INTERNATIONAL REAL ESTATE REVIEW

2023 Vol. 26 No. 3: pp. 420 – 462

Housing Market Dynamics in Kazakhstan: An Estimated DSGE Model

Akhmedyarova, Akbobek
Nazarbayev University, CF "Nac Analytica"
E-mail: akbobek.akhmedyarova@nu.edu.kz

This study investigates the drivers of housing price fluctuations in Kazakhstan by using a dynamic stochastic general equilibrium (DSGE) model with the housing market. We estimate the model by using Bayesian methods with data for the period of 2010Q1 to 2020Q4. We find that housing preference shocks play a crucial role in explaining for housing market fluctuations. These shocks account for a substantial portion of housing price and consumption behavior variations. Surprisingly, monetary policy, government spending, productivity and markup shocks show limited explanatory power for housing price fluctuations. Our findings suggest the importance of monitoring potential housing bubbles, as well as the impact of housing market fluctuations on the broader economy, thus highlighting the housing wealth effect. Additionally, our analysis indicates that the pension withdrawal policy has a minor long-term effect on business-cycle fluctuations in Kazakhstan. Overall, technology shocks are key drivers of gross domestic product (GDP) variance, while inflation rate variation is mainly explained by monetary policy and foreign demand shocks.

Keywords

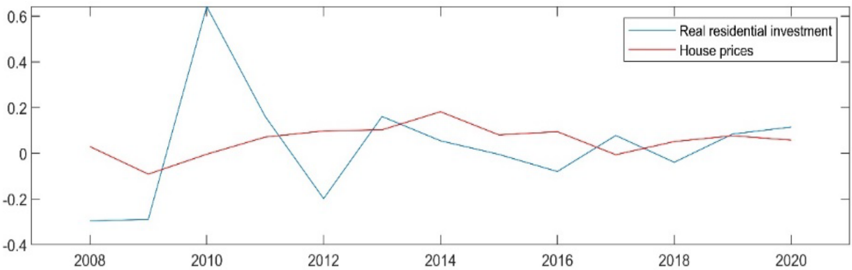
DSGE; Housing market; Bayesian estimation; Kazakhstan

JEL Classification: C11, E30, E32, R21

1. Introduction

This study explores the effect of various economic disturbances on the housing market in Kazakhstan. Given the central role played by real estate over-borrowing in the global financial crisis of 2008, the causes and consequences of the housing market fluctuations have become a key concern for policymakers throughout the world (Funke and Paetz, 2013). Kazakhstan has experienced extraordinary housing market fluctuations over the last decade. This is especially relevant to real residential investment. Figure 1 highlights those fluctuations: housing investments varied remarkably, with annual growth rates fluctuating from -30 percent in 2008 to 64 percent in 2010. Meanwhile, housing prices increased annually by an average of 6 percent, and peaked at 14 percent in 2014. Seitz (2021) argues that housing costs for the citizens in Almaty and Astana are more unaffordable than in notably expensive cities such as San Francisco and Vancouver. Low home affordability and extremely high prices involve questions as to whether a housing market bubble exists.

Figure 1 Housing Market Dynamics in Kazakhstan



Source: Constructed by author based on Bureau of National Statistics. Online data.

To understand the main drivers of the business cycle and housing price fluctuations in Kazakhstan, we examine the effect of different shocks on aggregate macroeconomic variables by using a dynamic stochastic general equilibrium (DSGE) model. On the supply side, we introduce a technology shock in the production function of firms and price mark-ups (cost-push shock). On the demand side, there is a housing preference shock that picks up all unmodeled shifts in the demand for housing. We also study the effects of monetary policy and government spending shocks. In order to examine the link between the housing market and key macro variables, we use variance and historical shock decompositions based on the DSGE model. They show that aggregate supply and monetary policy shocks are not the main drivers of housing prices, which are mainly driven by a housing preference shock. This suggests that changes in housing prices should not be attributed to productivity changes and government mortgage policy. Housing preference shocks are sudden and unexpected changes in the preferences of individual households which can significantly impact the housing market. These shocks can be driven by various factors, including sentiment, speculation motives, and investment considerations. Moreover, housing preference shock is found to be the fundamental source of housing price bubbles (Liu and Ou, 2021). Our findings suggest that housing preference shocks can have different implications for borrowers and savers. Positive housing preference shocks of savers, for instance, lead to increased housing prices and collateral value. This, in turn, enables borrowers to increase their debt holdings and raise consumption. On the other hand, positive housing preference shocks of borrowers result in a shift towards the housing sector, reduce consumption, increase borrowing for housing, and increase housing prices.

In 2020, the Kazakhstani government implemented a pension reform that allowed individuals in the second pillar of the pension system to withdraw their pension savings above a certain benchmark for purchasing housing or using them for medical treatment. While this reform aimed to improve housing affordability in Kazakhstan, it has faced criticism for its potential impact on housing price acceleration and speculation, as well as its limited effectiveness in addressing the issue of housing affordability. Moreover, the access to pension savings was limited, benefiting only those who are already financially well-off and have met their needs, thus widening the income gap and contradicting the principles of the pension system (Bekbossinova et al., 2022). Examining the allocation of household credit in Kazakhstan provides further insights into the concerns that surround the sustainability of household credit provision. It is noteworthy that approximately 60 percent of the total household credit is allocated towards consumer loans, while the remaining 40 percent is dedicated to mortgages (Ybrayev et al., 2023). This high share of consumer lending raises questions about the long-term viability of credit provisioning in Kazakhstan, given the heavy reliance on credit access to meet short to medium-term consumption needs. We study the impact of the early pension withdrawal policy on the estimated housing market model. Our analysis indicates that the introduced pension reform does not have a significant effect on housing prices in Kazakhstan, despite a reduction in non-housing consumption in the short run. Specifically, a 20 percent increase in pension withdrawals have led to a modest 1.4 percent decrease in consumption, 0.2 percent increase in output, slight inflation increase by 0.1 percentage points, and negligible effects on housing prices (+0.02 percentage points). While the reform may have affected the consumption of non-housing goods, its impact on price dynamics is marginal. It is important to note that our analysis focuses on examining the impact of the pension reform on the macroeconomy and housing market dynamics, rather than specifically studying its effect on housing affordability. While the influence of the reform on housing prices and consumption patterns has been assessed, a comprehensive evaluation of its direct implications for housing affordability requires further investigation.

The high share of consumer loans over mortgages suggests that housing demand in Kazakhstan may not primarily stem from a strong preference for homeownership, but rather a focus on immediate consumption requirements. The economic circumstances in Kazakhstan could be influencing this phenomenon. If people face limited access to mortgage financing or higher borrowing costs for mortgages compared to consumer loans, they may choose the latter option to meet their immediate consumption needs. This preference for consumer loans could be driven by factors such as higher interest rates on mortgages, stricter eligibility criteria, or limited availability of mortgage products. Despite this borrowing trend, our study uncovers a significant finding known as the housing wealth effect. This effect reveals that changes in housing prices have a substantial impact on consumer behavior, regardless of the loan structure. As housing prices increase, individuals experience a positive wealth shock, thus leading to higher consumer spending. This underscores the important role that the housing market plays in shaping consumption patterns. Housing not only provides a stream of housing services but also serves as collateral due to its long-term value stability. The spillover effects that result from housing collateral are shown to significantly contribute to increased consumption during periods such as the housing market bubble of the late 1980s (Christensen et al., 2016). These emphasize the need for policymakers in Kazakhstan to remain cognizant of the potential risks associated with the housing market. It is crucial to recognize that a burst in the housing market bubble can potentially trigger unfavorable lending practices by banks, further compounded by its impact on consumer spending. These cascading effects can have far-reaching consequences for the overall economy of Kazakhstan. Therefore, policymakers must exercise prudent oversight, actively monitor the housing market and implement appropriate regulatory measures to mitigate potential risks and foster financial stability in the country.

Finally, we find that the inflation rate in Kazakhstan exhibits volatility driven by two main factors: foreign consumption of non-durable goods and monetary policy shocks, with monetary policy shocks accounting for 54 percent. Technology shocks play a prominent role in explaining output fluctuations, and explains for approximately 45 percent of the variation. In terms of interest rate volatility, government spending shocks take the lead, which account for over 66 percent of the variation.

The remainder of this paper is organized as follows. Section 2 summarizes recent research on the housing market. Section 3 presents the DSGE modeling framework. Section 4 puts forward the calibration, while Section 5 describes the estimation results. Section 6 discusses the pension policy effects. Finally, Section 7 summarizes and discusses the policy implications. Appendix includes tables and graphs.

2. Literature Review

Several studies have assessed the role of housing market dynamics in business cycles. Iacoviello and Neri (2010) find procyclical changes in consumer spending and housing investment with housing wealth. Yang et al. (2017) explore regional variations in the impacts of monetary policy on consumption and house prices within China. Their study uncovers diverse consumption responses to monetary policy shifts across different Chinese regions, which highlight the pivotal role of house prices in mediating these interactions. Funke and Paetz (2013) construct an open economy DSGE model with two types of households (borrowers and savers) and two sectors (housing and non-housing) to examine the effects of housing price shocks on the Hong Kong economy. Their results suggest that property prices in Hong Kong are mainly affected by housing-specific shocks, while shocks to the loan-to-value (LTV) ratio do not substantially drive property prices.

Christensen et al. (2016), on the other hand, show that both the LTV ratio and housing demand stimulate the real economy in China. Funke et al. (2018) analyze the impact of nonlinear LTV ratios on property prices in Hong Kong in the context of DSGE. A comparison of the nonlinear policies with a linear Taylor-type LTV policy suggests that nonlinear property transfer taxes (stamp duties) are more effective in dampening property prices than nonlinear or linear LTV policies. Iacoviello and Neri (2010) find that the increased demand for housing, which is referred to as a housing preference shock, increases housing prices and the ability of collateralized households to borrow. The authors show that enhanced productivity in the goods sector increases housing prices. At the same time, a positive technology shock in the housing sector lowers housing prices. Similarly, Wen and He (2015) and Ng and Feng (2016) show that housing demand considerably accounts for the fluctuations in housing prices in China. Aspachs-Bracons and Rabanal (2010) examine the drivers of real estate prices in Spain during the European Monetary Union (EMU) period. They conclude that most of the variation in housing prices is due to shocks in the housing preferences. Moreover, they find that monetary policy shocks play a minor role in explaining for the Spanish housing price boom, even if persistently low levels of real interest rates are assumed to be responsible. Additionally, Hu and Tiwari (2021) underscore financing-related variables driving property cycles in Australia. Their study indicates that property investment cycles are shorter and more volatile than development cycles, influenced by factors such as financing rather than market sentiment or broader economic cycles. Funke et al. (2018) analyze the impact of housing sector shocks on the rest of the economy by developing a small open economy model for New Zealand. Their results suggest that a significant part of the movements in housing prices are due to shocks in housing preferences. They also show that a small fraction of the changes in housing prices are due to monetary policy shocks. At the same time, Ng and Feng (2016) document that the spillover effect on housing prices is determined by external and news shocks.

The role of the housing wealth of individuals has been examined in several studies. Case et al. (2005), and Campbell and Cocco (2007) find positive effects of changes in real estate wealth on consumption. Lee and Song (2015) assess the impact of the real estate sector on Korean business cycles and find that housing demand shocks explain for most of the variation, primarily in aggregate consumption, via a collateral constraint mechanism. At the same time, prices in the housing market are found to be more volatile than those in the non-residential sector. Iacoviello and Neri (2010), for instance, find that investments and inflation in the housing market are more volatile compared to other markets. Our results are in line with the literature, which suggest that housing prices, on average, are reoptimized every quarter, while the prices of non-housing goods change every two quarters.

A number of studies (Case et al., 2005; Ng, 2015; Seitz, 2021) have extensively examined the intricate relationship between real estate and consumption, and reveal that housing holds a unique position within the real economy compared to other types of assets (Funke et al., 2018). In particular, housing serves as a primary asset for households, and fluctuations in residential wealth wield a more significant impact on consumption than fluctuations in alternative assets. The substantial influence of housing prices on consumption has been widely observed by Iacoviello and Neri (2010). Their research suggests that variations in the housing market have noticeable consequences on the larger economy, with a more pronounced influence on consumer spending rather than business investments. This influence has intensified over the years, partly as a result of financial advancements.

3. Model

The baseline model is built on the framework developed by Funke and Paetz (2013). This small, open economy version of the New Keynesian DSGE models includes key economic agents such as households, domestic producers, the central bank, and retailers. To better reflect the structure of the Kazakhstani economy, several features have been introduced. Notably, the model incorporates the impact of the early pension withdrawal policy, which introduces a credit shock into the housing market. This policy allows individuals to access their pension savings early, and enables them to use the funds for mortgage down payments or housing restoration purposes.

In contrast to the model in Funke and Paetz (2013), which adopts a currency board system, our model assumes that the monetary policy in Kazakhstan follows the Taylor rule. The National Bank of Kazakhstan (NBRK) employs the nominal interest rate as its policy instrument, which reacts to deviations in the inflation rate, output growth, and real exchange rate from their respective trends. This adjustment enables us to analyze the interplay between monetary policy decisions and the housing market, thus providing insights into the effects of interest rate changes on housing demand, investment, and overall economic stability.

