann (2001) shows that, across 16 industrialized countries, changes in real credit are closely aligned with changes in real GDP on an annual basis. Also, GDP can have impact on the mortgage market, assuming that construction sector grows also when economic activity grows; this in turn leads to increased supply of dwellings at the market (Krkoskova & Szkorupova, 2021).

Empirical literature usually examines the impact of macroeconomic variables on size and origination of mortgage loans indirectly, through housing pricing. The close long-term positive empirical relationship between the dynamics of property prices and aggregated mortgage loans has been well documented (Brissimis & Vlassopoulos, 2007; Gimeno & Martínez-Carrascal, 2006). Therefore, those macroeconomic factors that affect house prices should also affect mortgage lending. While most of such papers indeed confirm that macroeconomic variables are associated with house prices, the explanatory power of specific macroeconomic variables differ depending on the sample coverage and approach applied. Study of Adams and Fuss (2010) indicate that on the sample of 15 developed countries over a period of thirty years house prices on average increased in the long run by 0.6% in response to a 1% increase in economic activity, but estimates vary considerably for individual countries due to regulatory and mortgage market characteristics. Similar cross-country study (Tsatsaronis & Zhu, 2004) indicates that inflation has a strikingly high long-term association between house prices and inflation in 17 industrialized countries. On the other hand, some country-specific studies emphasize importance of interest rates in variations of house prices; for instance, study on house prices in Greece (Apergis, 2003) indicate that mortgage interest rate is the variable with the highest explanatory power of house prices variations, followed by inflation and employment.

Studies that directly estimate the impact of macroeconomic factors on the mortgage market are less frequent in the existing empirical literature. The study of DeFusco & Paciorek (2017) indicates that in the USA a 1 percentage point increase in long-term mortgage interest rate reduces mortgage demand by between 2 and 3 percent, while work of Bhutta and Ringo (2021) revealed that surprise cut in the interest rate for mortgages insured by the Federal Housing Administration immediately boost mortgage market. Fitzpatrick and McQuinn (2004) points out that adjusted disposable household income has a positive impact on demand for mortgage loans in Ireland. Regarding the peer countries in the region of Central and Eastern Europe, the study on the impact of macroeconomic variables on mortgage loans in V4 countries reveals the existence of long-term relationships between the mortgage loans and GDP, interest rate, and the unemployment rate (Krokoskova & Szkorupova, 2020).

METHODOLOGY

The empirical analysis is based on regression modelling. In addition to the macroeconomic variables typically covered by similar empirical studies discussed in the literature review, set of explanatory variables is extended to be more comprehensive and to incorporate specifics of Serbian mortgage markets, such as exceptionally high level of euro-indexed mortgage loans. The empirical model is specified as

$$Y = X_1\beta_1 + X_2\beta_2 + Z\gamma + u \qquad (1)$$

where

- Y is a total of outstanding residential mortgage loans (dependent variable);
- X_1 is a set of explanatory macroeconomic variables from the real sector (real GDP growth, real wage growth, public and private investments);
- X_2 is a set of explanatory macroeconomic variables from the monetary sector (price level, key policy rate, Euribor, exchange rate);
- Z is a set of control variables from the housing market (dwelling construction permits and prices);
- u is a random error assumed to be independently, identically and normally distributed.

Selection of the explanatory variables was driven both by the theoretical premises and data availability on the quarterly basis. In the case of macroeconomic variables from the real sector, household disposable income and employment are two macroeconomic variables with the most likely expected impact on the size of the housing loans. Unfortunately, these variables are not available on quarterly level, so they are proxied with wages and GDP. Since wages are the major component of household income, it is reasonable to assume that dynamics of real wages should correspond to dynamics of real changes in household purchasing power apart from income coming from new employment. On the other hand, changes in real GDP comprises not only the increase in household consumption stemming from the increase in real wages, but also from the increase in employment that was significant during the observed period.

In addition to real GDP and real wages, two additional variables are included into explanatory variables from the real sector to capture effects of business and investment cycle on housing loans. The first one is share of public investment in fixed assets, which reflects government involvement in the construction industry. This variable is also an indirect measure of fiscal stance bearing in mind that high level of government investment activities typically corresponds to the expansive fiscal policy. Public investing is accompanied by private investing, captured by a share of foreign direct investment in GDP since the majority of private investment in Serbia comes from the international investors. This variable reflects the economic cyclicality as increase and decline in private investment, especially from international investors, is usually associated with economic expansion and contraction, respectively.

