

A Structural and Economic Analysis of the Norwegian House Market

Abstract

This research investigates the trends of the Norwegian housing market from 1990 to 2024. It applies quantitative economic models and draws from secondary data to compile facts that define the housing situation in Norway. It examines how macroeconomic factors, including real GDP, interest rates, CPI, unemployment, construction costs, and building permits, affect the price of residential real estate, with a particular focus on the roles played by the government, financial institutions, and investors. Panel data regression, ARIMA, VAR, and descriptive statistics are employed to analyze secondary data from sources such as FRED and International Housing Association. The results indicate that real GDP and house prices exhibit a strong positive relationship. It also finds that interest bank rates have a significant impact on housing demand and prices, with lower interest rates being characterized by high demand and escalation in prices. Findings suggest that GDP growth and interest rates directly impact housing demand and prices in Norway. The study concludes that structural and economic factors drive persistent market imbalances, and it recommends targeted government policy reforms that inform systematic structural changes to promote a more sustainable and equitable housing market in Norway.

1. Introduction

The Norwegian housing market is defined by a growing disparity between supply and demand for houses that impacts affordability. Amundsen (2023) claims that despite Norway's robust economy and steady growth, the country is still grappling with a worsening housing issue, as evidenced by rising prices and significant regional housing disparities. A growing proportion of Norwegians are unable to become homeowners as a result of the sharp rise in housing costs, particularly in several large cities where wage growth has lagged. According to Gulyan (2016), growing property prices foreshadow an impending housing bubble, even though Norway's real estate market has recently drawn a lot of investors because of its high standard of living and sensible government controls. This tendency has threatened Norwegian households' long-term financial stability, social cohesion, and economic inclusion.

Over the past 20 years, the cost of homes in Norway has increased dramatically, making them increasingly out of reach for prospective purchasers, particularly those from low-income and first-time homebuying families in some big cities. For instance, compared to other urban and suburban locations, housing expenses in Oslo alone have tripled since the early 2000s (Amundsen, 2023). The issue remains unresolved despite government initiatives aimed at limiting price hikes and improving housing supply. Statistics indicate that, despite an increase in the number of homes being constructed each year, this is insufficient to meet the demand for housing (International Housing Association, 2019). According to Anundsen (2021), there is a shortage because the country has not built enough new housing complexes to keep up with current trends in urbanization and population growth.

According to recent trends, price increases have also been noted in rural and suburban locations. However, metropolitan areas have seen the most significant manifestation of this trend. The tendency has been attributed to several variables, including a shortage of available housing units, lower interest rates on loans, and a rise in housing demand (Granath Hansson et al., 2024). Previous studies have shown that several structural issues exacerbate the housing shortage. Strict zoning regulations and burdensome procedures, for instance, hinder new development, resulting in a housing unit shortage relative to demand and a corresponding rise in costs (Sørvoll, 2024). Concurrently, additional construction delays are caused by the capacity issues facing the Norwegian building sector.

The housing crisis has gotten worse due to supply-side limitations and demand-side issues. According to Olsen and Midtgaard (2024), the Norges Bank, for example, has kept interest rates low for the last ten years, which encourages borrowing and raises consumer purchasing power and demand for housing. Demand has increased as more people seek the available apartments. Furthermore, statistics show that Norway's home price index has stayed steady at about 30%, suggesting that prices are reasonable when taking interest rates and income levels into account between 2011 and 2019 (International Home Association, 2019). Additionally, the housing supply is under even greater strain due to shifting demographics resulting from urbanization and population growth, particularly in metropolitan regions. Investor activity has also had an impact on the market, leading to price volatility and decreased affordability. When formulating strategies to address the housing issue, these structural and economic factors play a critical role.

Norway's housing supply side has been hindered by strict zoning laws, lengthy bureaucratic processes for acquiring building permits, and the high cost of building supplies (Sørvoll, 2024). Record-low interest rates have encouraged speculative investment, which has further inflated housing prices (Olsen & Midtgaard, 2024). Together, these factors have created a market imbalance characterized by a growing demand for homes and a limited supply of available housing. Every year, new structures are constructed, but due to a mismatch, they are insufficient to meet the demands of homes.

This study examines the imbalances between the supply and demand of housing in Norway and their implications on affordability. In doing so, it assesses how economic models interact with market variables and are impacted by major players, including the government, financial institutions, and investors, to trigger changes in the housing market. Additionally, it looks at how well economic models explain the current housing situation, the role of important players like the government, financial institutions, and investors have shaped the dynamics of the Norwegian housing market in recent years, and how policy changes can help address the housing crisis and foster a more equitable and sustainable housing market in Norway.

2. Literature Review

Historical Overview of the Norwegian House Market

The challenges in the Norwegian housing market have a history that dates back to the 19th century. A recent inquiry into the current state of affairs by Grytten (2024) provides a comprehensive historical perspective on the Norwegian housing market, tracing price movements from 1819 to the present. This inquiry points out that over the past 200 years, Norway's home prices have fluctuated, typically in response to shifts in monetary policy, industrialization, GDP growth, and other broad economic factors. A summary of the developments in the Norwegian real estate market from 1819 to the 2000s is also given by Eitrheim and Erlandsen (2004). According to these scholars, housing has been subject to stringent controls during specific sub-periods. This is particularly true between 1940 and 1969, when sale prices for almost every type of real estate were strictly controlled. For the initial portion of this time, property prices were flat before the Second World War. However, rentals were regulated for several years. Initially, certain flat types were subject to rent control from 1916 to 1936. Later, rents for unfurnished apartments in older buildings have been restricted since 1940 in certain towns (Eitrheim & Erlandsen, 2004).

The Central Bank of Norway records indicate that post-war housing policy had a profound impact on the development of modern housing trends. To alleviate post-war housing scarcity, the government implemented social housing programs and rent limitations in the mid-20th century. Price volatility and speculative investment were fuelled by the expansion of market liberalization that emanated from the deregulation in the 1980s, as well as rising demand (Grytten, 2024). Although Norway's post-war housing policy attempted to ensure equal access to housing facilities, the administrative agencies' criteria were only partially linked to need and primarily intended to influence the relationship between housing facilities and economic resources in less apparent ways (Gulbrandsen & Torgersen, 1978). There were also differences between owners of different house sizes as a result of interest coalitions that sprouted from the growing political goal of universal ownership and the various interventions that were developed at the time (Gulbrandsen & Torgersen, 1978).

Apart from putting an end to occasional confrontations between the "authorities" and owners, Gulbrandsen and Torgersen (1978) contend that these modifications had no notable effects when the previous landlord-tenant conflict ended. Unintentionally, the price control measures affected the processes used for tax assessment (Gulbrandsen, 1978). Furthermore, serious housing issues surfaced in the late 19th century, the 1980s, and the 2008 global financial crisis (Grytten, 2024).

Each of these periods has witnessed sharp price increases, followed by corrective market adjustments, which have had a significant impact on supply and demand in the housing market.

Recent gains in real estate prices in Norway, particularly in Oslo, the country's capital, have sparked discussions about how long the market may continue to rise before reaching an equilibrium (Larsen, 2018). According to Grytten, several scholars have questioned whether the nation is experiencing a bubble, as he believes that the market is experiencing one (Torvund, 2013). It is essential to consider that although relatively short-term consumer purchasing behavior affects the former, investment motivations have a greater impact on the housing market compared to other commodity markets (Grytten, 2024). This suggests that, in contrast to typical consumer goods markets, long-term investment decisions frequently have a significant impact on the housing market.