In our model, the primary focus is on housing as the main investment practice, which accurately reflects the real situation in Kazakhstan. We recognize the significant role that housing plays as a prevalent investment choice in the country. The absence of rent controls and minimal property taxes contribute to a competitive market environment, which in turn encourages individuals, especially those in the upper middle class, to invest in real estate. Owning a house in Kazakhstan offers various advantages, including the potential for property appreciation, generation of capital gains, and opportunity for wealth accumulation and financial security.

Another important aspect addressed in our analysis is the prevalence of homeownership in Kazakhstan. Unlike many other countries where renting is common, homeownership is the prevailing norm in Kazakhstan. Only a small percentage of urban housing, approximately 3 percent, is occupied by renters (Seitz, 2021). This unique characteristic of the housing market has implications for housing supply, demand, and investment patterns. Our model accounts for the dominance of homeownership, thus enabling a more accurate understanding of the dynamics of the Kazakhstani housing market.

Finally, it is important to note that while our model captures the various aspects of the Kazakhstani housing market, it may not fully capture the specific dynamics of real estate prices across different cities in Kazakhstan. We acknowledge that real estate prices in Kazakhstan are almost unrelated across cities but within a particular urban area. This suggests that local factors play a significant role in driving housing prices in Kazakhstan. Although our model may not explicitly capture this particular aspect, we strive to provide a comprehensive understanding of the overall housing market dynamics in Kazakhstan based on the available data and model assumptions.

3.1 Households

Two agent groups are divided based on the discount factor: borrowers and savers, which are denoted by the letters b and s, respectively. Borrowers are less patient and face a borrowing constraint when they take out a loan for real estate purchases. In an open DSGE model, ω represents the proportion of borrowers and $1\text{-}\omega$ represents the proportion of savers. Subscripts C and D represent non-residential and residential goods, respectively. LTV limit allows impatient households to borrow up to a fraction of the value of the newly acquired housing.

3.1.1 Borrowers

The representative borrower is infinitely-lived and maximizes the expected utility:

$$E_0 \sum_{t=0}^{\infty} \beta_b^t \left[\frac{1}{1-\sigma}(X_{j,t}^b)^{1-\sigma} - \frac{1}{1+\phi}(N_{j,t}^b)^{1+\phi}\right] \tag{1}$$

where E_0 is the conditional expectation operator evaluated at time 0, $X_{j,t}^b$ denotes the consumption index related to welfare and $N_{j,t}^b$ corresponds to the labor supply in the sector j. Additionally, ϕ and σ represent the intertemporal elasticity of substitution relative to labor and consumption, respectively. Finally, β_b^t is the discount factor of the borrower. Following Funke and Paetz (2013), the welfare-related consumption index is the weighted average of the non-housing consumption expenditure flow and housing stock:

$$X_{j,t}^b = \tilde{C}_t^{b^{1-\gamma\epsilon^{D,b}}} D_t^{b^{\gamma\epsilon^{D,b}}} \tag{2}$$

where $\widetilde{C_t}$ and D_t represent the comprehensive indices of non-housing and housing consumption, respectively. γ is the share of housing in utility, which determines the relative scale of the non-durable and durable sectors, $\epsilon^{D,b}$ is a housing preference shock that impacts the marginal rate of substitution between non-housing and housing goods. One notable characteristic of the housing market in Kazakhstan is the absence of a rental market. Rental housing is almost non-existent outside of Astana, with a high homeownership rate of around 95 percent. This aligns with our assumption that houses are primarily owner-occupied. Borrowers can trade bonds without nominal risk, but cannot use the international market to cover their spending. As a result, they are constrained by the following budget constraints:

$$C_t^b + P_{D/C,t} I_{D,t}^b - B_{H,t}^b = -R_{t-1}\frac{B_{H,t-1}^b}{\Pi_{C,t}} + \frac{W_t N_t^b}{P_{C,t}} \tag{3}$$

where $\Pi_{C,t+1} \equiv \frac{P_{C,t+1}}{P_{C,t}}$ is the inflation rate based on the consumer price index (CPI), $B_{H,t}^b$ represents the actual domestic debt stock (valuated by the domestic non-residential price index), and R_{t-1} is the nominal interest rate (the loan interest rate of the loan contract issued during $t-1$), $W_{j,t}^b$ is the wage rate of a specific sector, $I_{D,t}^b = D_t^b - (1-\delta)D_{t-1}^b$ defines the housing investment, $P_{D/C,t} \equiv \frac{P_{D,t}}{P_{C,t}}$ is the relative housing price and δ corresponds to the depreciation rate of the housing stock. The decision of borrowers to prioritize housing investment and have fewer alternative investments can be influenced by various factors, including expectations of capital growth, lifestyle preferences, and other considerations. In Kazakhstan, it is common for middle-class individuals to purchase properties as investments, which they may choose to rent out. This practice is facilitated by the limited availability of housing in the country, making real estate a favorable investment choice. Additionally, low trust in the banking system further restricts investment options in Kazakhstan (Daulenova and Taylor, 2021), which further emphasizes the significance of housing as the primary investment avenue.

Borrowers do not save and face the following borrowing constraint:

$$R_{t-1}B^b_{H,t} \leq (1-\chi)(1-\delta)E_t[P_{D/C,t+1}D^b_t \Pi_{C,t+1}] \tag{4}$$

where χ represents the fraction of housing goods that cannot be used as collateral. Thus, the amount that a borrower will repay in the following period depends on the future value of housing stocks, depreciation, and the LTV ratio. When the price of the housing good goes up or the housing good is renovated, borrowers can increase their debt. At the same time, when the LTV ratio is decreased, the fraction of residential goods that can be used as collateral goes down, in accordance with Equation (3.4). As a result, borrowers are compelled to reduce their debt. The borrower maximizes Equation (3.1) subject to Equations (3.3) and (3.4). The first-order conditions (FOCs) for this optimization problem are:

$$\frac{W^b_{j,t}}{P_{C,t}} = \frac{(X^b_t)^{\sigma}(N^b_{j,t})^{\phi}(\tilde{C}^b_t)^{\gamma\epsilon^{D,b}_t}}{(1-\gamma\epsilon^{D,b}_t)(D^b_t)^{\gamma\epsilon^{D,b}_t}}, j = C, D \tag{5}$$

$$P_{D/C,t} = \left(\frac{\gamma\epsilon^D}{1-\gamma\epsilon^D}\right)\frac{\tilde{C}^b_t}{D^b_t} + (1-\chi)(1-\delta)\psi_t P_{D/C,t+1}E_t\Pi_{D,t+1}$$
$$+\beta_b(1-\delta)E_t\left[\left(\frac{1-\gamma\epsilon^D_{t+1}}{1-\gamma\epsilon^D_t}\right)\left(\frac{X^b_t}{X^b_{t+1}}\right)^{\sigma}\left(\frac{D^b_{t+1}}{\tilde{C}^b_{t+1}}\right)^{\gamma\epsilon^D_{t+1}}\left(\frac{\tilde{C}^b_t}{D^b_t}\right)^{\gamma\epsilon^D_t} P_{D/C,t}\right] \tag{6}$$

$$R_t\psi_t$$
$$= 1-\beta_b E_t\left[\left(\frac{1-\gamma\epsilon^D_{t+1}}{1-\gamma\epsilon^D_t}\right)\left(\frac{X^b_t}{X^b_{t+1}}\right)^{\sigma}\left(\frac{D^b_{t+1}}{\tilde{C}^b_{t+1}}\right)^{\gamma\epsilon^D_{t+1}}\left(\frac{\tilde{C}^b_t}{D^t_b}\right)^{\gamma\epsilon^D_t}\frac{R_t}{\Pi_{C,t+1}}\right] \tag{7}$$

where λ_t denotes the Lagrangian multiplier on the borrowing constraint and ψ_t denotes the marginal value of borrowing. The condition for labor supply is given by Equation (3.5). The FOC (Equation 3.6) equates the marginal utility of non-durable consumption to the shadow price of housing goods. Finally, Equation (3.7) represents an Euler equation modified to account for the borrowing constraint.

3.1.2 Savers

The key differences between savers and borrowers lie in their financial behaviors, preferences, and constraints. In the context of the housing market, savers and borrowers diverge in terms of their investment options and constraints. Borrowers can trade bonds without nominal risk but are restricted from using the international market to cover their spending. On the other hand, savers have the flexibility to invest in foreign bonds and are influenced by factors such as the nominal exchange rate and foreign interest rate. This contrast suggests that savers have a broader range of investment avenues available to them compared to borrowers.

Additionally, the preference for housing as an investment avenue differs between savers and borrowers within the Kazakhstan housing market. Savers may opt for alternative investment options by considering factors such as capital growth expectations, lifestyle preferences, and other. In contrast, borrowers prioritize housing investment and have fewer alternative investment options.

The representative saver lives infinitely and seeks to maximize:

$$E_0 \sum_{t=0}^{\infty} \beta_s^t \left[\frac{1}{1-\sigma} (X_{j,t}^s)^{1-\sigma} - \frac{1}{1+\phi} (N_{j,t}^s)^{1+\phi} \right] \tag{8}$$

subject to the constraint:

$$\begin{aligned} C_t^s + P_{\frac{D}{C},t} I_{D,t}^s - B_{H,t}^s - \eta_t B_{F,t}^s \\ = -R_{t-1} \frac{B_{H,t-1}^s}{\Pi_{C,t}} - \frac{R_{t-1}^\star \eta B_{F,t-1}^s}{\Pi_{C,t}} + \frac{W_t N_t^s}{P_{C,t}} \end{aligned} \tag{9}$$

where η_t denotes the nominal exchange rate, $B_{F,t}^s$ represents foreign bond holdings, while $R_t^\star$ corresponds to the foreign interest rate. The FOCs of the savers are as follows:

$$\frac{W_{j,t}^s}{P_{C,t}} = \frac{(X_t^s)^\sigma (N_{j,t}^s)^\phi (\tilde{C}_t^s)^{\gamma \epsilon_t^{D,s}}}{(1-\gamma \epsilon_t^{D,s})(D_t^s)^{\gamma \epsilon_t^{D,s}}}, j = C, D \tag{10}$$

$$\begin{aligned} P_{\frac{D}{C},t} = \left(\frac{\gamma \epsilon^D}{1-\gamma \epsilon^D} \right) \frac{\tilde{C}_t^s}{D_t^s} \\ + \beta_s (1-\delta) E_t \left[\begin{array}{c} \left(\frac{1-\gamma \epsilon_{t+1}^D}{1-\gamma \epsilon_t^D} \right) \left(\frac{X_t^s}{X_{t+1}^s} \right)^\sigma \left(\frac{D_{t+1}^s}{\tilde{C}_{t+1}^s} \right)^{\gamma \epsilon_{t+1}^D} \\ \left(\frac{\tilde{C}_t^s}{D_t^s} \right)^{\gamma \epsilon_t^D} P_{D/C,t+1} \end{array} \right] \end{aligned} \tag{11}$$

$$1 = \beta_s E_t \left[\left(\frac{1 - \gamma \epsilon_{t+1}^D}{1 - \gamma \epsilon_t^D} \right) \left(\frac{X_t^s}{X_{t+1}^s} \right)^\sigma \left(\frac{D_{t+1}^s}{\tilde{C}_{t+1}^s} \right)^{\gamma \epsilon_{t+1}^D} \left(\frac{\tilde{C}_t^s}{D_s^t} \right)^{\gamma \epsilon_t^D} \frac{R_t}{\Pi_{C,t+1}} \right] \tag{12}$$

3.2 Firms

In each sector, we assume a two-step production process in which intermediate goods are used in the production process of final goods with constant elasticity of substitution (CES) technology. Final goods producers use the output of intermediate goods firms, who operate under monopolistic competition, as their input. In the context of the goods market in Kazakhstan, the model presented provides a reasonable fit by incorporating a two-step production process and considering the dynamics of the final goods production and retail firms. The assumption of monopolistic competition among intermediate goods firms and perfect competition among retail firms reflects the market structure observed in the housing sector as well. For instance, building supply firms offer a range of construction materials and tools, and while there may be multiple suppliers for each type of product, the market is often dominated by a few major players. These dominant firms may have some degree of market power, which allows them to differentiate their products or set prices to some extent. On the other hand, real estate agencies operate in the market as intermediaries between buyers and sellers of properties. They assist individuals and businesses in buying, selling, and renting real estate. In the model, real estate agencies are assumed to operate under perfect competition. This means that there are numerous agencies in the market, who all have access to the same pool of properties listed for sale or rent.

The inclusion of a markup parameter (μ_t^j) in the production function reflects the pricing behavior of intermediate goods firms and their ability to set prices above marginal costs. This markup captures the market power and pricing strategies within the wholesale sector, which can have implications for the overall cost structure and pricing of final goods.

Furthermore, the model considers the profit-maximizing behavior of retailers in determining the optimal quantity of final goods to produce. By maximizing profits, retailers balance the price of the final goods and cost of inputs from intermediate goods firms. This approach recognizes the role of retailers as price-takers in the market, where they adjust their production decisions based on market conditions.