The set of macroeconomic explanatory variables from the monetary sector includes the overall price level, NBS key policy interest rate, 6-month Euribor and nominal exchange rate RSD/EUR. While inflation and national interest rates are two most commonly used variables in analysis of housing and mortgage market, Euribor and exchange rate are included to capture effects of the exceptionally high level of euro-indexed mortgage loans and respective mortgage interest rates which are closely linked to Euribor.

Eventually, two control variables are added into model to control for the effects of housing market. As discussed in the literature review, housing prices have a strong positive association with mortgage lending. Therefore, omitting house prices from analysis can distort estimation of direct effects that macroeconomic variables may have on the mortgage loan market. Additionally, the volume of dwelling construction permits is included to control the supply-side effects of the housing market on mortgage lending.

The model is estimated in dynamic version, which means that all of the variables are specified either as a growth rates or differences. Estimation of dynamic model is preferred rather than model in nominal terms, to minimize possible issues of non-stationarity which are typically present in the case of monetary variables. Since the source data set combines monthly, quarterly (and in case of residential prices biannual) data, all the data are transformed to quarterly values and then annualized to smooth time series and eliminate seasonality, as well as to make matching of flow, stock and monetary variables more sensible. The detailed explanation of the variables, data sources, procedure of data annualization and applied growth metrics are described in the Appendix.

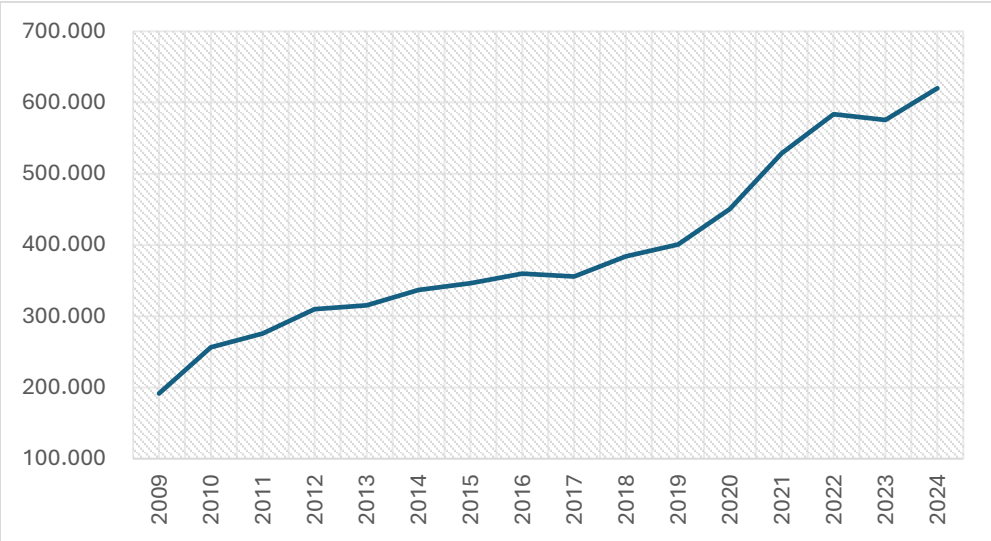
RESULTS

Descriptives

The empirical analysis, imposed by data availability, covers the period Q1 2009 to Q3 2024, stretching from the aftermath of global economic crises and severe fiscal consolidation up to the period of expansive monetary policy and quantitative easing that eventually led to the post Covid surge in inflation. Over the period considered, value of outstanding residential loans steadily and substantially increased (Figure 1); by 2024, value of mortgage loans more than tripled than in 2009.

Descriptive statistics on dependent variable and explanatory variables are presented in Table 1. More specifically, Table 1 displays descriptives on annualized changes in variables. Regarding variables, real net wage was growing on average 2.6%, slightly outpacing moderate growth of the real GDP that was 2%. Share of public investment in GDP annually increased 18 basis points on average, opposite to the share of FDI in GDP that was mostly stable (very small average increase of 4 basis points).