Classical Supply and Demand Theory

According to the rule of demand, there is typically an inverse relationship between the quantity required and the price in a given market (Jaiswal, 2024). In other words, individuals would be less willing to purchase a thing if its price increased. Figure 2-1 illustrates how consumers shift from comparatively more expensive goods to commodities when their prices decrease. In a market economy, where products and services are exchanged at market prices, and producers sell as many units as they can profitably, the supply function is stated (Inoua & Smith, 2020). The overall supply grows when more producers decide it is beneficial to supply their goods as prices rise. To keep the supply from being diminished by rising prices, the supply function remains non-decreasing. The mathematical expression for the supply function is $S(a, p)$, where it stands for market-specific attributes and p for price. The full market supply capacity, or $S(a)$, indicates the maximum number of units that could be supplied if the price were endlessly high (Inoua & Smith, 2020). Because producers' cost structures vary, supply increases as prices do.

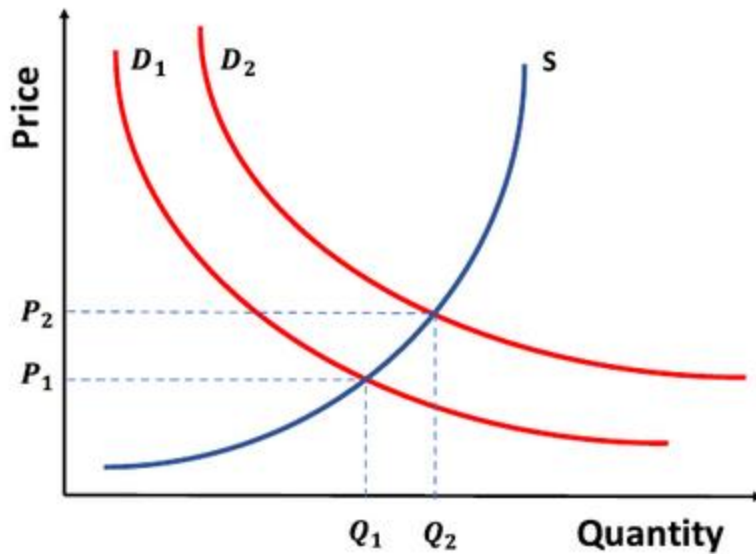


Figure 2-1: The Supply And Demand Model

Source: Jaiswal (2024)

According to Figure 2-1, manufacturers will supply more of an item if the price at which it can be sold is higher. Increasing output is lucrative due to the increased price. Similar to the demand side, a change in the cost of a productive input or a technological advancement could cause the supply side to move (Jaiswal, 2024). Conversely, the amount of a commodity that consumers are willing to buy at a given price is known as the market demand function (Inoua & Smith, 2020). After addressing more urgent needs, clients will likely want a unit if they can afford it, depending on their priorities and financial situation. When urgent needs are taken into account, a customer would want a unit of a commodity if they could afford it with their remaining wealth, as noted by Inoua and Smith (2020). When a customer's reservation price, or maximum willingness to pay, surpasses the cost, the function shows how many units they are willing to buy overall. As prices increase, demand decreases because the step function is non-increasing. The factors that determine supply, including the cost of production, the price of replacements, the technology used, and other production inputs, are all assumed to remain constant over a given supply evaluation period (Jaiswal, 2024).

Garnier, Say, and Dupuit's pyramidal model is an economic model that explains how a hierarchy of requirements shapes consumer demand and how this relates to the willingness to pay (WTP) for

different goods and services. This paradigm posits that consumer demand for goods fluctuates. Instead, it adheres to a systematic procedure whereby the consumer's available funds and the products' urgency dictate which are given priority.

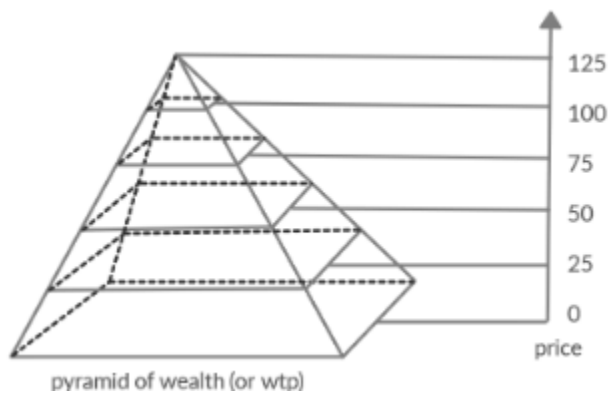


Figure 2-2: Pyramidal Model

Source: Inoua & Smith (2020)

The imbalance and its impact on prices can be evaluated in the context of the Norwegian housing market using the pyramidal model in Figure 2-2 and the principles of demand and supply theory. The wealth distribution in society is represented by a pyramid in this model, where the wealthiest individuals are at the top and the poorest individuals are at the bottom. The cross-sectional area of the price-corresponding pyramid is used to determine the market demand at each price. According to Inoua and Smith (2020), if the price is zero, all customers can afford to buy the product; as the price rises, a smaller portion of the population can afford it; and once the price reaches a particular threshold, none can afford. This model provides insight into how price changes resulting from multiple factors can collectively impact demand at a given time.

The Aggregate demand (AD) and aggregate supply (AS) model

Another model that can be used to conceptualize Norway's housing market is the AD-AS model, which offers insights into the short- and long-term supply and demand dynamics (Laszek and Olszewski, 2023). The impact of supply and demand on output and pricing in a market facilitates the analysis of short-term economic shifts and the influence of external events on key variables affecting prices in a given market (Dutt, 2002). The four main components of this model are net

exports (X-M), government spending on goods and services (G), investment (I), and consumption [C]; these together make up AD (Jahre & Steinfeldt-Foss, 2024). When any of these factors change, the AD curve changes as well. Lower prices stimulate firms and individuals to spend more, which raises real GDP, as depicted in the AD curve, which typically slopes downward. The short-run aggregate supply (SRAS) curve, on the other hand, illustrates the amount of output companies can produce at various price points as the analysis dictates, assuming a constant nominal wage rate (Gordon, 2012). Its increasing slope suggests that worker costs remain constant despite potential short-term price fluctuations. The aggregate supply (LRAS) curve may eventually become almost vertical with flexible pricing, adjusted nominal wages, and optimal capacity utilization (Jahre & Steinfeldt-Foss, 2024).

When there are fewer goods and services available at the current price point than the amount desired, there is an economic imbalance between aggregate supply and demand (Jahre & Steinfeldt-Foss, 2024). Also, if abrupt changes in one aspect do not align with changes in the other, mismatches like these occur. Demographic factors, such as population growth and changes in income or advantageous interest rates, can cause changes in demand without corresponding changes in supply.