The demand curve for each product (k) is derived from the profit-maximizing behavior of retailers and their response to relative prices. The demand curve equation reflects the elasticity of demand (ϵ_j) for the product within sector j. This formulation captures the responsiveness of consumers to changes in prices and provides insights into the demand dynamics within the housing market.

3.2.1 Retail Firms

Retail firms in sector j are perfectly competitive and produce final goods with the production function below:

$$Y_{j,t} = \left[\int_0^1 Y_{j,t}^{\frac{1}{1+\mu_t^j}}(k)dk\right]^{1+\mu_t^j} \tag{13}$$

where $Y_{j,t}$ represents the aggregate output, and $Y_{j,t}(k)$ denotes the output of intermediate goods firm, k which is used as input. μ_t^j is the markup of prices over the marginal cost in the wholesale sector. The retailer is a price-taker and determines the optimal number of final goods to produce. The retailer maximizes profits:

$$P_{j,t}Y_{j,t} - \int_0^1 P_{j,t}(k)Y_{j,t}(k)dk \tag{14}$$

subject to Equation (3.13). Thus, we obtain the demand curve for product k:

$$Y_{j,t}(k) = \left[\frac{P_{j,t}(k)}{P_{j,t}}\right]^{-\epsilon_j} Y_{j,t} \tag{15}$$

3.2.2 The Wholesale Sector

At the bottom of the production process, there is a continuum of monopolistically competitive firms that produce intermediate goods. Each intermediate goods producer is assumed to follow a stochastic constant returns to scale production function. $Y_{j,t}(k) = A_{j,t}N_{j,t}(k)$, where $A_{j,t}$ represents sector-specific labor productivity and $N_{j,t}$ denotes labor input. To minimize costs, each intermediate goods producer optimizes labor input based on the marginal cost of production. In the case of the non-durable goods sector, the optimization problem is given by Equation (3.16) with the constraint in Equation (3.17), while for the durable goods sector, the optimization problem is given by Equation (3.18) with the constraint in Equation (3.19). The objective is to ensure that the labor input and sector-specific productivity are sufficient to meet the demand for intermediate goods, which is determined by the relative prices of the intermediate goods and elasticity of demand. Each firm minimizes the costs as follows:

$$min\ W_t N_{C,t}(k) \tag{16}$$

s.t.

$$A_{C,t} N_{C,t}(k) \geq \left\{\frac{P_{C,t}(k)}{P_{C,t}}\right\}^{-\epsilon_C} Y_{C,t} \tag{17}$$

and

$$min\ W_t N_{D,t}(k) \tag{18}$$

s.t.

$$A_{D,t} N_{D,t}(k) \geq \left\{\frac{P_{D,t}(k)}{P_{D,t}}\right\}^{-\epsilon_D} Y_{D,t} \tag{19}$$

The real marginal cost in each sector represents the cost of producing one additional unit of output, which takes into account the labor input, sector-specific productivity, and preferences and consumption patterns of borrowers and savers. These marginal costs are derived from Equations (3.20) and (3.21), which aggregate the optimal labor-leisure decisions of borrowers and savers and reflect the interplay among consumption, labor supply, housing stock, and sector-specific productivity. The real marginal cost in each sector is given by the following two equations after aggregating the optimal labor–leisure decision of borrowers and savers:

$$MC_{C,t} = \frac{(X_t)^{\sigma}(N_{C,t})^{\phi}(\tilde{C}_t)^{\gamma\epsilon_t^D} S_{C,t}^{\alpha_C}}{(1-\gamma\epsilon_t^D)(D_t)^{\gamma\epsilon_t^D} A_{C,t}} \tag{20}$$

$$MC_{D,t} = \frac{(X_t)^{\sigma}(N_{D,t})^{\phi}(\tilde{C}_t)^{\gamma\epsilon_t^D} S_{D,t}^{\alpha_D}}{(1-\gamma\epsilon_t^D)(D_t)^{\gamma\epsilon_t^D} A_{D,t} P_{D/C,t}} \tag{21}$$

3.2.3 Market Clearing

Market clearing for each good k in each sector j requires the following conditions:

$$Y_{C,t}(k) = C_{H,t}(k) + \int_0^1 C_{H,t}^i(k)di \tag{22}$$

$$Y_{D,t}(k) = I_t^D(k) + \int_0^1 I_{D,t}^i(k)di \tag{23}$$

These equations represent the equilibrium relationships between the aggregate output of each sector and various components of consumption and investment.

The aggregate consumption of non-durable goods (C_t) and the housing stock (D_t) are given by Equations (3.24) and (3.25) respectively:

$$C_t = \omega C_t^b + (1-\omega)C_t^s \tag{24}$$

$$D_t = \omega D_t^b + (1-\omega)D_t^s \tag{25}$$

We can approximate Equations (22) and (23) around a symmetric steady state by:

$$\hat{y}_{C,t} = (1-\alpha_C)\hat{c}_t + \alpha_C \hat{c}_t^* + \alpha_C \nu_C \hat{s}_{C,t} + g_t \tag{26}$$

$$\hat{y}_{D,t} = (1-\alpha_D)\hat{\imath}_{D,t} + \alpha_D \hat{\imath}_{D,t}^* + \alpha_D \nu_D \hat{s}_{D,t} + g_t \tag{27}$$

where g_t is a government expenditure shock.

3.3 Exogenous Processes

To solve the model, we linearize all equilibrium conditions by using a first-order Taylor approximation. Therefore, all variables are represented in terms of logarithmic deviations from their steady-state levels. The dynamics of the model are governed by six exogenous processes that capture all exogenous perturbations of the model. They are represented by the following equations:

$$a_{j,t} = \rho_{a_j} a_{j,t-1} + \epsilon_t^{a_j}, j = C, D \tag{28}$$

$$e_t^{\mu} = \rho_{\mu_j}^{+} \epsilon_{t-1}^{\mu_j} + \epsilon_t^{\mu_j} - \rho_{\mu_j}^{-} e_{t-1}^{\mu_j} \tag{29}$$

$$e_t^{D,j} = \rho_{D,j} e_{t-1}^{D,j} + \epsilon_t^{D,j}, j = s, b \tag{30}$$

$$g_t = \rho_g g_{t-1} + \epsilon_t^g \tag{31}$$

$$\hat{c}_t^* = \rho_{C^*} \hat{C}_{t-1}^* + \epsilon_t^{C^*} \tag{32}$$

$$\hat{\imath}_t^* = \rho_{D^*} \widehat{D}_{t-1}^* + \epsilon_t^{D^*} \tag{33}$$

$$\hat{p}_{D,t}^* = \rho_{p_D^*} \hat{p}_{D,t-1}^* + \epsilon^{p_{D,t}^*} \tag{34}$$

$$\hat{p}_{C,t}^* = \rho_{p_C^*} \hat{p}_{C,t-1}^* + \epsilon^{p_{C,t}^*} \tag{35}$$

where all $\epsilon_t^i \sim N(0, \sigma_i^2)$ The aggregate supply shocks are represented by Equations (3.28) and (3.29), with sector-specific productivity shocks (technology shocks) and cost-push shocks that depend on the exogenous variations of price mark-ups. The demand shocks include household-specific housing preference shocks. Equation (3.30) is defined as the marginal rate of substitution between housing and non-housing consumption in the utility function. Government expenditure shock follows Equation (3.31). Foreign consumption of housing and non-housing goods is modeled by Equations (3.32) and (3.33). Finally, Equations (3.34) and (3.35) define foreign price shocks. These shocks are assumed to follow an autoregressive process, where the current shock is a combination of its lagged value and a random disturbance term. The coefficient ρ determines the persistence of these shocks over time.

3.4 Monetary Policy

The NBRK operates with the primary objective of maintaining price stability, and as part of its approach, adopts an inflation-targeting framework. In this framework, the nominal interest rate is determined by the Taylor principle, which guides the response of the central bank to various economic indicators. Specifically, the monetary policy rule takes into account fluctuations in inflation, real output growth, and the real exchange rate.

To capture the dynamics of the monetary policy rule, we assume the adoption of the Taylor rule, where the nominal interest rate is determined based on inflation and GDP growth while allowing for interest rate smoothing. The equation that represents this rule is:

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho_r} \left[\left(\frac{\Pi_{C,t}}{\Pi_C}\right)^{\rho_\Pi} \left(\frac{Y_t}{Y_{t-1}}\right)^{\rho_Y}\right] \varepsilon_t^r \tag{36}$$

Equation (3.36) implies that the NBRK responds to the movements of inflation and output growth. In this equation, $\frac{R_t}{R}$ represents the nominal interest rate, $\frac{R_{t-1}}{R}$ denotes the lagged nominal interest rate, ε_t^r represents the monetary policy shock, $\rho_r \in [0,1]$ denotes the interest rate smoothing parameter, ρ_Π and ρ_Y stand for parameters associated with the sensitivity of interest rates to current inflation ($\frac{\Pi_{C,t}}{\Pi_C}$) and the output gap ($\frac{Y_t}{Y_{t-1}}$), respectively. To further analyze the impact of the monetary policy rule, we linearize the equation around its steady state. The log-linearized form of Equation (3.36) is expressed as:

$$\hat{R}_t = \rho_r \hat{R}_{t-1} + (1 - \rho_r)[\rho_\Pi \hat{\pi}_{C,t} + \rho_y(\hat{y}_t - \hat{y}_{t-1})] + \varepsilon_t^r \tag{37}$$

The adoption of the Taylor rule in the inflation-targeting framework of the NBRK allows for a dynamic adjustment of the nominal interest rate based on inflation and output growth. This approach provides the central bank with the flexibility to respond to changes in economic conditions.

3.5 Pension Policy

In this section, we delve into an analysis of the potential impact of the recently implemented early withdrawal pension policy on the economy of Kazakhstan. The Kazakhstani government introduced this policy in January 2021 to address the issue of low home affordability in the country. Under this policy, individuals are granted the option to withdraw a portion of their pension savings for purposes such as property restoration, down payments for mortgage housing, transferring funds to private asset managers, or paying for certain healthcare services. However, there is the contention that this pension policy may inadvertently contribute to housing price inflation.

To analyze the impact of the pension policy, we conduct estimations to assess its effects on key economic indicators. In our analysis, we treat the pension policy shock as a credit shock, following the approach outlined by Favara and Imbs (2015). Specifically, the new pension regulations are incorporated through the collateral constraint of borrowers. When a positive pension policy shock is introduced, the collateral constraint is less tight. Since the constraint is binding, borrowers will borrow only the allowed amount. Without the pension shock, the constraint is more tightened and therefore restricts the loans that borrowers can obtain. The collateral constraint equation now becomes:

$$R_{t-1}B_{H,t}^{b} \leq (1-\chi)(1-\delta)E_t\left[P_{D/C,t+1}D_t^b \Pi_{C,t+1}\right]Pension \qquad (38)$$

where $Pension$ is *iid* and normally distributed. This shock reflects changes in household debt because of the available withdrawals from the pension savings accounts. This shock either diminishes the depreciation of the housing stock (δ) or increases the LTV ratio (1 - χ). Moreover, it is crucial to differentiate the pension shock from the LTV shock. While the pension shock centers around the changes in household debt due to pension savings withdrawals, the LTV shock is related to changes in the LTV ratio and its implications for borrowing constraints. The pension shock operates through adjustments in the collateral constraint of borrowers, which allows for variations in loan accessibility based on available pension savings. In contrast, the LTV shock directly influences the maximum loan amount that borrowers can secure based on the value of the property.

4. Data and Estimation

We derive the model parameters through a combination of calibration and estimation. For certain parameters where estimation is challenging, we resort to values derived from the existing literature to maintain consistency and accuracy. Specifically, we refer to the work of Funke and Paetz (2013) to determine the depreciation rate of the housing stock (δ) at 0.01, which corresponds to a depreciation rate of one percent. The discount factors for borrowers (β_b) and savers (β_s) are fixed at 0.96 and 0.99, respectively. Thus, the discount factor of the savers corresponds to a steady-state interest rate of 9.5 percent, which aligns with the key rate set by the NBRK. Since there is no information about the sector-specific degree of openness, we calibrate the elasticities of substitution between goods produced domestically and abroad at $\zeta = \eta = 2$. The share of housing in the construction sector of Kazakhstan is approximately 10 percent throughout the sample period (Bureau of National Statistics of Kazakhstan), so we set ξ to 0.1. Finally, the 70 percent LTV of Kazakhstan is used as a proxy for the fraction of the housing goods not used for loan purposes. So, we fix χ at 0.3. The values of the calibrated parameters are summarized in Table 1.