Figure 1. Total outstanding residential loans, mil RSD, Q1 2009- Q3 2024



Source: NBS data, authors calculation

Among the monetary variables, inflation was the most dynamic with average growth of 5.25%, reflecting the high inflation rates at the beginning and the end of the period covered. Interestingly, the NBS key policy rate declined annually by 56 basis points on average, despite the high average inflation rate. Unlike domestic interest rates, Euribor slightly increased by 14 basis points on average. Nominal exchange rate on depreciated on average, by 1.54 RSD per year.

Table 1. Descriptive statistics

	Mean	St. Dev.	Min	Max
Outstanding residential loans, % growth	8.67	8.29	-1.14	36.34
Real GDP, % growth	2.05	2.45	-2.07	8.72
Real net wages, % growth	2.59	3.95	-5.47	10.43
Gross government investments to GDP, p.p. increment	0.18	0.56	-1.32	1.16
Gross foreign direct investments to GDP, p.p. increment	0.04	1.98	-6.64	6.57
Overall price level, % growth	5.25	4.40	0.51	16.01
NBS key policy rate, p.p. increment	-0.46	2.24	-7.17	4.50
Euribor, p.p. increment	0.14	1.00	-1.35	3.77
RSD/EUR exchange rate, RSD increment	1.54	4.35	-5.45	14.97
Dwelling construction permits, % growth	8.26	19.73	-30.62	46.07
Price of new dwellings, % growth	3.84	7.87	-9.03	22.63

Source: authors calculation

Construction permits for building was the most dynamic explanatory variable, growing 8.26% on average. Such a huge increase rate reflects the construction boost after recovery from the global crisis and fiscal consolidation. The average growth in prices of newly constructed dwellings (3.84%) was lower than the growth in overall prices, which is a consequence of the higher volatility of dwelling prices opposite to the continuously positive inflation rates.

Estimation results

Bearing in mind the relatively large number of explanatory variables with respect to number of observations (around 5 observations per estimated parameter) and possible overfitting and multicollinearity issues, the following empirical strategy is applied to ensure robust estimation of the model (1) parameters. In the first step, only control variables Z are included in the model since housing market variables are expected to have a direct and significant impact on the variations in outstanding residential loans. In the next step, explanatory variables X_1 from the real sector are added into model. Eventually, full specification is estimated, by extending the specification in the second step with a set of monetary variables X_2. The rationale of this approach is that, if the explanatory variables are properly defined and selected, then the estimated regression coefficients will not be particularly sensitive to alternations of model specification in terms of size, sign and significance. The estimation results are presented in Table 2, wherein each estimation from reg1 to reg3 incrementally introduces new explanatory variables. To ensure that multicollinearity does not distort the estimated coefficients, the model estimations are supplemented with a Variance Inflation Factor (VIF) analysis. In the broadest model specification (reg3), the estimated VIF values range from 1.72 for housing prices to 4.71 for the key policy rate, which remains below the commonly accepted threshold of 5, indicating that multicollinearity is unlikely to have a detrimental effect on the results, as suggested in the literature.

Table 2. Estimation results

	reg1	**reg2**	**reg3**
Dwelling construction permits, % growth	-0.1663**	-0.2537***	-0.1723***
	(0.0628)	(0.0778)	(0.0547)
Price of new dwellings, % growth	0.3562***	0.4117***	0.3749***
	(0.1334)	(0.1384)	(0.0970)
Real GDP, % growth		-0.6955	-0.1803
		(0.4967)	(0.3748)
Real net wages, % growth		0.4008	0.8451***
		(0.2896)	(0.2617)
Gross government investments to GDP, p.p. increment		5.6484**	5.4362***
		(2.3577)	(1.4191)
Gross foreign direct investments to GDP, p.p. increment		-0.5559	0.9280**
		(0.4338)	(0.3951)

	reg1	reg2	reg3
Overall price level, % growth			1.4439***
			(0.2162)
NBS key policy rate, p.p. increment			-1.5989***
			(0.5323)
Euribor, p.p. increment			-1.4211*
			(0.7679)
RSD/EUR exchange rate, RSD increment			0.9961***
			(0.2466)
No. of Obs.	58	58	58
R-Squared	0.22	0.32	0.74

Source: authors calculation; Note:

DISCUSSION

Across all specifications, the growth rate of dwelling construction permits exhibits a statistically significant and negative association with the growth of residential mortgage lending. While this finding might look counterintuitive at first sight, it is in line with the theoretical proposition known in the literature on house prices as "demand hypothesis". Demand hypothesis, empirically verified and well-documented, claims that an expansion in housing supply (proxied by increased permitting activity) most likely acts as a moderating force on credit growth, possibly by tempering expectations of further housing price appreciation (Bahmani-Oskooee et al., 2021). In contrast, the growth rate of new dwelling prices is consistently positive and statistically significant at the 1% level. This result corresponds to the major finding from the related literature on close correlation between house prices and mortgage lending (Brissimis & Vlassopoulos, 2007; Gimeno & Martínez-Carrascal, 2006). It suggests that rising housing prices are a strong driver of mortgage loan expansion, potentially reflecting both heightened demand for credit in response to wealth effects and speculative investment behavior. The sensitivity of credit growth to housing prices underscores the pro-cyclical nature of the mortgage market.

In the second and third estimation (reg2 and reg3), the inclusion of broader macroeconomic variables provides further insight. While real GDP growth appears with a negative sign in both estimations, its coefficient is not statistically significant, indicating that overall economic growth does not directly translate into mortgage credit expansion in this context. This is a surprising result since empirical literature usually confirms positive association between mortgage lending and GDP (Krokoskova & Szkorupova, 2020) or household income (Fitzpatrick and McQuinn, 2004). By contrast, real net wage growth is positively associated with loan growth and becomes statistically significant in estimation reg3, reinforcing the role of household income dynamics in driving credit demand.

A particularly notable result is the strong and statistically significant positive impact of gross government investment (as a percentage of GDP) on residential loan growth. The magnitude of this coefficient suggests a substantial multiplier effect that public

investments have on the credit activity, most likely by improving infrastructure, boosting employment especially in construction and construction-serving sectors, and generating broader economic confidence that relaxes lending institutions and facilitates borrowing. On the other hand, the impact of private investments proxied by FDI appears inconclusive.

Specification reg3 introduces a set of monetary and financial variables that greatly improve the model's explanatory power. Notably, consumer price inflation exhibits a strong and statistically significant positive relationship with credit growth, likely capturing the nominal expansion of loan volumes in response to rising price levels (Tsatsaronis & Zhu, 2004). Conversely, increases in the NBS key policy rate and Euribor are both associated with significant reductions in loan growth, in line with theoretical expectations regarding the contractionary effects of tighter monetary policy on credit activity. These findings highlight the sensitivity of the mortgage market to both domestic and external interest rate environments.

Finally, the RSD/EUR exchange rate appears with a positive and statistically significant coefficient. Given the prevalence of euro-indexed loans in the Serbian banking system, this result suggests that depreciation of the dinar may increase outstanding residential loans in nominal terms or possibly reflect substitution effects as households hedge against currency risk by investing in real estate.

CONCLUSIONS

This analysis provides clear insights into the influence of macroeconomic variables on the residential loan market in Serbia by distinguishing between real sector and monetary sector effects. Overall, the results of analysis confirm that macroeconomic factors exert significant influence on mortgage loan dynamics. The R-squared values indicate that model fit improves substantially after adding macroeconomic variables (especially monetary indicators) from 22% to 74%. This suggests that including broader macroeconomic and financial variables substantially improves the explanatory power of the regression model and confirms the multifaceted nature of housing-related dynamics. Also, the results show that while both real and monetary factors shape mortgage market dynamics, monetary variables exhibit greater and more consistent explanatory power, underlining the central role of monetary policy and financial conditions in credit cycles.

On the side of the real sector, wage growth shows a positive influence on loan growth once included in a broader model specification, underscoring the importance of wage dynamics in shaping borrowing capacity. Surprisingly, real GDP growth does not display a statistically significant relationship with residential loan growth, suggesting that aggregate economic performance does not necessarily translate into increased household borrowing in the mortgage market. Among all macroeconomic indicators, public investment as a share of GDP stands out as the most influential factor. Its positive and significant impact on mortgage loan growth is somewhat unexpected and may point to indirect multiplicative effects of fiscal spending on acceleration of mortgage lending.