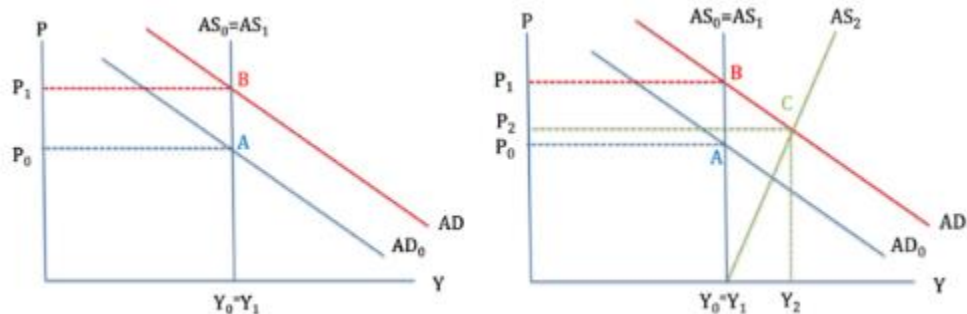


Figure 2-3: Interaction between Supply And Demand Relative to Prices

Source: Jahre, & Steinfeldt-Foss (2024).

The relationship between supply and demand in relation to pricing in Norway is depicted in the graph in Figure 2-3. While the graph on the right shows long-term adjustment, the one on the left shows the short-term mismatch for new buildings. The reason for the short-term supply inelasticity is long building times. Newly built homes make up just about 1% of Norway's housing stock each

year (Jahre & Steenfeldt-Foss, 2024). Grytten (2018) notes that capacity constraints and regulatory restrictions in the building industry further hinder the completion of new buildings. Even if many new housing complexes are pre-sold, these planned units do not immediately increase the housing stock and have no immediate effect on supply (Jahre & Steenfeldt-Foss, 2024). Consequently, the short-term supply remains virtually constant despite increased housing activity. Over time, the supply side gets a little more elastic, as shown in Figure 2-3 (right). Developers are encouraged to begin and complete more projects as prices rise. When these houses are put on the market, the curve slowly shifts to the right, increasing the supply of homes from Y1 to Y2 and stabilizing prices around P2. This partial adjustment lessens the disparity between supply and demand. However, persistent delays brought on by monetary, legal, and construction-related problems continue to limit the supply's ability to adjust to shifts in demand accordingly.

Factors Determining House Prices

Demand-Related Factors

Despite the complexity of the process, the supply and demand for housing are significantly influenced by several factors, including GDP growth, income, employment, and others (Xu, 2017). According to recent studies, Norway's GDP per capita has nearly quadrupled from \$22,000 to over \$75,000 since the 1970s (Halvorsen, Ozkan, & Salgado, 2022). This shift suggests that customers now have a lot more purchasing power. During economic booms, demand typically rises more quickly than supply can keep up, resulting in observable imbalances and higher prices. This is consistent with economic theory, which states that when supply is limited relative to demand, prices will increase (Grytten, 2018; Hilber & Vermeulen, 2016).

A comprehensive examination of the demand-side variables influencing home values in Norway reveals the intricate relationship between interest rates, property market dynamics, and income growth. With the current surge in housing market activity, very mild house price increases from 2017 to early 2020 came to an end (OECD, 2022). Vigorous homebuying activity during the first year of the COVID-19 epidemic is driving a sharp rise in demand for homes, according to recent trends. Although this is a one-time event, it suggests that more households are becoming able to afford homes. This finding is corroborated by an OECD (2020) study of the process's causes, which

found that Norway's high and rising housing values are primarily attributed to significant household incomes, wealth, low lending rates, and a growing population.

Model-estimated and observed comparisons of home prices, however, show that Norwegian home prices have been marginally higher than those during the global financial crisis despite the existence of firm bases. Nevertheless, these elements are causing prices to rise quickly. According to Grytten (2024), in large cities like Oslo, the growth in housing prices has diverged from the income growth. This implies that despite robust economic growth and comparatively high average salaries, home prices have increased dramatically.

Interest rates affect the cost of construction loans, which in turn impact the supply of housing buildings (Jahre and Steinfeldt-Foss, 2024). According to Olsen and Midtgaard (2024), long-term low interest rates have prompted mortgage borrowing and speculative investment in the real estate market. 76.4% of all households in Norway are homeowners, making the high ownership percentage one of the country's distinguishing characteristics (Sleire & Cook, 2022). This is partially due to reduced interest rates that promote borrowing for home purchases. Particularly in cities, property values rose throughout the pandemic. Since more than 90% of mortgages have variable rates, the early 2020 interest rate cuts alleviated the financial strain on mortgage customers (Sleire & Cook, 2022). As the epidemic changed housing preferences and increased demand for larger homes in rural areas, Oslo saw a net outflow for the first time in 20 years.

Prior research has validated a favorable relationship between interest rates and household prices. Interest rates have a significant influence on real home prices; hence, using real home prices as an indicator in a monetary policy framework would be more advantageous, as Robstad (2014) asserts. This author also points out that Norway's mortgage stock refinance rate is relatively mild, given the limited response of real credit to changes in property prices and interest rates. Stabilizing property values at their base during the business cycle will help stabilize household debt if housing is the primary use of household credit (Robstad, 2014). These results are supported by Bjørnland and Jacobsen (2010), who found that a monetary policy shock had a significant effect on property values in Norway. Let's say that comparable SVAR studies using data from the US, EU, or OECD attest to this significant influence. In such a scenario, Robstad (2014) concludes that all models indicate a limited impact of monetary policy on household credit. Based on OECD data on

demographic characteristics, an empirical examination of the relationship between population and housing price changes found that for every percentage point increase in population growth, house price growth increased by 1.4 percentage points (Gevorgyan, 2019). This suggests that cities with steady population growth will probably see further increases in housing costs.

Supply-Related Factors

Building construction and land availability are the two key factors influencing a stable housing market. Anundsen (2021) argues that delays in home construction projects, mostly brought on by rigid land-use restrictions and ineffective bureaucracy, have significantly reduced the availability of new housing units. Since construction takes a long time, the market's present and future conditions are essential because uncertain prospects could lead to a decline in construction activity (Jahre & Steinfeldt-Foss, 2024). Because there are fewer homes on the market due to low construction activity, supply and demand are unbalanced. Stricter lending regulations that set a maximum loan-to-income ratio of 500%, slower population growth, and a surge in building activity all contributed to Norway's housing price increases, which have been consistent for years (Sleire & Cook, 2022). In 2018 and 2019, the national home price grew at a rate of over 2% annually. However, the real estate market recovered at the beginning of the pandemic due to record low mortgage rates that characterized the market (Sleire & Cook, 2022).

Zoning and regulatory restrictions are other significant supply-side factors that influence the housing market. According to Sørvoll (2024), supply constraints have been exacerbated by Norway's stringent zoning laws, particularly in urban areas with high demand, such as Oslo and Bergen. Private exploration interests are allowed to participate in the planning process even though Norway's building standards and planning are governed by the Planning and Building Act (PBA) of 2008 (Stjernström, Junker, & Thorsen, 2023). Stjernström and colleagues' investigation reveals that the land-use planning and building aspects constitute distinct regimes, even though they are incorporated into the same statute. Private zoning plans thereby increase the likelihood of jigsaw planning, which leads to a planning conclusion devoid of comprehensive perspectives. Stjernström, Junker, and Thorsen (2023) further assert that if private investors participate as official planning participants in the creation or co-development of a zoning plan, their strong

market interests may have an impact on formal planning. The price of the residence may suffer as a result.