Table 1 Calibrated Parameters and Steady State Values

Parameter	Description	Value
ξ	Share of housing sector in aggregate production	0.10
β_s	Discount factor of savers	0.99
β_b	Discount factor of borrowers	0.96
δ	Depreciation rate of the residential stock	0.01
χ	Fraction of pension savings not withdrawn from pension account	0.30
ζ_c	Elasticities of substitution between domestic goods (non-durable)	2.00
ζ_d	Elasticities of substitution between domestic goods (durable)	2.00
η_c	Elasticities of substitution between foreign goods (non-durable)	2.00
η_d	Elasticities of substitution between foreign goods (durable)	2.00

The estimation of parameters for which limited information is available is conducted by using a Bayesian approach in our analysis. To incorporate prior knowledge, we specify prior distributions for these parameters. The mean and standard deviations of the estimated parameters can be found in Table 2, while the priors for the shock parameters are described in Table 3. The selection of these priors is guided with considerations specific to the housing market in Kazakhstan. For instance, we set the prior mean of the share of borrowing (ω) at 20 percent, which aligns with the domestic debt to the private sector in Kazakhstan that averages at around 22-23 percent (National Bank of the Republic of Kazakhstan, 2013). The persistence priors for durable and non-durable goods (τ_d and τ_c) are set at 0.3. Regarding consumption habits (h_c), we use a prior of 0.2. Considering the wealth effect of housing in Kazakhstan to be moderate, we choose a prior mean of 0.5 for γ. The degrees of openness for durable (housing) and non-durable goods are both set to 0.3, which approximately reflects the share of imports in the GDP of Kazakhstan during the sample period. Finally, prior means for intertemporal substitution elasticity

(σ) and inverse of the Frisch elasticity (ϕ) are set to one and three, respectively. These values are commonly employed priors in the literature and serve as reasonable starting points for estimation. In terms of the shock processes, we specify the autoregressive (AR) parameters for all shocks as 0.3, which indicates a moderate degree of persistence. The prior means of the standard deviations for these shocks are set at 0.1, thus reflecting the expected level of variability in the respective processes.

Table 2 Results from Metropolis-Hastings (Parameters)

Para-meter	Prior			Posterior			
	Distri-bution	Mean	St dev.	Mean	St dev.	HPD 5%	HPD 95%
Share of housing							
γ	beta	0.5000	0.1000	0.7150	0.0580	0.6303	0.8068
Share of borrowers							
ω	beta	0.2000	0.1000	0.3527	0.0895	0.2048	0.4995
Degree of openness (non-durable)							
α_c	beta	0.3000	0.1000	0.6808	00636	0.5775	0.7873
Degree of openness (durable)							
α_d	beta	0.3000	0.1500	0.1585	0.0627	0.0588	0.2562
Calvo lotteries in housing sector							
θ_d	beta	0.3000	0.1500	0.1060	0.0560	0.0178	0.1904
Calvo lotteries in cons.							
θ_c	beta	0.6500	0.1500	0.4522	0.0879	0.3112	0.5996
Persistence priors in cons.							
τ_c	beta	0.3000	0.1000	0.2511	0.0830	0.1136	0.3828
Persistence prior in housing							
τ_d	beta	0.3000	0.1000	0.1846	0.0639	0.0791	0.2845
Consumption habits							
h_c	beta	0.2000	0.1000	0.0873	0.0461	0.0159	0.1548
Intertemp. substit. elasticity							
σ	beta	1.0000	1.0000	1.6882	0.1688	1.4175	1.9657
Subst. elasticity of leisure							
ϕ	gamma	3.0000	2.0000	9.9092	2.7075	5.6073	14.1251
Technology shock (non-durable)							
ρ_{a_c}	beta	0.3000	0.1000	0.2974	0.0852	0.1552	0.4334
Technology shock (durable)							
ρ_{a_d}	beta	0.3000	0.2000	0.2995	0.2011	0.0015	0.5933
Cost-push shocks (non-durable)							
ρ_{mu_c}	beta	0.3000	0.1000	0.5955	0.0865	0.4565	0.7372
Cost-push shocks (durable)							
ρ_{mu_d}	beta	0.3000	0.1000	0.2987	0.1001	0.1327	0.4574
Housing preference shock of borrowers							
ρ_{d_b}	beta	0.3000	0.1000	0.2284	0.0773	0.1010	0.3501

(Continued…)

(Table 2 Continued)

Parameter	Prior			Posterior			
	Distribution	Mean	St dev.	Mean	St dev.	HPD 5%	HPD 95%
Housing preference shock of savers.							
ρ_{d_s}	beta	0.3000	0.2000	0.2401	0.1271	0.0245	0.4301
Government spending							
ρ_g	beta	0.3000	0.1000	0.5737	0.0827	0.4389	0.7097
Foreign cons. of non-residential goods							
ρ_{c^*}	beta	0.3000	0.1000	0.2991	0.1005	0.1351	0.4598
Foreign cons. of residential goods							
ρ_{d^*}	beta	0.3000	0.1000	0.2992	0.0999	0.1346	0.4591
Interest rate smoothing							
ρ_r	beta	0.3000	0.2000	0.9631	0.0087	0.9495	0.9776
Interest rate sensitivity to inflation							
ρ_Π	gamma	1.5000	0.2000	1.4650	0.1892	1.1459	1.7643
Interest rate sensitivity to output gap							
ρ_Y	gamma	0.5000	0.2000	0.4462	0.1582	0.1874	0.6928

To conduct our empirical analysis, we utilize quarterly data that span from the first quarter of 2010 to the fourth quarter of 2020. This dataset comprises seven key macroeconomic variables: real GDP, real consumption, the Kazakhstan interbank offered rate (KIBOR), CPI inflation, housing price inflation, employment, and government consumption. The first variable of interest is real GDP, which provides a measure of the overall economic performance of the country. Another significant variable in our dataset is real consumption, which captures the aggregate level of household spending on goods and services. Real consumption is a vital component of economic activity, as it reflects the purchasing power and expenditure patterns of households in Kazakhstan. The KIBOR is a key benchmark interest rate in the financial system of the country. The KIBOR represents the average interest rate at which banks are willing to lend to each other, thus providing insights into the cost of borrowing and overall liquidity conditions in the banking sector. CPI inflation is an important indicator of price changes for a basket of goods and services consumed by households. The variable measures the rate at which consumer prices are increasing over time, thus reflecting the overall level of inflation in the economy. Housing price inflation is specifically focused on tracking changes in the prices of residential properties. Employment data captures the number of people who are actively engaged in the labor force, which indicates the state of the job market and labor market conditions. Lastly, government consumption represents the expenditure of the government on goods and services, including public administration, defense, education, healthcare, and infrastructure development. This variable reflects the role of the government in the economy and its contribution to the overall economic activity. To ensure comparability and eliminate seasonal effects, all variables are seasonally adjusted. We apply the TRAMO-SEATS method to detrend the data, and use a one-sided Hodrick-Prescott filter. The data used in our study are publicly accessible and can be downloaded from the website of the Bureau of National Statistics of Kazakhstan. By employing this comprehensive dataset, we aim to capture the dynamics of the Kazakhstani economy and provide reliable empirical results for our analysis.

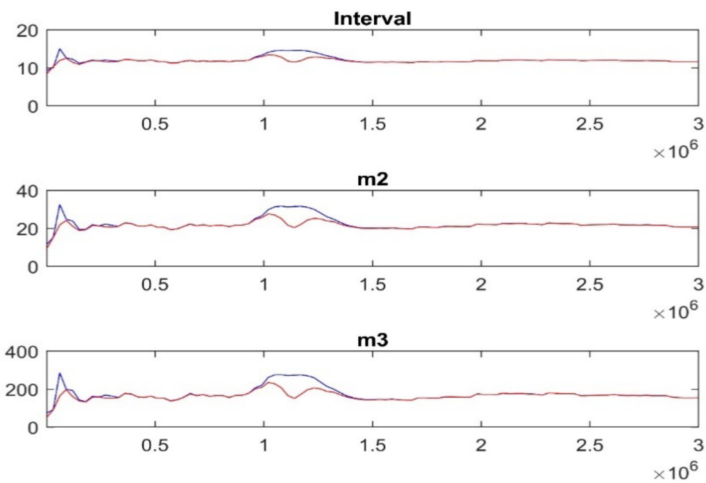
Table 3 Results from Metropolis-Hastings (Standard Deviation of Shocks)

Parameter		Prior			Posterior			
		Distribution	Mean	St dev.	Mean	St dev.	HPD 5%	HPD 95%
Housing preference shock of savers	σ_{d_s}	inv. gamma	0.1000	0.2000	0.8170	0.2749	0.4366	1.1540
Housing preference shock of borrowers	σ_{d_b}	inv. gamma	0.1000	0.2000	1.9897	1.0001	0.7679	3.2090
Technology shock (non-durable)	σ_{a_c}	inv. gamma	0.1000	0.2000	2.2591	0.4554	1.5239	2.9921
Technology shock (durable)	σ_{a_d}	inv. gamma	0.1000	0.2000	0.0846	0.0551	0.0266	0.1524
Cost-push shocks (non-durable)	σ_{μ_c}	inv. gamma	0.1000	0.2000	4.1661	1.4179	2.1637	6.1544
Cost-push shocks (durable)	σ_{μ_d}	inv. gamma	0.1000	0.2000	0.0869	0.0605	0.0258	0.1532
Foreign cons. of non-residential goods	σ_{c^*}	inv. gamma	0.1000	0.2000	0.0905	0.0616	0.0245	0.1701
Foreign cons. residential goods	σ_{d^*}	inv. gamma	0.1000	0.2000	0.0934	0.0711	0.0250	0.1709
Government spending	σ_g	inv. gamma	0.1000	0.2000	3.0582	0.4151	2.3780	3.7207
Monetary Policy shock	ε_t^r	inv. gamma	0.1000	0.2000	0.0676	0.0146	0.0439	0.0903

We estimate the mode and covariance matrix of the joint posterior distribution, where the covariance matrix is approximated by an inverse Hessian matrix. Then, we evaluate the posterior distribution of the parameters by using the Metropolis-Hastings algorithm. Draws from the unknown distribution of parameters are based on 2 blocks of 3,000,000 draws of parameters with the random walk Metropolis-Hastings algorithm.

Figure 2 presents the multivariate convergence diagnostic of the Markov chain Monte Carlo (MCMC) chains. The three plots show the convergence analysis which uses the first (Interval), second (m2), and third (m3) central moments of the posterior likelihood function. The two lines in each plot indicate convergence within and between the sequences. The blue line in the first panel of Figure 2 represents the 80 percent quantile range based on the pooled draws from the two sequences, whereas the red line represents the mean interval range based on the individual draws from each sequence. As both lines are horizontal and coincide for the majority of iterations of the Metropolis-Hastings algorithm, all three measures show convergence. Overall, the acceptance rates for the two sequences are 24 percent and 26 percent, respectively. The resulting means and standard deviations of the marginal posterior distributions of the estimated parameters are reported in Tables 2 and 3.

Figure 2 Multivariate Convergence Diagnostics



Source: The author

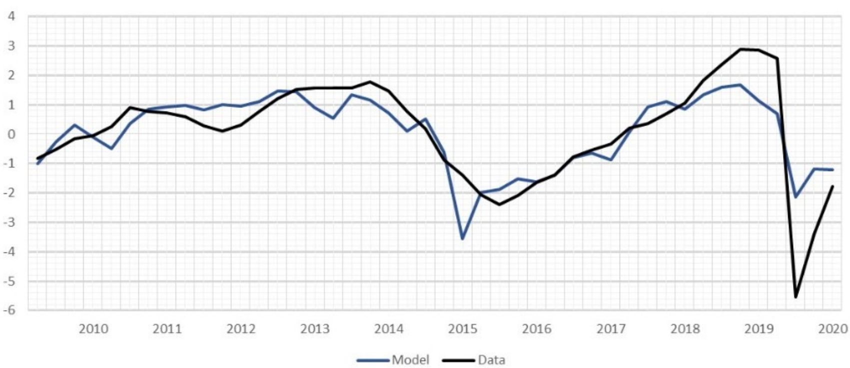
5. Estimation Results

5.1 Model Fit

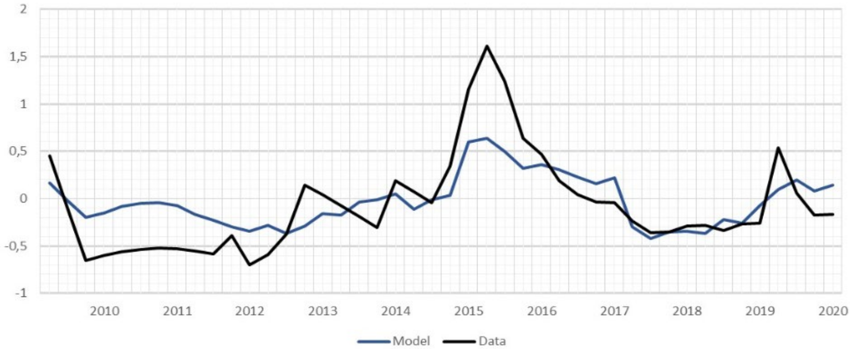
To assess the performance of our model and compare its estimates with the actual data, we employ the Kalman filter to generate one-sided predicted values. These predicted values serve as a means of evaluating the ability of the model to capture the dynamics of the Kazakhstani economy. Figure 3 provide a visual representation of the observed and predicted values for the six key variables over the sample period. In these figures, the black line represents the actual data, while the blue line corresponds to the one-sided predicted values generated by our model. By comparing these lines, we can gain insights into the accuracy of the model in capturing the observed patterns and trends in the data. Upon examining the figures, several observations can be made. First, in terms of interest rates, consumption, inflation, and housing prices, the actual data exhibit higher levels of volatility compared to the one-sided predicted values. This suggests that our model may underestimate the degree of fluctuations in these variables, thus potentially indicating the presence of additional factors or dynamics not fully captured by the model. On the other hand, when analyzing the GDP and employment, we observe that the model-generated values fluctuate more vigorously than the actual data. This discrepancy suggests that our model might be oversensitive to certain factors within the Kazakhstani economy. Despite these deviations, it is important to note that most variables exhibit a reasonable level of in-sample fit. The model generally captures the overall trends and patterns observed in the actual data, albeit with some variations. It is worth considering that the presence of measurement errors in the data could contribute to the relatively poorer fit of the model for variables such as inflation and housing prices. These measurement errors, which arise from data collection and the reporting processes, can introduce noise and inaccuracies that affect the ability of the model to precisely replicate the observed values.