Turning to the impact of monetary variables, the findings clearly indicate that the monetary environment plays a more decisive role in shaping mortgage credit dynamics. Inflation exerts a strong and positive effect on residential loan growth, most likely reflecting nominal adjustments of new loans to higher dwelling prices, as well as the tendency of households to invest in real estate during periods of rising prices. Furthermore, both the NBS key policy rate and the Euribor rate are negatively and significantly associated with mortgage loan growth, illustrating the sensitivity of the Serbian mortgage market to changes in interest rates at both domestic and international levels. Finally, the RSD/EUR exchange rate also emerges as a significant determinant of mortgage loan dynamics, through adjustment of euro-indexed loans to changes in nominal exchange rates.

On the real sector policy side, the clear impact of public investment suggests that well-targeted fiscal spending can indirectly stimulate housing finance and should therefore be strategically coordinated with housing market goals. With regard to the monetary sector, the findings indicate that policymakers should give priority to maintaining a stable and predictable monetary environment, carefully managing policy rates to balance inflation control with support for credit growth. Finally, considering the significant influence of the exchange rate and the widespread use of euro-indexed loans, it is essential to safeguard exchange rate stability to minimize risks for both borrowers and lenders, supported by macroprudential measures that reduce currency-induced credit risk exposure.

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CONFLICT OF INTERESTS

The authors declare that there are no financial, professional or personal relationships that could lead to bias in the results or interpretation of this research.

APPENDIX

Table A1. List of variables used

Variables	Definition	Data source
Outstanding residential loans	Sum of RSD, foreign currency and foreign currency indexed housing loans, quarterly average, RSD million	National Bank of Serbia, Structure of claims on households by purpose
Real GDP	Gross domestic product, chain-linked volume measures, quarterly, RSD million	Statistical Office of the Republic of Serbia, National Accounts
Net wages	Average monthly net earnings, quarterly average, RSD million	Statistical Office of the Republic of Serbia, Labor market
Gross government investments	Gross fixed capital formation of the general government sector, quarterly, % of GDP	Statistical Office of the Republic of Serbia, National Accounts
Gross foreign direct investments	Net increase in financial liabilities from foreign direct investment, quarterly, % of GDP	National Bank of Serbia, Balance of Payments of the Republic of Serbia
Consumer price index	Base index (2006=100), quarterly average, index number	Statistical Office of the Republic of Serbia, Prices
Key policy rate	NBS key policy rate, quarterly average, %	National Bank of Serbia, Statistics of interest rates and dinar exchange rates
Euribor	Six-month EURIBOR rate, quarterly average, %	European Central Bank
Exchange rate	Exchange rate RSD/EUR, quarterly average, ratio	National Bank of Serbia, Statistics of interest rates and dinar exchange rates
Construction permits, dwelling	Dwelling for which building permits have been issued, quarterly aggregated	Statistical Office of the Republic of Serbia, Construction
Price of new dwellings	Average price of dwellings in new construction, RSD per m2, biannual	Statistical Office of the Republic of Serbia, Construction

An important part of the empirical approach was consolidation of the data with different frequency (monthly, quarterly, biannual) and different nature (flow, stock, monetary). Monthly data are transformed to quarterly values by simply averaging values from respective months (housing loans, CPI, interest and exchange rates, wages, construction permits), while in case of residential prices with biannual availability it is assumed that the same biannual value corresponds to both respective quarters.

In the case of stock variables (housing loans, wages) and monetary variables (prices, interest and exchange rates), which reflect a state of variable at specific point in time, annualization is not needed. The data on flow variables (GDP, investments, construction permits) are further annualized as

$$X_t^A = \sum_{j=t-3}^{t} X_t^Q,$$

where *Q* refers to quarterly value and *A* to annual value. To avoid issues with non-stationarity, variables are transformed either into growth rates or differentials, depending on the nature of the variables. In case of GDP, wages, prices and construction permits, growth rates come up as the more natural metrics to capture dynamics, computed as (small letter refers to growth rate):

$$x_t^A = \frac{X_t^A}{X_{t-4}^A} - 1$$

In case of interest and exchange rates, dynamics are captured by differentials

$$\Delta X_t^A = X_t^A - X_{t-4}^A$$