Additionally, reliable public transit and convenient access to essential services have a significant impact on housing demand in various areas. Ensuring that the demands of a diverse population are one of the primary goals of Norway's National Transport Plan (2022–2033). In this sense, roads are designed, constructed, operated, and maintained with pedestrians, cyclists, motorcyclists, and public transportation users in mind (Institution of Engineers, 2024). Improved transit and infrastructure appear to have a positive impact on home values. For example, Mikula and Moanar's (2023) evaluation of the anticipated accessibility after the building of an underwater road tunnel system in Norway revealed that, based on estimates of a repeated sales model in a difference-in-differences framework, the construction led to an average 12.8% increase in property values. Less expensive homes, which increased as the tunnel's opening neared, contributed to this effect (Mikula & Moanar, 2023).

Although not exclusively supply-side, investor activity and speculative behavior have a significant influence on the dynamics of the Norwegian housing market. According to Grytten (2024), periods of rapid price increases are often accompanied by increased investor activity. Further evidence suggests that early and higher-priced home purchases by households create a self-reinforcing loop, as property prices are likely to continue rising (Ben-David et al., 2018). As a result, households assess daily patterns and make predictions about future price increases. They thus decide to invest in homes, which raises demand.

Finally, land prices, interest rates, and governmental regulations all have a significant influence on the cost, revenue, and risk of investments (Xu, 2017). The measures implemented by both central and local authorities to support those who are less fortunate in the housing market are part of Norway's national strategy for the social housing policy (2021–2024). The Ministry of Local Government and Modernisation (2022) reports that about 179,000 persons experience disadvantages in the housing market, even though many are homeowners. The goal of the housing strategy is to provide more individuals with the opportunity to rent or buy a home. This program also impacts the housing market.

3. Methodology

In accordance with Wright's (2015) advice for examining economic patterns across time, the study uses a quantitative approach to investigate the structural and economic variables impacting the Norwegian housing market. Using quarterly observations from 1990 to 2024, it makes use of secondary data from the Federal Reserve Economic Data (FRED). Real GDP, interest rates, house prices, CPI, unemployment, labor costs, investments, and an increase in building permits are some of the important factors that are examined. Compared to monthly data, FRED's quarterly data provides trustworthy macroeconomic insights. The series mean was chosen above alternative techniques like interpolation and multiple imputation to impute missing values because of its capacity to maintain data integrity in this situation (Alwateer et al., 2024).

Autoregressive Integrated Moving Average (ARIMA) Model

Based on historical trends, we anticipate real residential property prices using an ARIMA (p, d, q) model. The model's specifications are as follows:

$$Y_t = c + \sum_{i=1}^p \phi_i Y_{t-i} + \sum_{j=1}^q \theta_j \varepsilon_{t-j} + \varepsilon_t \dots \dots \dots 1$$

Where:

- Y_t represents housing prices at time t ,
- ϕ_i are autoregressive parameters,
- θ_j are moving average parameters,
- ε_t is the error term (Bakar & Rosbi, 2017)

The ARIMA model provides a clear picture of the seasonality and cyclical trends in the housing cycle. Short-term forecasting is feasible, which benefits investors and governments.

Vector Autoregression (VAR) Model

A VAR model was employed to examine the dynamic relationships between home prices and macroeconomic variables:

$$X_t = A_0 + A_1X_{t-1} + A_2X_{t-2} + \dots + A_kX_{t-k} + \varepsilon_t \dots \dots \dots 2$$

where X_t is a vector of interest rates, housing prices, GDP, and CPI(the endogenous variables), and A_i are coefficient matrices. Granger causality tests were used to test causal relationships (Akkaya, 2021). The VAR model is helpful because it illustrates how shocks to one variable affect others over time and considers the interdependencies between multiple economic indicators.

Panel Data Regression Models

Panel regression models were employed to assess the impact of economic variables on home prices, as the study encompasses a range of macroeconomic variables over time. Panel data models were deemed appropriate as they account for both cross-sectional and time-series variability.

Fixed Effects (FE) Model

The Fixed Effects (FE) model assumes that region-specific traits are time-invariant and account for unobserved variability across Norway's several regions. The FE model is described as follows:

$$Y_{it} = \beta_0 + \beta_1X_{it} + \alpha_i + \varepsilon_{it} \dots \dots \dots 3$$

Where:

- Y_{it} = Real Residential Property Prices,
- X_{it} = Vector of independent variables (Interest Rate, GDP, CPI, Unemployment, Labor Costs, etc.),
- α_i = Region-specific fixed effect,
- ε_{it} = Error term (Bell & Jones, 2014).

The FE model is recommended when time-invariant factors, such as geographic features, may influence housing prices but are not explicitly incorporated into the model.

Random Effects (RE) Model

The Random Effects (RE) model assumes that there is no correlation between the independent variables and unobserved heterogeneity. According to the model's specifications:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + u_i + \varepsilon_{it} \dots\dots\dots 4$$

where u_i is the random influence that varies by geography (Bell & Jones, 2014). When regional differences are considered random and unrelated to explanatory variables, the RE model is appropriate.

Model Diagnostic Tests

To ensure the robustness of the econometric models, several diagnostic tests were performed. Stationarity was assessed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to identify unit roots, as non-stationary time series require transformation prior to regression analysis (Mamun et al., 2018). Variance Inflation Factor (VIF) analysis was employed to detect multicollinearity among independent variables, which could otherwise bias coefficient estimates. Additionally, the Breusch-Pagan and White tests were used to assess heteroskedasticity, determining whether the error terms had constant variance; any violations would necessitate adjustments, such as the use of robust standard errors to maintain statistical validity (Ndungu, 2023).

4. Results

Descriptive Statistics

Descriptive statistics reporting essential aspects of the Norwegian housing market from 1990 to 2024 (N = 139) are shown in Table 4-1.

Table 4-1: Essential Factors in the Norwegian Housing Market from 1990 to 2024

Metric	N	Mean	Std Dev	Min	25%	50%	75%	Max
Real Residential Property	13							
Prices	9	87.85	35.15	33.32	53.36	91.52	121.97	144.09
	13							
Interest Rate	9	4.24	3.07	0.25	1.78	3.45	6.08	14.18
Real Gross Domestic	13	617,525.3	120,375.7	385,129.	530,372.9	645,171.8	712,682.0	823,800.8
Product	9	4	8	60	5	0	0	0
	13							
Consumer Price Index	9	2.45	1.31	-1.43	1.55	2.28	3.07	6.74
	13			38,482.6				190,870.7
Registered Unemployment	9	78,401.25	22,441.91	7	63,034.53	74,615.36	91,783.80	0
	13	13,196,52	4,524,845	6,354,73	10,962,21	13,196,52	13,383,35	24,304,01
Labor Costs (Construction)	9	0,000	,000	1,000	0,000	0,000	0,000	0,000
				-				
		-		278,860,	-	-		
	13	7,192,256	79,395,50	00	9,077,500	7,192,256	16,007,0.,	242,453,0
Other Investment (Net)	9	,000	0.000	0.000	.000	.000	.000	0.000
Construction Permits	13							
Issued Growth Rate	9	0.55	12.44	-26.52	-7.94	0.34	6.45	38.07

The table's data indicate that during the study period, actual residential property values showed both significant volatility and a robust rise. Real GDP exhibited steady increases, and inflation remained stable, although interest rates fluctuated significantly, signaling changes in monetary policy. Net investment flows and construction labor costs were extremely erratic, indicating supply-side limitations and general economic uncertainty. Similar to this, unpredictable shifts in the issuance of building permits exacerbated already-existing market imbalances by causing instability in the future supply of homes.