Figure 3 Data and Predicted Values from the Model

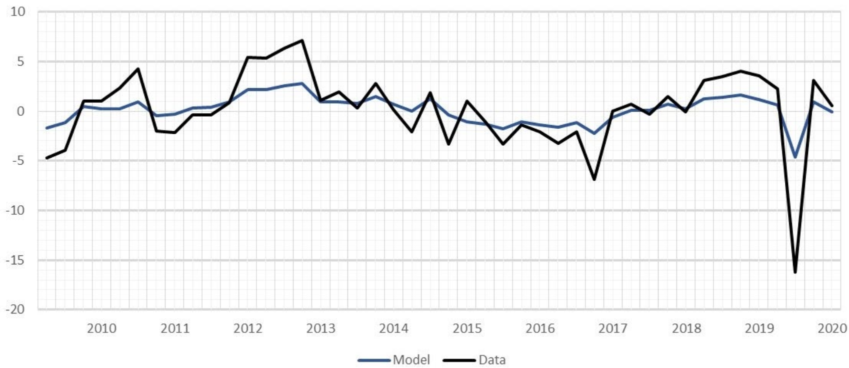
Panel A – GDP



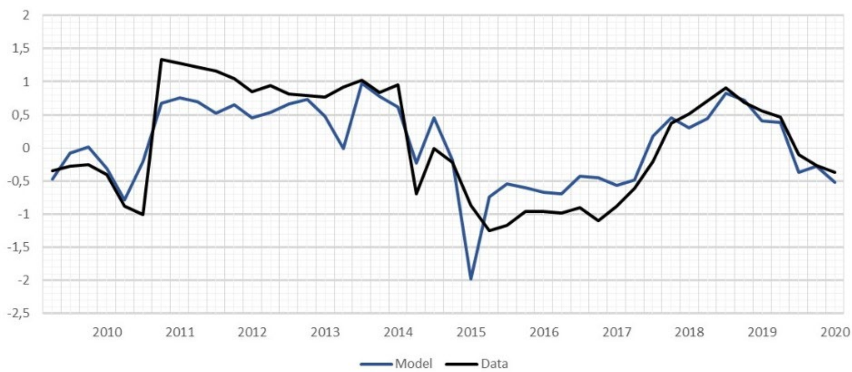
Panel B – Interest Rate



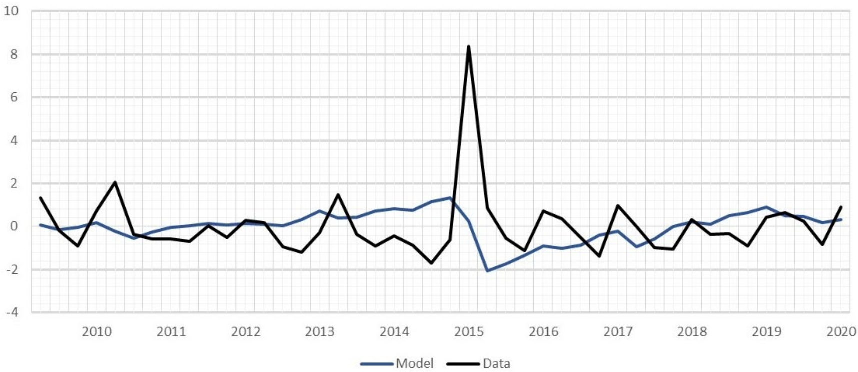
Panel C – Consumption



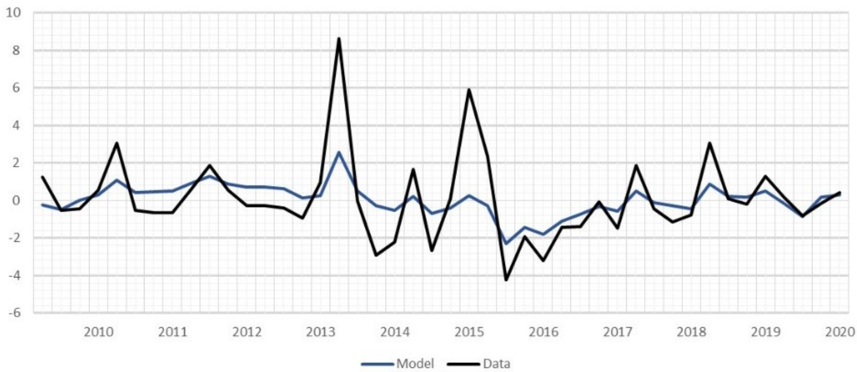
Panel D – Employment



Panel E – Inflation



Panel F – Housing Prices



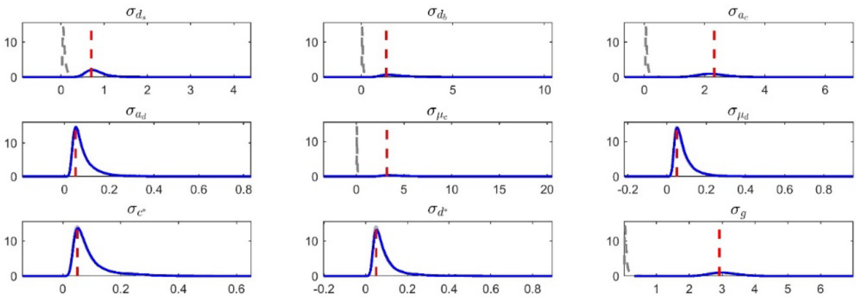
Note: Source – the author.

5.2 Posterior Distributions

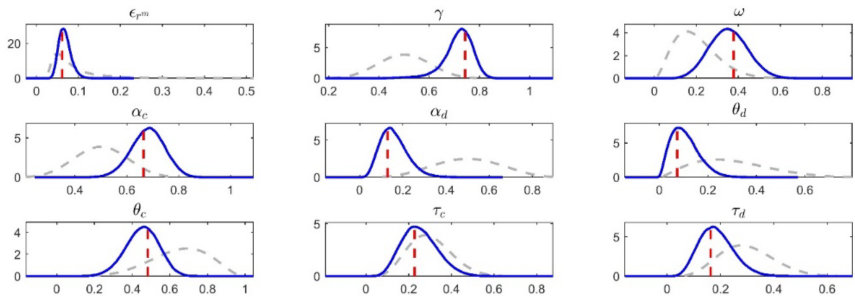
Generally, all of the parameters appear to be well identified, as evidenced by the posterior distribution not being centered on the prior, which indicates that the estimates are quite significant (Figure 4). The estimation results are provided in the last four columns of Tables 2 and 3. The posterior mean of the share of housing in the welfare-relevant consumption index (γ) is very high (around 72 percent), thus implying an extremely strong wealth effect on the consumption pattern of households. From a modeling perspective, this suggests a stronger collateral channel when the unavailability of credit makes households face tighter credit constraints. As a result, further housing price acceleration increases household dependence on housing price gains to facilitate consumer spending. In reality, such a strong wealth effect indicates that a significant portion of the household income is allocated towards housing-related costs, including mortgage or rent payments, utilities, and maintenance, leaving little room for other essential expenditures.

Figure 4 Prior and Posterior Distributions

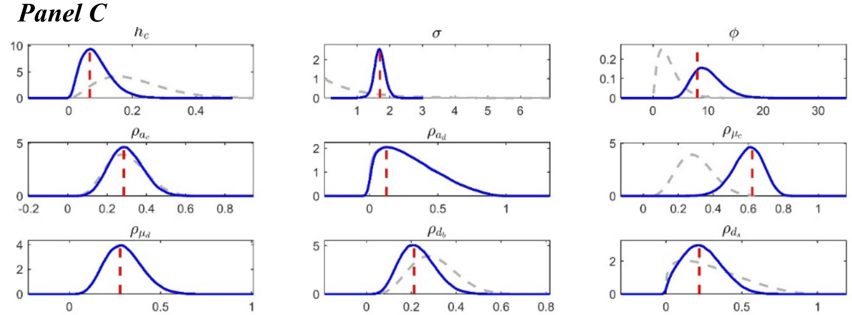
Panel A



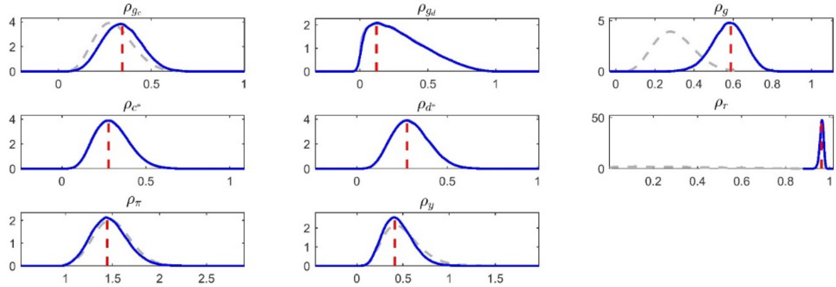
Panel B



Panel C



Panel D



***Source*:** The author.

The estimated share of borrowers (ω) at 35 percent aligns closely with the reality of Kazakhstan, where approximately 22 percent of the economically active population hold consumer loans (National Bank of the Republic of Kazakhstan, 2013). The moderate degree of openness for non-housing goods (68 percent) and very small degree of openness for housing goods (16 percent) are intuitively appealing. It is expected that the housing sector is less accessible to foreigners due to the complexities involved in purchasing a house compared to non-durable consumer products. An intriguing finding is the flexibility of prices in the housing sector (θ_d = 0.11) compared to the relative inflexibility in the non-durable goods sector (θ_c = 0.45). The results suggest that 45 percent of the firms in the sector of non-durable goods do not change prices within one quarter, compared to only 11 percent in the housing sector. In other words, prices in the sector of non-durable goods on average remain constant for 2 quarters, while prices in the sector of durable goods are reoptimized every quarter (the number of quarters when prices are unchanged is equal to $\frac{1}{1-\theta}$). This is in line with Abilov (2021), who find a high price stickiness of domestic goods in Kazakhstan. Furthermore, by examining property price statistics, it is evident that the residential property prices in Kazakhstan are indeed flexible. The housing market has experienced rapid and volatile appreciation in home values since the independence of Kazakhstan. The degree of backward-looking price setting for durable goods is estimated at 0.18, thus indicating a small proportion of firms in the housing sector that base their prices on past information. Notably, the habit persistence parameter exhibits a small value of 8.7 percent, which aligns with the findings in Tolepbergen (2022) of a lower estimate for this parameter compared to previous assumptions. The intertemporal substitution elasticity of 1.68 suggests that households in Kazakhstan show a relatively strong inclination to adjust their consumption patterns in response to changes in interest rates or the prices of goods and services. This indicates a higher responsiveness to intertemporal trade-offs in their decision-making process. Moreover, the leisure substitution elasticity of 9.92 indicates that individuals in Kazakhstan are highly responsive to changes in wages, particularly in terms of adjusting their leisure time.

In terms of production processes, the mean standard deviation of 2.259 for the technology shock of consumption goods suggests moderate variability and uncertainty in their production in Kazakhstan. On the other hand, the mean standard deviation of 0.084 for the technology shock of housing goods indicates a more stable production process with lower variability. These findings imply that the production of consumption goods is subject to more fluctuations and risks compared to housing production, which exhibits greater stability in Kazakhstan. A similar pattern is observed for the cost-push shock. An interesting result is that in Kazakhstan, government spending exhibits a moderate level of variability with a mean standard deviation of 3.058, which suggests that changes in government expenditures can have significant fluctuations and impacts on the economy. On the other hand, monetary policy measures demonstrate relatively low levels of variability with a mean standard deviation of 0.067, thus indicating a more stable and consistent approach to managing the money supply and interest rates. Overall, these findings suggest that government spending has the potential to introduce greater volatility into the economy compared to the stability associated with the monetary policy in Kazakhstan.

5.3 Variance Decomposition

Table 4 provides insights through variance decompositions, and highlights the contribution of different shocks to the variance of economic variables at different time horizons. The findings reveal significant factors that influence the variability in output, employment, interest rate, consumption, inflation, and housing prices. Technology shocks play a prominent role, and account for approximately 45 percent of the variation in output in the first quarter and asymptotically. This finding aligns with the research conducted by Abilov (2021), which also emphasizes the substantial impact of technology shocks on output fluctuations, and attributes 43 percent of the variations to technological factors. Housing preference shocks explain for around 21 percent of the asymptotic variation in output and 22 percent of the variation at impact in the model. This finding supports our earlier observation of the strong wealth effects associated with residential goods.

Cost-push mark-up shocks contribute to 23 percent of the volatility in output, while their influence on employment is even more pronounced, which accounts for 71 percent of the variation. During periods of low oil and gas prices, energy companies in Kazakhstan face reduced profit margins as their revenues decline. To maintain their profitability, these companies may need to cut costs, which can include reducing their workforce through layoffs and job cuts. This can result in employment declines in the energy sector and related industries. Government spending shocks and monetary policy shocks also play a role in employment variability, which contribute 13 percent and 6 percent, respectively. The interest rate volatility is primarily driven by government spending shocks, which account for more than 66 percent of the variation.

Table 4 Conditional Variance Decomposition at Different Horizons

Variable and Horizon		σ_{a_c}	σ_{d_*}	σ_{μ_c}	$\sigma_{d,b}$	$\sigma_{d,s}$	σ_g	ε_t^r
Output	1	45.17	3.27	22.75	1.86	19.82	5.24	1.56
	4	45.82	3.10	22.65	1.89	20.06	4.77	1.57
	8	45.52	3.26	22.93	1.87	19.94	4.76	1.56
	12	45.49	3.26	22.91	1.87	19.93	4.82	1.56
	∞	45.45	3.26	22.90	1.87	19.92	4.87	1.56
Employment	1	2.79	2.32	71.05	0.71	3.45	13.45	6.15
	4	2.85	2.36	71.72	0.63	3.52	13.70	5.17
	8	2.81	2.34	71.54	0.66	3.48	13.55	5.55
	12	2.80	2.33	71.35	0.68	3.47	13.51	5.79
	∞	2.80	2.33	71.24	0.70	3.46	13.48	5.94
Interest Rate	1	2.71	18.64	3.54	6.43	0.29	66.97	1.30
	4	2.74	18.07	3.45	6.61	0.27	68.23	0.52
	8	2.73	18.72	3.39	6.46	0.27	67.48	0.86
	12	2.72	18.72	3.44	6.44	0.28	67.24	1.05
	∞	2.72	18.69	3.48	6.44	0.28	67.13	1.16
Consumption	1	0.33	5.05	4.98	79.12	0.87	1.03	8.49
	4	0.32	5.23	2.93	86.13	0.78	0.65	3.91
	8	0.32	5.29	3.91	82.97	0.80	0.69	5.96
	12	0.32	5.18	4.39	81.36	0.82	0.78	7.08
	∞	0.32	5.12	4.65	80.46	0.84	0.84	7.71
Inflation	1	2.77	26.21	1.11	1.27	8.28	5.42	54.38
	4	2.78	25.91	1.11	1.28	8.32	5.43	54.64
	8	2.77	26.19	1.11	1.27	8.28	5.43	54.40
	12	2.77	26.21	1.11	1.27	8.28	5.43	54.38
	∞	2.77	26.21	1.11	1.27	8.28	5.43	54.38
Housing Prices	1	0.01	0.33	0.14	0.04	81.90	0.07	17.43
	4	0.01	0.33	0.14	0.04	81.92	0.07	17.43
	8	0.01	0.33	0.14	0.04	81.90	0.07	17.43
	12	0.01	0.33	0.14	0.04	81.90	0.07	17.43
	∞	0.01	0.33	0.14	0.04	81.90	0.07	17.43

Interestingly, housing preference shocks of borrowers explain for a substantial 80 percent of the variability in consumption, which underscores the strong link between housing preferences and consumption behavior. Furthermore, the housing preference shocks of savers determine almost all of the variation in housing prices, and accounts for 82 percent. These results are consistent with the findings of Funke and Paetz (2013), as well as Iacoviello and Neri (2010), who highlight the influence of housing preference shocks on housing price volatility and residential investment. Interestingly, our findings suggest that the impact of monetary and fiscal policies on housing prices is relatively limited compared to the influence of housing preferences. While monetary and fiscal policies can indirectly affect the housing market through broader economic conditions, such as interest rates and government spending, the primary driver of housing price variability lies in the preferences of borrowers and savers. This result is supported by Ybrayev and Becker (2019), who found a weak effect of monetary policy on housing prices in Kazakhstan. Their research suggests that other policy changes, exchange rate movements, and local factors have exerted a greater influence on the housing market.

The volatility in the inflation rate in Kazakhstan is influenced by two key factors: variations in foreign consumption of non-durable goods, which account for 26 percent of the variation, and monetary policy shocks, which contribute 54 percent. These factors are closely tied to the economic structure of Kazakhstan. Being heavily reliant on commodity exports, particularly oil and gas, Kazakhstan is susceptible to fluctuations in global oil prices. During periods of high oil prices, increased export revenues stimulate domestic demand, including the consumption of non-durable goods. Moreover, these high oil prices lead to a surge in foreign currency inflows, which can impact the exchange rate and make imported goods, including non-durable goods, relatively more expensive, thus contributing to inflationary pressures. Additionally, changes in monetary policy implemented by the NBRK influence inflation levels. When the central bank tightens monetary policy through interest rate increases, it reduces consumer borrowing and spending, which mitigates inflationary pressure. Conversely, an expansionary monetary policy, such as lowering interest rates or injecting liquidity into the financial system, stimulates borrowing and consumer spending, thus potentially leading to higher inflation. Overall, the findings from the variance decompositions shed light on the factors that drive variability in the key economic variables. These insights enhance our understanding of the dynamics within the model and provide valuable implications for the Kazakhstani economy.

5.4 Historical Decomposition

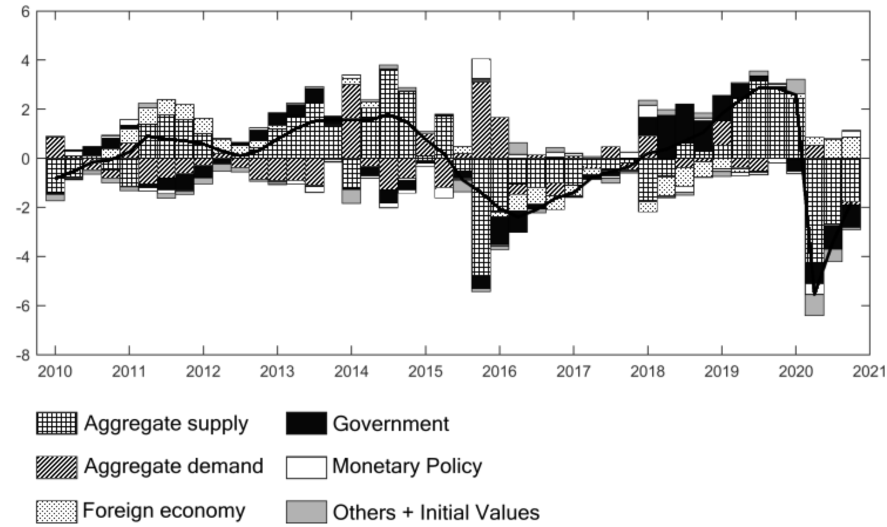
We present the historical shock decompositions for the key macroeconomic variables, namely GDP, inflation, housing prices, and interest rates, in Figure 5. The purpose of these decompositions is to gain insights into the relative contributions of the different types of shocks to the fluctuations observed in these variables throughout the entire study period. In our analysis, we classify the shocks into five distinct groups: aggregate supply, aggregate demand, foreign economy, government, and other shocks. The aggregate supply shocks encompass the technology and mark-up shocks, which capture variations in productivity and pricing power. On the other hand, the aggregate demand shocks revolve around the housing preference shocks of both savers and borrowers, thus reflecting shifts in their preferences for housing-related expenditures. The foreign economy shocks encompass the influence of foreign consumption patterns and price distortions in the housing and non-housing goods sectors. These shocks capture the spillover effects that originate from the international markets. Lastly, the government shocks account for any policy or fiscal measure implemented by the government that has an impact on the economy. The remaining category, referred to as other shocks, incorporates any residual shocks not explicitly captured by the other groups. By examining the historical decomposition of these variables, we can discern the relative significance of each shock in driving the fluctuations observed over the entire study period. Furthermore, we aim to explore the implications of the model regarding the main shocks that underlie the economic turbulence experienced in 2015 and 2020.

Panel A of Figure 5 provides valuable insights into the factors that drive output fluctuations in the Kazakhstani economy. The historical shock decomposition reveals that aggregate supply shocks play a crucial role in shaping output dynamics. Specifically, the productivity shock emerges as a significant contributor to output fluctuations during the study period. Analyzing the specific time periods, we observe that the productivity shock exhibits a positive effect in 2014, thus contributing to output growth. However, during 2015 and 2016, the productivity shock exerts a negative influence on output, which coincides with a period of significant volatility in oil prices. The global economy experienced a substantial decline in oil prices between mid-2014 and early 2016, with Kazakhstan being heavily reliant on oil exports. As a result, the Kazakhstani GDP fluctuated in response to the challenging conditions prevailing in the oil market. Furthermore, the productivity shock emerges as the primary driver of the output surge witnessed in 2020. The COVID-19 pandemic outbreak prompted the introduction of strict quarantine measures in Kazakhstan, which led to business closures and adversely affected productivity levels. Consequently, the productivity shock played a pivotal role in shaping the output dynamics during this unprecedented period of economic disruption.

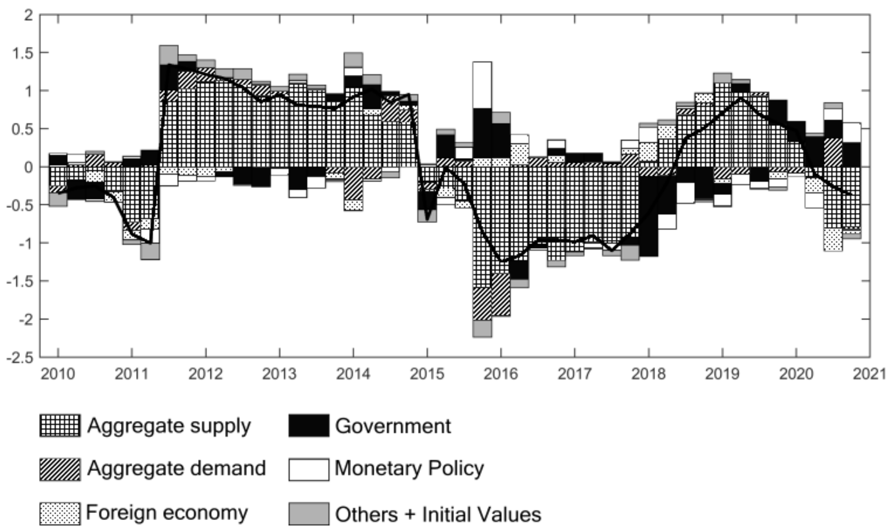
Turning our attention to employment, Panel B provides insights into the factors that influence changes in the labor market. Consistent with the findings for output, we observe that productivity shock is the key driver of employment fluctuations. Changes in productivity levels directly impact labor demand and the hiring decisions of firms, thus influencing employment trends. The historical shock decomposition analysis underscores the significance of productivity shocks in shaping the fluctuations observed in both output and employment. This highlights the importance of factors that affect productivity levels, such as oil price dynamics and the disruptive effects of the COVID-19 pandemic, in understanding the dynamics of the Kazakhstani economy.