Correlation Analysis

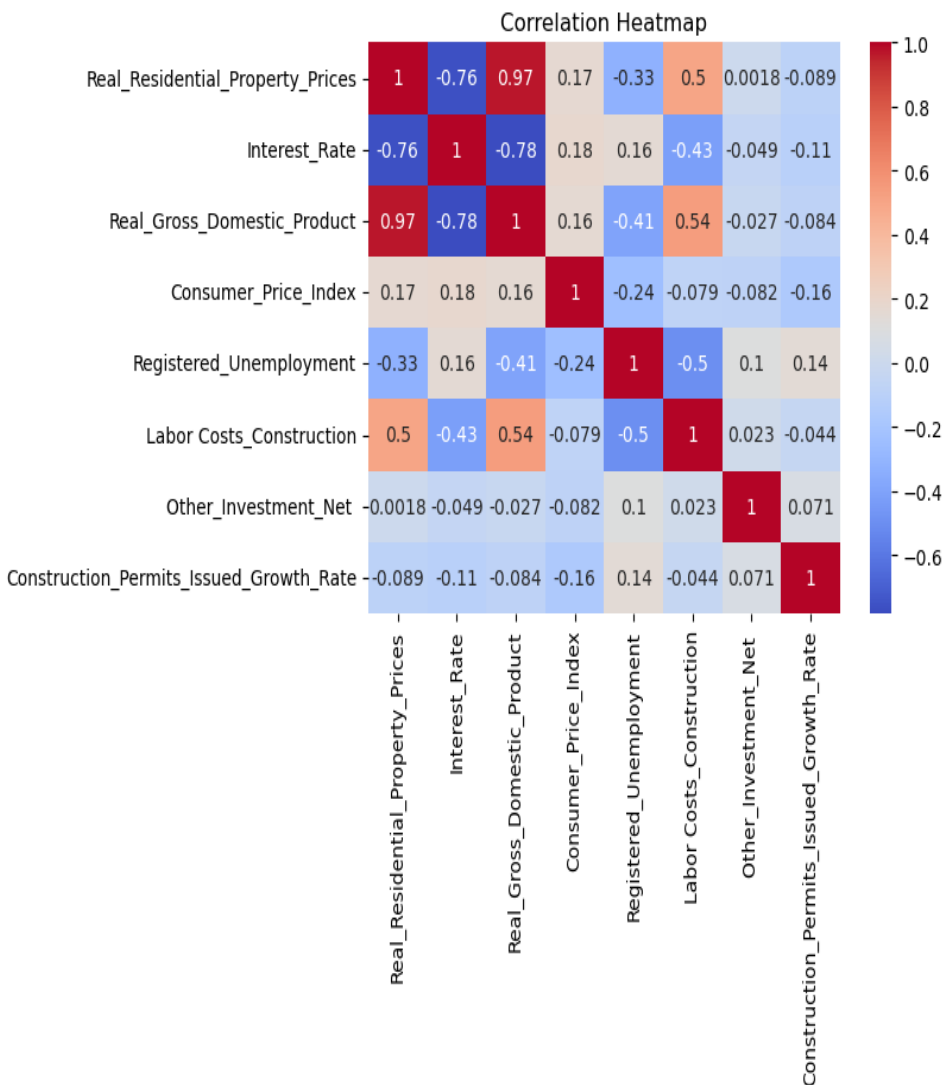


Figure 4-1: Correlation Heat-Map

As evidenced by the correlation heat-map, economic expansion is a significant contributor to housing inflation, which reveals a strong relationship between real estate prices and GDP growth. Low interest rates, on the other hand, have a negative correlation with prices, which supports the idea that inexpensive borrowing increases demand. While unemployment has a weak and inverse relationship with prices, demonstrating its effect on home demand, construction labor costs exhibit a weak positive association, indicating cost pass-through to purchasers. The fact that building

permits, net investment, and inflation show little association with price trends highlights the significant impact of GDP and interest rates on the state of the Norwegian housing market.

Autoregressive Integrated Moving Average (ARIMA) Model

Except for CPI, unemployment, net investment, and permit growth, which are stationary at the 5% level, all stationarity tests show that the majority of variables are non-stationary in their original form ($p > 0.05$). All variables attain stationarity ($p < 0.05$) after first differencing, confirming their suitability for time-series modeling and preventing erroneous regression results.

The fourth-order autoregressive (AR) term is substantial ($p < 0.001$) and has a coefficient of 0.8952, whereas previous AR terms are insignificant, indicating considerable price persistence according to the SARIMAX model. Every moving average (MA) component is highly significant ($p < 0.001$), indicating that previous shocks have had a substantial impact on current prices. Model diagnostics confirm a good fit: the Jarque-Bera test confirms residual normality ($p = 0.59$), and the Ljung-Box test shows no residual autocorrelation ($p = 0.11$). Variance instability is revealed by the Breusch-Pagan heteroskedasticity test ($p = 0.01$), indicating the necessity of corrective measures.

The SARIMAX model effectively captures the dynamics of housing prices, highlighting the importance of previous shocks and lagged persistence. Despite being strong, its prediction ability could be improved by adding pertinent exogenous variables.

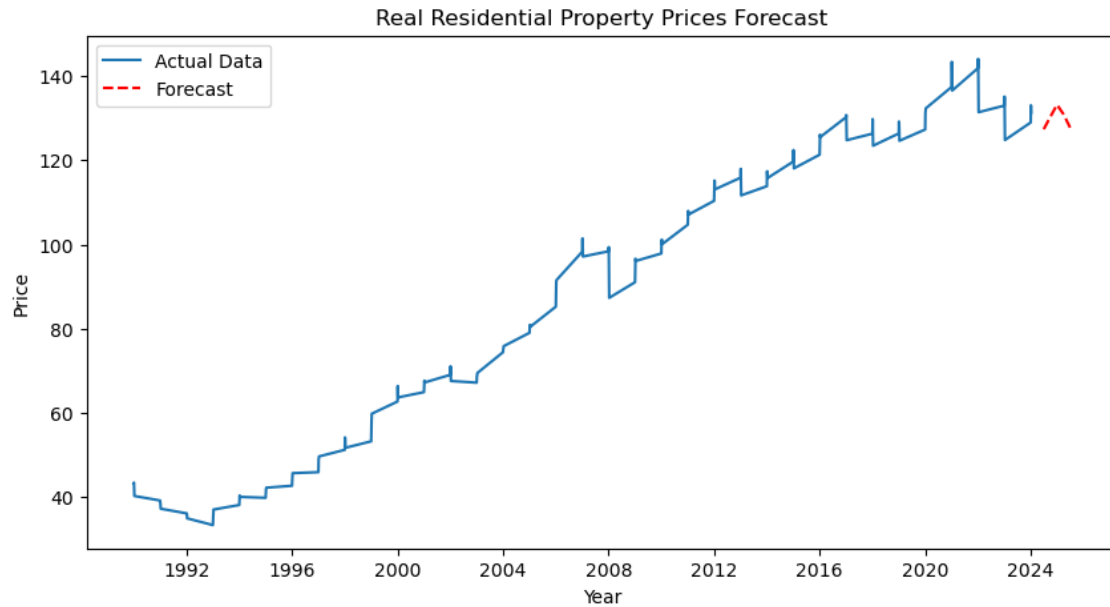


Figure 4-2: Real Residential Property Prices Forecast

Source: FRED

With noticeable cyclical swings, the Real Residential Property Prices Forecast chart (Figure 4-2) shows a consistent upward trend in Norwegian home prices from the early 1990s to 2024. The global financial crisis in 2008 led to a steep decline, but the 2010s and early 2020s saw a strong recovery. As a reflection of macroeconomic uncertainty related to inflation, changes in interest rates, and possible market corrections, forecasted values show little short-term volatility. The model accurately depicts past price cycles and predicts modest future fluctuations consistent with recognized economic trends.

Vector Autoregression (VAR) Model

Strong model fit is demonstrated by the vector autoregression (VAR) model, which was estimated using OLS with 134 data over eight equations (AIC = 133.335; BIC = 139.044; HQIC = 135.655; log-likelihood = -10190.6). The findings reveal hysteresis and persistence in home prices, characterized by short-term corrections that are followed by a longer-term continuation of the price trend.

Although the effect lessens over time, lagged interest rates show a negative correlation with current home prices, which aligns with the traditional notion that links borrowing costs to housing demand.

Lagged variables, particularly those with four-period delays, have a longer-term influence on real estate prices, although CPI, GDP, and unemployment have little short-term impact.

While home prices and macroeconomic variables have little direct influence, interest rates appear to be largely self-determined, exhibiting a strong association with their historical values. Real GDP is mostly determined by its lagged values and unemployment rate; as unemployment rises, growth is eventually constrained. Unemployment has a secondary effect on inflation, which exhibits strong autoregressive behavior and gradually returns to equilibrium.

Table 4-2: Summary of Significant VAR Model Coefficients

Dependent Variable	Lagged Predictor	Coefficient (β)	p-value	Interpretation
Registered Unemployment	L1. Registered Unemployment	0.440	<0.001	Strong persistence in unemployment trends
	L2. Registered Unemployment	-0.516	<0.001	Significant negative correction from earlier unemployment levels
	L3. Registered Unemployment	0.343	0.002	Continued influence of past values
	L4. Registered Unemployment	-0.361	0.002	Oscillating pattern of unemployment persistence
	L2. Real Residential Property Prices	-1005.66	0.028	Rising housing prices reduce unemployment
	L2. Real Gross Domestic Product	-0.340	0.042	Economic growth contributes to lower unemployment
Construction Labor Costs	L4. Real Gross Domestic Product	47,669.83	0.010	Long-term economic growth raises construction wages

Dependent Variable	Lagged Predictor	Coefficient (β)	p-value	Interpretation
Other Investment Net	L4. Other Investment Net	0.0044	0.003	Investment boosts construction labor costs
	L3. Other Investment Net	0.0046	0.023	Sustained investment influences labor wages
	L2. Construction Permits Issued Growth Rate	25,317,509.72	0.012	Past construction activity increases labor demand and wages
	L1. Other Investment Net	-1.08	<0.001	Strong mean reversion of investment flows
	L2. Other Investment Net	-0.68	<0.001	Continued correction of investment behavior
	L3. Other Investment Net	-0.48	0.001	Further support for mean reversion
	L1. Real Gross Domestic Product	-3.39 million	0.005	Economic growth leads to reduced net investment (possible capital outflows)
Construction Permits Issued Growth	L4. Registered Unemployment	3.36 million	<0.001	Higher unemployment increases investment volatility
	L1. Construction Permits Issued Growth Rate	-0.926	<0.001	Strong negative autocorrelation (declining trend)
	L2. Construction Permits Issued Growth Rate	-0.746	<0.001	Sustained downward momentum
	L3. Construction Permits Issued Growth Rate	-0.460	<0.001	Further indication of declining permit growth
	L4. Construction Permits Issued Growth Rate	-0.231	0.020	Slower correction persists
	L1. Interest Rate	-4.072	0.035	Higher interest rates reduce construction activity
	L1. Real Gross Domestic Product	-0.000613	0.005	Economic growth reduces permit issuance (possibly due to maturity or overheating)

According to the VAR model, Norwegian registered unemployment is significantly impacted by its own lagged values, suggesting that labor market trends are persistent. Unemployment is significantly impacted negatively by economic metrics like real GDP and housing prices, indicating that labor demand is supported by economic and housing market growth.

Lagged values of GDP, investment, and construction activity are the main drivers of construction labor costs; prior-year gains in permits and investment also contribute to wage growth because of the increased need for skilled labor. On the other hand, the short-term impacts of unemployment, CPI, and interest rates are negligible, underscoring the long-term vulnerability of construction salaries to general economic circumstances.

Although investment levels exhibit mean reversion over time, they are also significantly influenced by GDP and unemployment, which reflects the impact of the overall state of the economy on

capital flows. On the other hand, construction permits exhibit a declining trend that is influenced by historical values and negatively impacted by increasing GDP and interest rates. This suggests a cautious construction industry that would restrict new construction in the event of increased costs or more difficult access to borrowing.

Fixed Effects Model vs Random Effects Model

The Hausman test results ($H = 0.0000$, $p = 1.0000$, $df = 6$) demonstrate that there are no discernible variations between fixed and random effects estimates, hence endorsing the random effects hypothesis. The random effects hypothesis is thus validated, indicating that unobserved regional heterogeneity is uncorrelated with the explanatory variables.

With a near-perfect between-region fit ($R^2 \text{ between} = 0.9998$) and substantial within-region variation ($R^2 \text{ within} = 0.6356$), the random effects panel regression accounts for 94.98% of the variance in real residential property prices ($R^2 = 0.9498$). Statistical significance is demonstrated by the model $F(6,133) = 419.74$, $p < 0.001$). House prices are strongly negatively impacted by interest rates, while there are notable positive correlations between CPI, unemployment, and construction labor costs. A modestly negative link between the growth rate of construction permits and net investment was statistically insignificant, indicating a potential inverse effect on pricing that warrants more research.

Table 4-3: Parameter Estimates for Random Effects Model

Parameter	Estimate (β)	Standard Error	t-value	p-value	Lower CI	Upper CI
Interest Rate	-7.2004	0.6391	-11.267	0	-8.4645	-5.9364
Consumer Price Index	11.805	1.3553	8.7104	0	9.1242	14.486
Registered Unemployment	0.0005	0.00005691	7.9236	0	0.0003	0.0006
Labor Costs Construction	4.009E-09	2.921E-10	13.726	0	3.431E-09	4.587E-09
Other Investment Net	-1.357E-11	2.34E-11	-0.5801	0.5628	-5.986E-11	3.271E-11
Construction Permits Issued Growth Rate	-0.2883	0.1523	-1.8921	0.0606	-0.5896	-0.0131

To provide further information on the current status of the Norwegian housing market, this study also collected data from secondary sources. An overview of home prices from 1985 to 2016 is shown in Figure 3 below.