Figure 5 Historical Decomposition

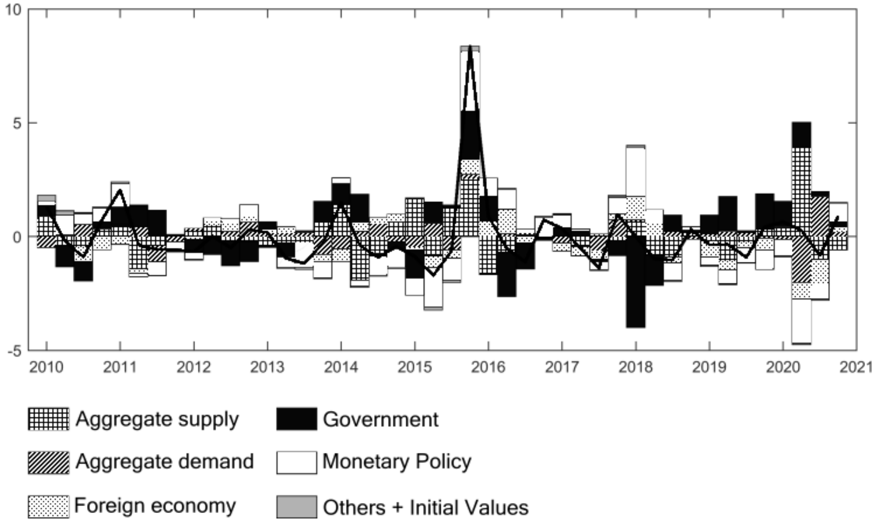
Panel A – GDP



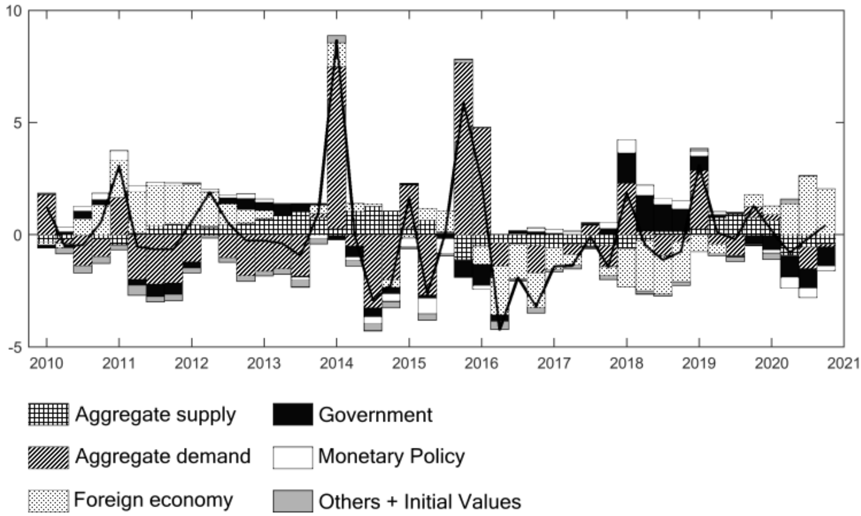
Panel B – Employment



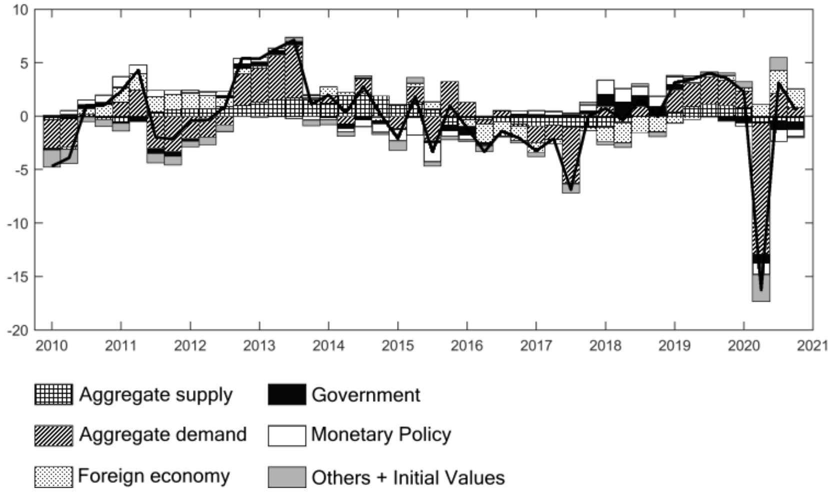
Panel C – Inflation



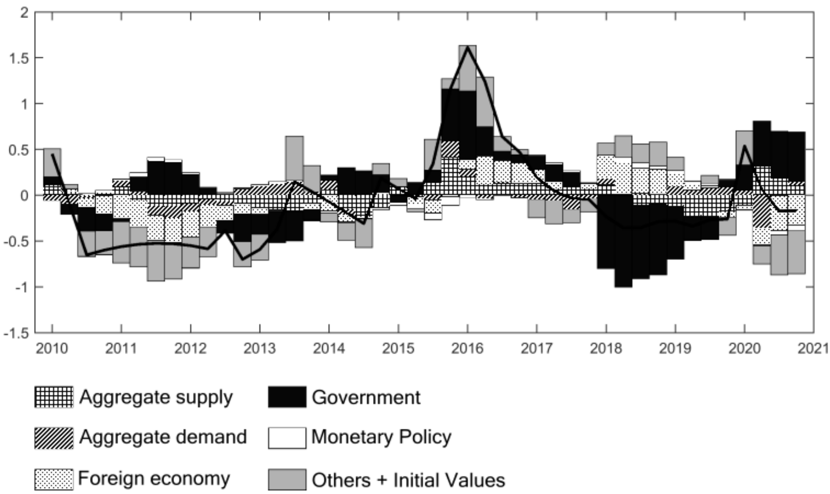
Panel D – Housing Prices



***Panel E* – Consumption**



***Panel F* – Interest Rate**



Source: The author

Panel C provides a historical decomposition of the inflation rate to shed light on the key drivers of inflation fluctuations in the Kazakhstani economy. The analysis reveals that the inflation rate is primarily influenced by two significant shocks: monetary policy and government spending shocks. Examining the specific time periods, we observe that these shocks played a prominent role in the inflation spikes experienced at the beginning of 2016. During this period, the authorities responded to the collapse in global oil prices by implementing rapid fiscal adjustments and adopting a free-floating exchange rate policy. These policy measures, aimed to address the economic challenges posed by the oil price decline, resulted in inflation rate spikes. The combination of the monetary policy and government spending shocks exerted upward pressure on prices during this period. In 2018, the government spending shock emerged as a key driver of inflation dynamics. With the phasing out of the Nurly Zhol stimulus initiative (an economic stimulus plan) and the implementation of measures to streamline spending, the total balance recorded a surplus of 1.4 percent of the GDP. This decrease in government spending offset the effects of the easing monetary policy shock, which led to a negative contribution of government spending shock to the inflation rate. This highlights the importance of fiscal policy measures in influencing inflation dynamics.

Furthermore, the impact of monetary policy shocks on the inflation rate is evident in the first quarter of 2020. The NBRK responded to the challenges posed by the productivity crisis by raising the policy rate. This tightening of monetary policy aimed to stabilize the inflation rate and address the economic difficulties at hand. As a result, monetary policy shocks exerted a negative influence on the inflation rate during this period. The findings highlight the importance of a coordinated approach to monetary and fiscal policy to maintain stable inflation and address economic challenges in Kazakhstan.

A closer examination of the housing price fluctuations and drivers reveals interesting insights. According to the historical shock decomposition analysis, housing preference shocks have emerged as the primary drivers of housing prices in Kazakhstan (Panel D). These shocks reflect the changing preferences and behaviors of the local population regarding their housing choices. In 2014, the situation of the housing market of Kazakhstan can be described as an inflated real estate bubble, with prices significantly higher than they should be due to market oversaturation and unrealistic pricing. In 2015, housing prices dramatically dropped. Contributing factors include a worsened business environment in Kazakhstan, capital outflows from the banking sector as people withdrew their deposits, and a decrease in mortgage volume due to banks either not granting mortgages or providing them in limited amounts. The contribution of foreign demand shocks to housing prices has become increasingly significant in recent years. This trend may be attributed to factors such as increased foreign direct investment, international collaborations, and the attraction of foreign buyers and investors to the Kazakhstani real estate market. In line with these dynamics, a proposal was introduced in 2018 to allow foreigners who are temporarily residing in Kazakhstan to purchase housing in multi-apartment buildings. By opening up the housing market to foreigners, the government of Kazakhstan aims to attract foreign investment, enhance the investment attractiveness of the country, and stimulate economic growth.

In Panel E, the historical shock decomposition confirms the variance decomposition results, thus indicating that housing preference shocks are the main drivers of consumption deviations. Consumption is a vital channel through which the housing sector impacts the rest of the economy (Iacoviello and Neri, 2010). Aggregate supply and foreign economy shocks also have some contribution to consumption fluctuations. The demand for non-housing goods in an open economy is expected to be affected by foreign demand and productivity shocks as well.

Panel F provides insights into the factors that influence the interest rates in Kazakhstan. The main drivers of interest rate fluctuations are identified as government spending and foreign economy shocks. The relationship between government spending and interest rates follows a conventional pattern, where an increase in government spending typically leads to upward pressure on interest rates. The historical shock decomposition reveals that during the periods of 2016-2017 and 2020, government spending shocks have a positive impact on the interest rate. This can be attributed to specific events and circumstances during those years. Between 2016 and 2017, the Kazakhstani government increased its spending on Astana Expo, which resulted in a rise in money demand and subsequently an increase in the interest rate. Similarly, in 2020, the government implemented increased expenditure measures to support households and firms during the restrictive quarantine measures imposed in response to the COVID-19 pandemic. These measures aimed to mitigate the economic impact of the pandemic and provide assistance to affected individuals and businesses. The higher government spending in this period also contributed to upward pressure on the interest rate.

Overall, the historical shock decomposition supports the variance decomposition results, which implies that aggregate supply shocks are the primary driver of output and consumption fluctuations, while aggregate demand shocks boost housing prices in periods of high housing price increases.

5.5 Impulse Response

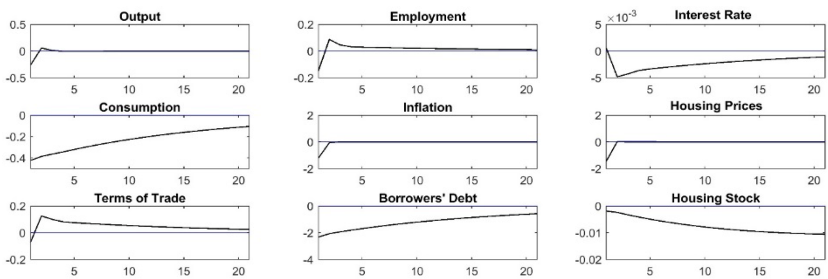
An impulse response analysis is used to examine the impact of housing preference, technology and monetary policy shocks on the key variables in the model. Figure 6 depicts the behavior of different variables, including real output, consumption, employment, housing prices, inflation, interest rate, terms of trade, and borrower debt. The values presented in the graphs represent the percentage deviation from the steady-state with quarterly periods.

<u>One Standard Deviation Contractionary Monetary Policy Shock</u>

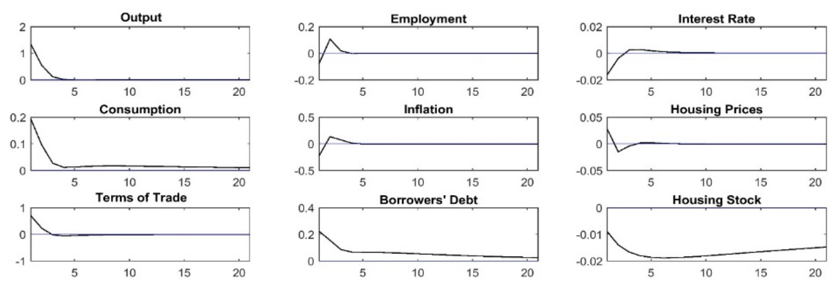
Panel A focuses on the effect of a one standard deviation contractionary monetary policy shock, which corresponds to an increase in the nominal interest rate. The results align with previous empirical studies on housing. Higher interest rates make current consumption relatively more expensive compared to future consumption, which prompts patient households to save more by reducing their current consumption. Additionally, the rise in the nominal interest rate raises the ex-post value of existing debt, which leads impatient households to decrease their borrowing. As a consequence, there is a decline in aggregate demand for housing, which prompts firms to reduce employment and results in lower marginal costs for the firms. Some of the firms adjust their prices downwards, which leads to a decrease in inflation by approximately 1 percent. This finding highlights the effectiveness of a monetary policy in managing inflation. Furthermore, the increase in the interest rate in Kazakhstan leads to a decrease in investment, consumption, and overall economic output, which aligns with the standard transmission mechanism of monetary policy. Lastly, reduced borrowing negatively impacts the demand for housing and contributes to a decline in housing prices.

Figure 6 Impulse Responses

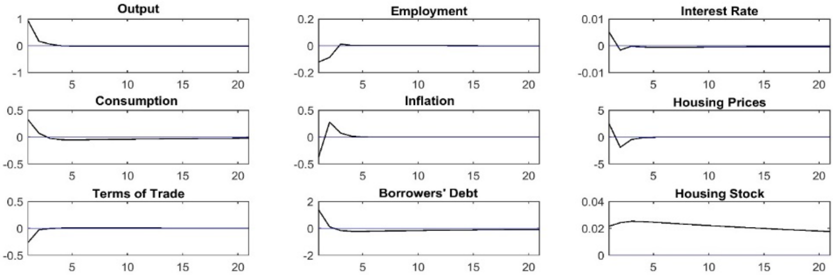
Panel A – Contractionary Monetary Policy Shock



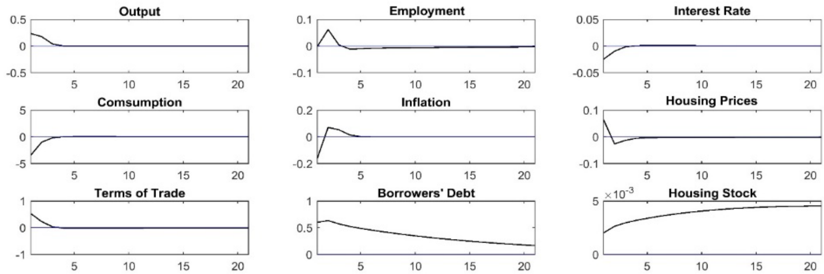
Panel B – Technology Shock



Panel C – Housing Preference Shock of Savers



Panel D – Housing Preference Shock of borrowers



Source: The author.

<u>One Standard Deviation Technology Shock</u>

Panel B plots the impulse responses of the model economy to a technology shock. Consistent with the findings of Iacoviello and Neri (2010), output and consumption experience an increase as a result of technological progress. The technology shock specifically affects the non-housing sector by enhancing the marginal efficiency of producing non-housing goods. This leads to a decrease in the inflation rate. The decline in prices within the non-housing sector prompts households to shift their demand from housing goods to non-durable goods. Consequently, there is a reduction in the housing stock. In response to the technology shock, the nominal interest rate decreases. Interestingly, the technology shock in the non-housing sector has a positive impact on housing prices and also provides increased borrowing opportunities for impatient households.

<u>One Standard Deviation Housing Preference Shock of Savers</u>

Panel C plots the responses to housing preference shock on a saver. When savers experience a positive housing preference shock, this leads to an increase in housing prices by approximately 3 percent. This, in turn, boosts the collateral value of impatient households, which enables them to increase their debt holdings. As a consequence of the increased collateral value and higher debt capacity, borrowers are able to enhance their consumption of both housing and non-housing goods. This increased consumption by borrowers has a positive effect on the overall economy, which results in a rise in total consumption. Furthermore, it is worth noting that despite the worsening terms of trade, the economy experiences a quarterly output growth of 1 percent. This suggests that the positive housing preference shock outweighs the negative impact of the deteriorating terms of trade, and leads to an overall expansion in output. These findings highlight the interconnectedness of housing preferences, collateral value, debt holdings, and consumption in shaping the behavior of savers, borrowers, and the broader economy.

One Standard Deviation Housing Preference Shock of Borrowers

Panel D provides details on the impact of housing preference shocks on borrowers. When borrowers experience a positive shock, their spending behavior temporarily shifts towards the housing sector. This has significant implications for the economy. First, there is an overall increase in aggregate output as borrowers demand more housing. This stimulates growth and expansion within the housing sector, which boosts aggregate output. However, this shift in spending comes at the expense of consumption. Borrowers reduce their consumption of consumer goods as they allocate more resources to housing. This emphasizes their preference for housing investment over immediate consumption. To finance their increased housing spending, borrowers take on more debt. Positive housing preference shocks prompt borrowers to increase their debt levels, which show their willingness to leverage their financial position for housing preference. The heightened demand for housing leads to higher prices in the housing goods sector, and reflects strong competition among borrowers. Furthermore, the decline in consumption due to the housing shock results in significant reduction in consumer goods inflation. With borrowers focusing more on housing, the demand for consumer goods decreases, which causes a noticeable decrease in consumer goods inflation.

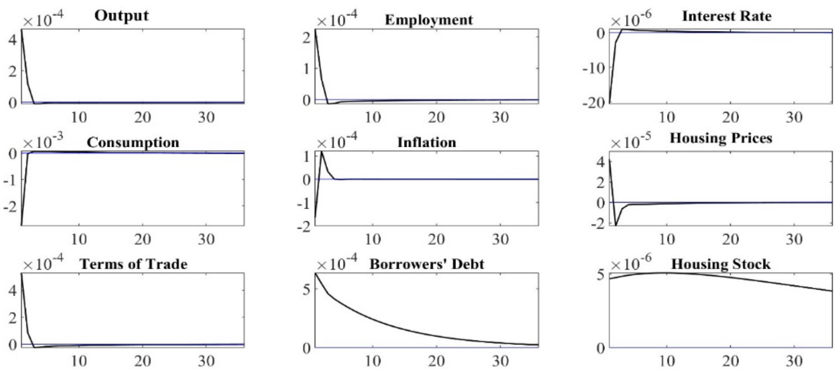
5.6 Pension Policy

Figure 7 plots the impulse response functions associated with an increase in the pension policy shock. Consistent with previous research, the immediate effect of the shock on housing prices, output, and employment is positive, but the magnitude of this effect is small and short-lived. This suggests that the impact of the pension withdrawal policy on these variables is relatively insignificant. The pension withdrawal policy allows borrowers to increase their debt levels to finance higher housing expenditures while reducing spending on consumption goods. Although there is a noticeable response in housing prices and other economic indicators, the overall effect on the economy of Kazakhstan is negligible.

These findings align with the study conducted by Funke and Paetz (2013) on the Hong Kong economy, where they also observe an insignificant long-term impact of a positive LTV ratio shock. This indicates that the pension policy changes in Kazakhstan, specifically the withdrawal policy, do not exert a substantial and sustained influence on the broader economic landscape.

Furthermore, our analysis indicates that the introduced pension reform does not have a significant effect on housing prices in Kazakhstan, despite a short-term reduction in non-housing consumption. Specifically, a 20 percent increase in pension withdrawals leads to a modest 1.4 percent decrease in consumption, 0.2 percent increase in output, slight increase in inflation by 0.1 percentage points, and negligible effects on housing prices (+0.02 percentage points). While the reform may have influenced the consumption of non-housing goods, its impact on price dynamics is marginal.

Figure 7 Impulse Responses to Pension Withdrawal Shock



Source: The author

It is important to note that our analysis focuses on examining the impact of the pension reform on the macroeconomy and housing market dynamics, rather than specifically studying its effect on housing affordability. While the influence of the reform on housing prices and consumption patterns has been assessed, a comprehensive evaluation of its direct implications for housing affordability requires further investigation.

6. Conclusion

The housing market fluctuations in Kazakhstan have gained significant attention, especially in light of the 2008 global financial crisis and recent acceleration in housing prices. To better comprehend these fluctuations, we examine the contributors to the housing market dynamics in Kazakhstan. Our approach involves developing and estimating a DSGE model. By using Bayesian estimation techniques, we estimate the model with seven quarterly time series that span 2010Q1 to 2020Q4. The posterior estimates derived from our analysis align closely with those identified in the DSGE housing literature.

One key finding of the study is the pivotal role played by housing preference shocks in explaining the observed housing market fluctuations. These shocks account for a substantial portion of the variation in housing prices and consumption behavior. Specifically, the housing preference shocks of borrowers drive the shifts towards housing expenditures, which lead to a decline in non-housing goods consumption. On the other hand, the housing preference shocks of savers have a more pronounced impact on housing prices.

Surprisingly, the study reveals that monetary policy shocks, which are often considered influential, appear to be insignificant in explaining the fluctuations in the housing market in Kazakhstan. Similarly, other significant shocks such as government spending, productivity and markup shocks show limited explanatory power for housing price fluctuations. These results highlight the need to consider alternative approaches beyond traditional policy measures to effectively address housing market fluctuations. The government of Kazakhstan should exercise caution and closely monitor the potential emergence of housing bubbles by considering alternative factors that may drive price movements and market dynamics.

Another noteworthy outcome of the analysis is the strong evidence of the housing wealth effect in Kazakhstan. Fluctuations in the housing market significantly impact consumption behavior, which indicates a spillover effect from the housing market to the broader economy. This result captures the notion that possessing property in Kazakhstan is viewed as a symbol of accumulating wealth or investment opportunity rather than a primary residence. Households in Kazakhstan are financially vulnerable to fluctuations in the housing market. When the value of housing assets increases, homeowners tend to feel wealthier and more financially secure. Conversely, if housing prices decline significantly, homeowners may experience a substantial loss in wealth, which can impact their overall financial stability and ability to meet other financial obligations. The impulse response functions confirm the presence of a significant housing wealth effect in Kazakhstan. Consumption and output exhibit strong responses to housing preference shocks, which underscore the importance of the housing market in shaping overall economic activity. These findings have important implications for policymakers, and highlight the need to take into account the potential spillover effects of housing market fluctuations on the broader economy.

Our analysis reveals that monetary policy shocks drive inflation in non-housing goods. In terms of price persistence, non-housing market prices are found to be highly sticky, while housing market prices exhibit greater flexibility. Regarding the drivers of fluctuations in real output, housing preference and technology shocks play substantial roles. The former explain for around 22 percent of output fluctuations and a significant 80 percent of consumption movements, while the latter account for approximately 45 percent of the output variance. Employment variations are primarily influenced by mark-up shocks (71 percent of the variation) and government spending shocks (13 percent of the variation). Interestingly, shocks related to collateral constraints have minimal impact on the housing market cycle in Kazakhstan, as observed in the analysis. This finding suggests that early pension withdrawal policy may not be the significant driver of housing market fluctuations in the country.

A historical decomposition analysis further uncovers the key drivers of inflation in Kazakhstan since 2010. Monetary policy and government spending shocks emerge as vital contributors. Housing preference shocks are identified as determinants of consumption fluctuations and housing price movements. Although foreign demand shocks generally do not hold significant weight in shaping housing prices, their contribution has become more prominent in recent times. Productivity disturbances greatly contribute to explaining output and employment variations. Furthermore, variations in the interest rate predominantly stem from government spending shocks.

To enhance the analysis, future research could consider incorporating fluctuations in housing investment into the model. This would provide a more comprehensive understanding of the underlying factors that drive the relationship between the housing market and macroeconomy in Kazakhstan.

References

Abilov, N. (2021). A medium-scale Bayesian DSGE model for Kazakhstan with incomplete exchange rate pass-through. *International Economic Journal,* 35(4), 486-522.

Aspachs-Bracons, O., and Rabanal, P. (2010). The drivers of housing cycles in Spain. *SERIEs*, 1(1), 101-130.

Bekbossinova, A., Oshanova, K., Khassenova, K., Alpysbayeva, A. and Moldasheva, A. (2022). Advantages and Disadvantages of Early Withdrawal of Pension Savings: An Expert Assessment. *Economics: The Strategy and Practice.* 17, 242-258.

Campbell, J. Y., and Cocco, J. F. (2007). How do house prices affect consumption? Evidence from micro data. *Journal of Monetary Economics,* 54(3), 591-621.

Case, K. E., Quigley, J. M., and Shiller, R. J. (2005). Comparing wealth effects: the stock market versus the housing market. *Advances in Macroeconomics,* 5(1).

Christensen, I., Corrigan, P., Mendicino, C., and Nishiyama, S. I. (2016). Consumption, housing collateral and the Canadian business cycle. *Canadian Journal of Economics/Revue canadienne d'économique,* 49(1), 207-236.

Daulenova, Z. and Taylor, L. (2021). The impact of fintech innovations and financial standards on bank performance in Kazakhstan. *18th KIRC 2021 Program Outline Research Conference*, *Almaty, 9-10 April.* Available at https://www.kimep.kz/bang-college-of-business/files/2018/03/18th-KIRC-2021-Proceeding_Final_revised_June17.pdf

Favara, G. and Imbs, J. (2015). Credit supply and the price of housing. *American Economic Review, 105(3), 958-992.*

Funke, M., and Paetz, M. (2013). Housing prices and the business cycle: *An empirical application to Hong Kong. Journal of Housing Economics, 22*(1), 62-76.

Funke, M., Kirkby, R., and Mihaylovski, P. (2018). House prices and macroprudential policy in an estimated DSGE model of New Zealand. *Journal of Macroeconomics*, 56, 152-171.

Gan, J. (2010). Housing wealth and consumption growth: Evidence from a large panel of households. *The review of financial studies*, 23(6), 2229-2267.

Hu, Y. and Tiwari, P. (2021). Examining the Macroeconomic Determinants of Property Cycles in Australia. *International Real Estate Review*, 24(2).

Iacoviello, M., and Neri, S. (2010). Housing market spillovers: evidence from an estimated DSGE model. *American Economic Journal: Macroeconomics,* 2(2), 125-64.

Lee, J., and Song, J. (2015). Housing and business cycles in Korea: A multi-sector Bayesian DSGE approach. *Economic Modelling*, 45, 99-108.

Liu, C., and Ou, Z. (2021). What determines China's housing price dynamics? New evidence from a DSGE-VAR. *International Journal of Finance and Economics,* 26(3), 3269-3305.

National Bank of the Republic of Kazakhstan. (2013). Financial Stability Report of Kazakhstan, 2013. Available at:

https://www.nationalbank.kz/en/news/otchet-o-finansovoy-stabilnosti/rubrics/231

Ng, E. C. (2015). Housing market dynamics in China: Findings from an estimated DSGE model. *Journal of Housing Economics*, 29, 26-40.

Ng, E. C., and Feng, N. (2016). Housing market dynamics in a small open economy: Do external and news shocks matter? *Journal of International Money and Finance*, 63, 64-88.

Seitz, W. (2021). Urbanization in Kazakhstan: Desirable cities, unaffordable housing, and the missing rental market. *International Journal of Urban Sciences*, 25(sup1), 135-166.

Tolepbergen, A. (2022). The role of labor market structure and shocks for monetary policy in Kazakhstan. *International Journal of Economic Policy Studies*, 16(1), 179-210.

Wen, X. C., and He, L. Y. (2015). Housing demand or money supply? A new Keynesian dynamic stochastic general equilibrium model on China's housing market fluctuations. *Physica A: Statistical Mechanics and its Applications,* 432(C), 257-268.

Yang, Z., Wu, S. and Shen, Y. (2017). Monetary Policy, House Prices, and Consumption in China: A National and Regional Study. *International Real Estate Review*, 20(1).

Ybrayev, Z. and Becker, C. (2019). *Real Estate Market Evolution and Monetary Policy in Kazakhstan.* Economic Research Initiatives at Duke (ERID) Working Paper, (287). University of Central Asia – Institute of Public Policy and Administration (IPPA) Working Paper No. 54, Available at: https://ssrn.com/abstract=3409328

Ybrayev, Z., Talakin, A., Kairullayev, Y. and Zharkynbay, T. (2023). Household debt service ratio in a developing economy: borrower-based analytical tools and macroprudential policy overview in Kazakhstan. *Journal of Banking Regulation*, 1-15.