Figure 4-3: Fluctuation in house prices in Norway (1985-2016)

Source: Sandlie and Gulbrandsen (2017)

Noticeably, actual home prices in Norway have continuously surpassed inflation, according to the inflation-adjusted housing price graph, demonstrating a steady increase in actual housing expenses. Prices started to rise substantially in 1993 after growing very little between 1985 and 1992. They peaked in the early 2000s before briefly declining during the 2007–2008 financial crisis. After the crisis, prices recovered significantly, especially between 2010 and 2016, thanks to interest rate reductions by Norges Bank, which increased consumer disposable income due to the widespread use of variable-rate borrowing (Sandlie & Gulbrandsen, 2017). The steep increase in real prices is a reflection of deeper structural problems, such as speculative investment, inadequate regulation, and demand exceeding supply, even when a portion of the increase is consistent with inflation.

Data on home starts and sales were also gathered in order to identify any reoccurring trends that would provide more insight into Norway's housing supply. The graph in Figure 4-4 provides an overview of the trend.

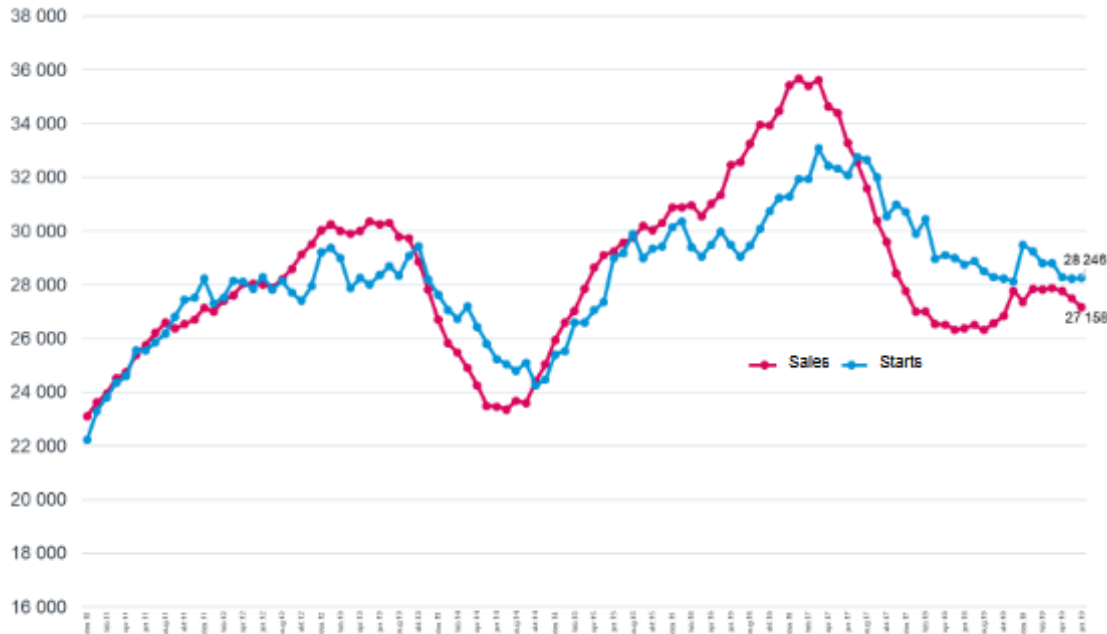


Figure 4-4: Norway's home starts and sales

Source: International Housing Association (2019)

Figure 4-4 illustrates Norway's ongoing housing supply and demand imbalances. While home starts stayed at about 32,000 units between 2016 and 2017, sales peaked at almost 36,000 units, suggesting surplus demand and possible price pressure. Despite very high starts, sales fell precipitously to around 24,000 units starting in 2017. This pattern suggests that while supply may have leveled off, lower affordability likely stifled demand, which helped explain the observed decline in sales activity.

We also collected data on the average annual housing demands as determined by population, beginning in 2019, compared to predicted annual building starts.

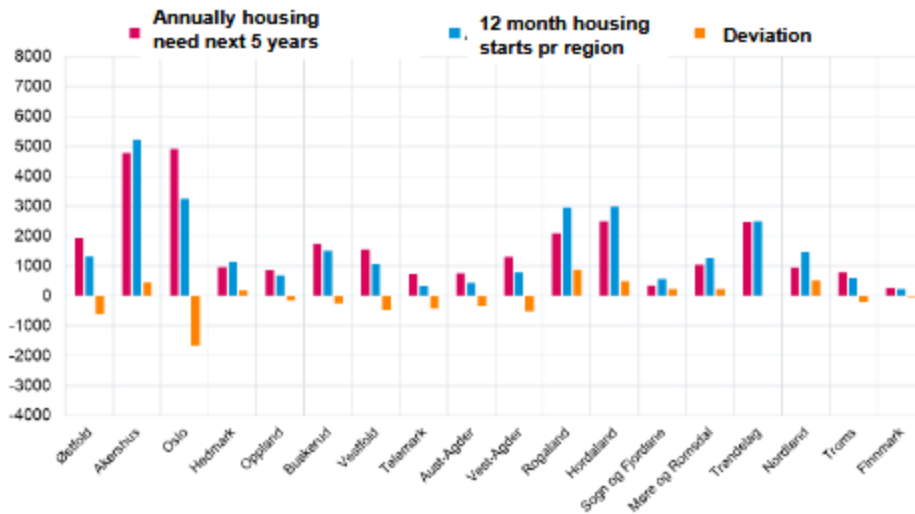


Figure 4-5: Housing Needs Vs Actual Housing Starts

Source: International Housing Association (2019)

A continuing shortage of housing is shown in Figure 4-5, which contrasts actual construction starts with population growth-based predicted housing demand. This structural imbalance indicates that, in recent years, new housing buildings have consistently failed to meet the demand generated by the population. The growing disparity suggests a widening housing shortage, likely contributing to rising home and rental prices. Younger and lower-income households may be disproportionately affected by such changes, which could exacerbate social inequality and increase the risk of financial distress if the imbalance persists. In a similar vein, this study collected information on housing demands versus building starts in a few large Norwegian towns; the results are shown in Figure 4-6.

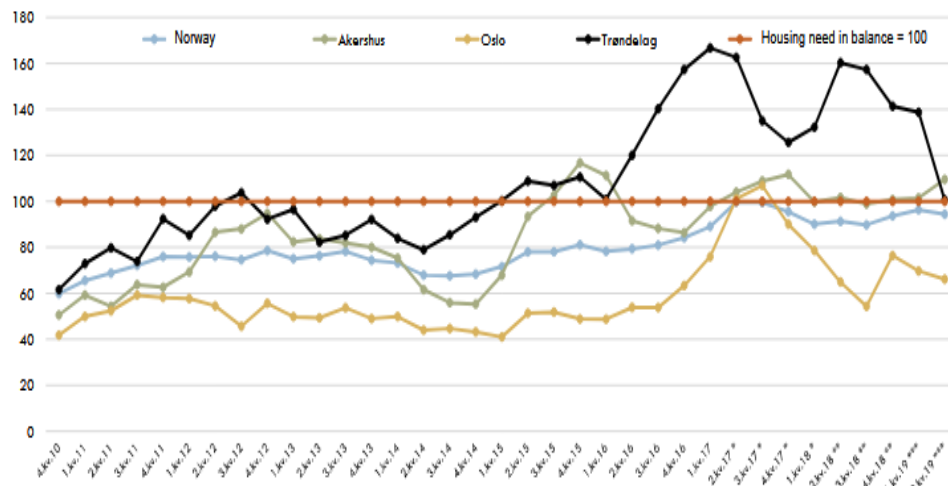


Figure 4-6: Start vs. Housing Needs Index in Norway

Source: International Housing Association, 2019

Figure 4-6 illustrates regional disparities between housing starts and actual housing needs across Norway, notably in areas such as Trøndelag, Oslo, and Akershus, where demand has consistently outpaced supply since 2016. Despite a national rise in housing starts, they remain insufficient relative to growing demand, as indicated by the widening gap from the equilibrium line (set at 100) (International Housing Association, 2019). This persistent shortfall underscores the structural housing crisis in urban regions.

5. Discussion

The State of Housing in Norway

According to the findings of this analysis, Norway's housing shortage is probably going to last because of a persistent mismatch between supply and demand brought on by urbanization, economic expansion, and a lack of new house construction. The demand for housing in metropolitan areas increases as household incomes rise due to urban employment and entrepreneurship, thereby pushing up costs. With a mean real estate price of \$ 87.85 and a range of \$ 33.32 to \$ 144.09, descriptive statistics indicate significant price volatility. These swings reflect both long-term appreciation and cyclical changes from 1990 to 2024.

Strong price persistence is confirmed by the SARIMAX model, which also reveals market hysteresis, as current prices are significantly influenced by historical values, particularly those of

four-period lags. This is consistent with the AD-AS framework (Dutt, 2002), which holds that short-term variations are caused by shocks or policy interventions, while long-term price patterns are influenced by structural economic fundamentals (such as GDP and interest rates). For instance, a brief price drop during the global financial crisis of 2008 was followed by a robust recovery aided by interest rate reductions from Norges Bank (Sandlie & Gulbrandsen, 2017).

These findings are corroborated by the VAR model, which demonstrates that historical home prices have a substantial impact on current values. A positive Lag-1 effect ($\beta = 0.198$) indicates momentum fueled by buyer optimism or speculation, whereas sporadic reversals following two lags are indicative of policy responses or economic cycles. Interest rates have a detrimental impact on affordability; these effects are most pronounced in the short term but diminish as markets adjust. Both unemployment and inflation have long-term, yet essential, effects; low unemployment keeps mortgage payments stable and housing demand high.

The Hausman test and panel regression validated the random effects model's validity. The analysis underscores the crucial importance of monetary policy by demonstrating a strong negative correlation between interest rates and housing prices, with a 1% increase in interest rates resulting in a 7.20-unit drop in prices (Robstad, 2014; Olsen & Midtgaard, 2024). House prices are significantly positively correlated with other factors, such as GDP, CPI, unemployment, and labor expenses associated with building.

Volatility in construction labor costs is a sign of supply-side limitations. Property prices have increased, and affordability has decreased as a result of rising labor expenses that seem to have been passed on to consumers. Housing instability is exacerbated by fluctuations in building permit issuance, which reflect erratic supply patterns. These results highlight ongoing supply and demand imbalances that lead to affordability difficulties and price increases.

Furthermore, the correlation study confirms a high negative correlation with interest rates and a substantial positive association with GDP and house prices. This supports more general macroeconomic models, such as the financial accelerator model, which relates inflation in asset prices to low borrowing costs. Demand is further fueled by rising GDP, which also increases investor optimism and purchasing power (Grytten, 2024).

Potential Implications of the Norwegian Current Housing Challenge

Historical patterns and projections suggest sustained long-term price growth in Norway. The analysis demonstrates that previous economic shocks have a significant impact on current home prices. The market was briefly destabilized by short-term swings, such as the 2008 financial crisis, but prices quickly recovered, and the overall effect on housing affordability remains detrimental. This is consistent with the supply-demand concept proposed by Inoua and Smith (2020), which suggests that a sustained undersupply in comparison to growing demand leads to higher prices, particularly for middle-class consumers. Further evidence that greater building activity has had little impact on price moderation is shown by the negative association between the growth of construction permits and home prices. Therefore, even if interest rates remain low, future price rises are anticipated to follow larger economic growth trends, especially those reflected in GDP.

Macroeconomic Factors that Influence the Norwegian Housing Market

The results demonstrate that monetary policy and interest rates, especially those made by Norges Bank, have been crucial in determining housing demand and price patterns in Norway. In line with the conclusions of Jahre and Steinfeldt-Foss (2024) and Olsen and Midtgaard (2024), lower interest rates have continuously increased homeownership and speculative investment. In contrast, higher rates have reduced affordability and slowed housing demand. Reduced interest rates during the COVID-19 pandemic increased mortgage uptake and drove up real estate prices, particularly in cities (Sleire & Cook, 2022). Because expectations of future price increases drive building and housing investment, this dynamic has stimulated investor speculation. However, monetary policy has an impact on more than just demand stimulation; it also affects the supply of housing by influencing the cost of building loans.

Rising GDP, a sign of economic expansion, has contributed to the inflation of home prices. The theoretical relationship between higher demand and greater purchasing power is supported by a strong positive association between real GDP and home prices (Grytten, 2018; Halvorsen et al., 2022; Xu, 2017). Pressure on the housing market has increased as investment confidence has increased along with GDP per capita. On the other hand, construction permits and CPI have had only a slight impact on home prices, whereas GDP and interest rates have had a significant impact.

Price inflation has not been reduced by expanding the housing supply alone, as evidenced by the weak negative correlation between permit growth and home prices. This is in line with research demonstrating that Norway's housing shortfall has not been addressed by increased construction levels (International Housing Association, 2019; Anundsen, 2021).

Structural constraints, such as land availability, price, and regulatory obstacles, nevertheless limit the efficacy of supply-side measures. Furthermore, since steady work promotes mortgage repayment and home demand, unemployment and employment policies have an indirect impact on pricing.

6. Conclusions

The study infers that economic models consistently predict a persistent and growing disparity between Norway's housing supply and demand. Permits issuance and construction of new buildings are still ongoing, but they have not slowed the rise in property prices. The market is susceptible to cyclical price spikes and potential bubbles due to long-term structural variables, including remarkably consistent GDP growth and supportive monetary policy, which have exacerbated affordability issues. The study supports the permanence of price increases by confirming that real estate values show significant lagged impacts. Demand is still high and has remained consistent over the last 20 years, while high labor costs, permission lags, and regulatory hold-ups limit supply.

Secondly, market dynamics are significantly shaped by central banks and governmental policies. GDP affects consumer confidence, wages, and unemployment, all of which have an indirect impact on house prices. In the same vein, persistently low interest rates have boosted demand, induced borrowing, and sparked speculation, all of which have contributed significantly to housing inflation (Olsen & Midtgaard, 2024). Although there has been a push for increased housing supply, the limited link between supply and price reduction suggests that fundamental supply-side initiatives are insufficient on their own. Labor market conditions also impact prices; lower unemployment boosts household demand and purchasing power, whereas higher unemployment lowers affordability and slows the pace of price increases.

All factors considered, the primary forces driving Norway's rising home prices are economic expansion and interest rate policy, with additional marginal influences from labor costs and employment levels. This study, therefore, recommends that long-term, comprehensive approaches involving monetary, fiscal, and regulatory reforms, in addition to supply expansion, will be necessary to address affordability. Government policy measures that focus on addressing the structural impediments and macroeconomic realities driving the housing market can help mitigate the imbalance causing ongoing upward pressure on housing prices.

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